Duquesne Light

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October 1, 1984

United States Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Mr. George W. Knighton, Chief
Licensing Branch 3
Office of Nuclear Reactor Regulation

SUBJECT: Beaver Valley Power Station - Unit No. 2
Docket No. 50-412
Outstanding Issue/Question Response

Gentlemen:

This letter forwards responses to the outstanding issues listed below. These items were discussed with the reviewer during a meeting which began April 24, 1984.

Attachment 1: Response to Outstanding Issue of the Beaver Valley Power Station Unit No. 2 Draft Safety Evaluation Report Section 13.2.1.1(1).

Attachment 2: Response to Outstanding Issue of the Beaver Valley Power Station Unit No. 2 Draft Safety Evaluation Report Section 13.2.1.1(5).

Attachment 3: Response to Outstanding Issue of the Beaver Valley Power Station Unit No. 2 Draft Safety Evaluation Report Section 13.2.1.1(5).

Attachment 4: Response to Outstanding Issue of the Beaver Valley Power Station Unit No. 2 Draft Safety Evaluation Report Section 13.2.1.2.

Attachment 5: Response to Outstanding Issue of the Beaver Valley Power Station Unit No. 2 Draft Safety Evaluation Report Section 13.2.1.3.

Attachment 6: Response to Outstanding Issue of the Beaver Valley Power Station Unit No. 2 Draft Safety Evaluation Report Section 13.2.1.3(3).

Attachment 7: Response to Outstanding Issue of the Beaver Valley Power Station Unit No. 2 Draft Safety Evaluation Report Section 13.2.1.3(4)(b).

Attachment 8: Response to Outstanding Issue of the Beaver Valley Power Station Unit No. 2 Draft Safety Evaluation Report Section 13.2.1.3(5).

Attachment 9: Response to Outstanding Issue of the Beaver Valley Power Station Unit No. 2 Draft Safety Evaluation Report Section 13.2.1.4 (I.A.2.1).

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Attachment 10: Response to Outstanding Issue of the Beaver Valley Power Station Unit No. 2 Draft Safety Evaluation Report Section 13.2.1.4 (I.A.2.3).

Attachment 11: Response to Outstanding Issue of the Beaver Valley Power Station Unit No. 2 Draft Safety Evaluation Report Section 13.2.2 (STA).

Attachment 12: Response to Outstanding Issue of the Beaver Valley Power Station Unit No. 2 Draft Safety Evaluation Report Section 13.2.2 (Fire Protection).

DUQUESNE LIGHT COMPANY

By E. J. Woolever
E. J. Woolever
Vice President

GLB/wjs
Attachments
cc: Mr. H. R. Denton, Director NRR (w/a)
Mr. D. Eisenhut, Director Division of Licensing (w/a)
Mr. G. Walton, NRC Resident Inspector (w/a)
Mr. E. A. Licitra, Project Manager (w/a)
Ms. M. Ley, Project Manager (w/a)

COMMONWEALTH OF PENNSYLVANIA)
) SS:
COUNTY OF ALLEGHENY)

On this 2nd day of October, 1984, before me, a Notary Public in and for said Commonwealth and County, personally appeared E. J. Woolever, who being duly sworn, deposed and said that (1) he is Vice President of Duquesne Light, (2) he is duly authorized to execute and file the foregoing Submittal on behalf of said Company, and (3) the statements set forth in the Submittal are true and correct to the best of his knowledge.

Anita Elaine Reiter
Notary Public

ANITA ELAINE REITER, NOTARY PUBLIC
ROBINSON TOWNSHIP, ALLEGHENY COUNTY
MY COMMISSION EXPIRES OCTOBER 20, 1986

ATTACHMENT 1

Response to Outstanding Issue of the
Beaver Valley Power Station Unit No. 2
Draft Safety Evaluation Report

Draft SER Section 13.2.1.1(1): Initial Training Program (excerpt)

Phase 1 - Academic and Nuclear Fundamental Training

This training course of formal classroom study will be approximately 14 weeks long; it is designed to provide individuals with basic knowledge in science and technology of power plant operations. The major areas to be covered are mathematics, basic nuclear physics, reactor principles, radiological fundamentals, chemistry, instrumentation and control, electrical theory, safety analysis, fluid flow, thermodynamics, and heat transfer.

With respect to instructions in the topics of fluid flow, thermodynamics and heat transfer, the staff requires the applicant to provide a program in accordance with the guidelines as outlined in Enclosure 2 of H. R. Denton's March 28, 1980, letter. The staff will review the program when it is docketed and report its findings in the final SER.

Response:

The current lesson plan LP-TMO-0 (attached), "Thermodynamics -- Introduction" provides an outline of subjects which satisfy the topics of fluid flow, theromodynamics and heat transfer as outlined in Enclosure 2 of the Denton letter. This course has been evaluated by the American Council on Education and has been recommended for upper division baccalaureate category, three semester hours in Nuclear Technology.

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Figure 0.7

DUQUESNE LIGHT COMPANY
Nuclear Division
Training Manual

LESSON PLAN

Course: Thermodynamics - Introduction

Course Hours: 183

Instructor: Slavichak / Roehlich

Date: May 7, 1982

Approved By: [signature]

Lesson Plan No. (Sequentially From 1): LP-TMO-0 (1 hr.)

References To Be Quoted: INPO Standards

Items Issued: (Attach copy of all passouts, quizzes, etc.)

1) Text: BVPS Thermodynamics; 2) Course Letter; 3) INPO Standards; 4) Course Schedule; 5) Steam Tables; 6) Lesson Plan Handouts

Introduction:

1. **Purpose:**

   To delineate the objectives, content, and schedule for the BVPS Thermodynamics Course.

2. **Motivation:** (Discuss how you plan to motivate students)

   Explain that a lack of knowledge of Thermodynamics can lead to serious safety problems, e.g., TMI; also a significant fraction of the NRC SRO and RO Licensing Exam covers Thermodynamics.

3. **General Outline:** (List detailed outline Section I)

   Course objectives, course content, course schedule

4. **General Student Goals:** (List detailed student objectives Section II)

   Upon completion of this lesson, the student will be aware of: the course objectives, how the course will be conducted, and the course schedule.

DUQUÉSNE LIGHT COMPANY
Nuclear Division
Nuclear Support Services Department

APPROVAL SHEET - LESSON PLAN AND TEXT REVISIONS

Document Title: LP-TMO-0

Rev. No.	Subjects Revised (Brief Description)	Revised by	Approval	
			Signature	Date

1	- Revised detailed outline to
	  - Course description
	  - Absence policy
	- Added student objectives
	- Added INPO Standards to handouts
		S. Slavichak
		S. Slavichak
			J Wassell	July 19, 1982

2	- Added revision approval form
	- Changed detailed outline format
	- Revised detailed outline to include more detailed:
	  - Performance requirements
	  - Absence policy
	- Changed Student Objectives format to terminal objectives and enabling objectives.
	- Added course objectives, description, and temporal breakdown to course letter.
	- Changed course schedule to lengthen time spent on lessons 6 & 7 while shortening time spent on lessons 1 & 5.
	- Abbreviated Thermodynamics Formulas, conversions and constants handouts.
	- Added exam policy statement to handout.
	- Modified transparency numbering system.
		S. Slavichak
		S. Slavichak
			J Wassell	June 15, 1982

Lesson Plan Outline	Instructor Notes and References
I. Issue of Materials	Students may keep; tell them to read the course letter now. (applies to A–E)
A. Course letter	
B. Text	
C. INPO Standards	
D. Course Schedule	
E. Lesson plan handout	
F. Steam Tables	Students must return; record copy number
II. Introduction of Instructor(s)	
A. Name(s)	
B. Office location(s)	
C. Background(s) (if asked)	
III. Introduction to Course	Preview lesson objectives with students , Show TP-TMO-0-0
A. Scope of the course	
1. Meet or exceed INPO standards	Refer to handout; show TP-TMO-0-1 , Course Letter
a. Technical specifications also are learned	
2. Help students understand heat transfer and fluid flow in plant systems	
a. During normal operations	
b. During emergency conditions	
3. Prepare students for NRC exams	
a. Both RO and SRO exams contain thermodynamics problems	
B. Course objectives (upon completion of this course)	Show TP-TMO-0-1, Course Letter
1. Students should be able to describe fluid flow and heat transfer processes in the plant	

Lesson Plan Outline	Instructor Notes and References
2. Students should be able to describe the heat and energy cycles involved with plant operations	
3. Students should be able to explain the reactor thermal and hydraulic limits	
C. Course content: Thermodynamics, Heat Transfer and Fluid Flow	These are the three major topics covered by this course
1. Chapter 1 - Fundamentals	
a. Units and conversions	
b. Properties of matter	
c. Pressure/vacuum scales	
d. Forms of energy	
2. Chapter 2 - Heat and the First Law of Thermodynamics	
a. Heat	
b. First law	
c. Heat tranfer	
(1) Radiation	
(2) Conduction	
3. Chapter 3 - Convection	
a. Convection	
b. Fluid flow	
c. Heat exchangers	
4. Chapter 4 - Systems, Pumps and Valves	
a. Systems	
b. General energy equation	
c. Bernoulli's equation	
d. Flow measuring devices	

Lesson Plan Outline	Instructor Notes and References
e. Pumps	
f. Pump laws and curves	
g. Pipes and valves	
h. Integrated fluid system behavior	
5. Chapter 5 - Behavior of Steam and Gases	
a. Entropy	
b. Steam tables	
c. Processes	
d. Moisture separators	
e. Ideal and real gases	
f. Steam/air mixtures	
6. Chapter 6 - The Conversion of Heat to Work: The Steam/Water Cycle	
a. Nozzles	
b. Air ejectors	
c. Turbines	
(1) Impulse	
(2) Reaction	
(3) Efficiency	
d. Condensers	
e. Cycles	
f. Cycle efficiency	
g. Calorimetric	
7. Chapter 7 - Nuclear Power Plant Characteristics	
a. Program Tavg	
b. Pressurizer	

Lesson Plan Outline	Instructor Notes and References

c. Thermal sleeves

d. Level indication

e. Core thermal limits

f. Boiling heat transfer

g. Core peaking factors

h. Technical specifications

i. Natural circulation

D. Conduct of the Course

1. The course is broken up into lessons which correspond to the chapters of the text

2. The lessons vary from 1 to 12 hours in length

3. Lessons are presented as a lecture

   a. Prior to the lecture(s) on a lesson, the student will be issued lesson objectives and given a text reading assignment

   b. Each lecture is approximately one hour long followed by a ten minute break

   c. During the lecture(s), the student should take notes

4. Subsequent to the lecture(s), the student will have text problems to complete

5. Prior to each exam, the text problems will be reviewed by the instructor

E. Exams

1. Total of six (6) exams during course

Lesson Plan Outline	Instructor Notes and References
a. Exam 1 covers Chapters 1-3, Exams 2 through 5 covers Chapters 4 through 7, respectively; Exam 6 is a comprehensive final exam	
b. Exam weighting	
(1) Exam 1 through 5 - 12% each (2) Exam 6 - 40%	
c. Exam conduct	Refer to handout on the Conduct of Training Dept. Exams
d. Exam content	
(1) Definitions (2) Essays (3) Short answers	
F. Performance	
1. Failure of the course will result in an Academic Warning (< 70%)	
2. Failing any quiz or test (< 70%) <u>or</u> marginally passing (≤ 72%) the course or final exam will result in a Report of Counseling.	
G. Absence	
1. Students will have to makeup for lost time	Stress that it is the students responsibility to meet with his instructor on the day he returns to work. Together they will arrive at a schedule for completion of the missed work.
2. Catch-up time will be on a one for one basis (no overtime!)	
a. e.g., A student who missed four (4) days of class will have four (4) days after his return to work to make-up all he missed. Concurrently he must learn the new material taught during this make-up period	
H. Course schedule	
1. Briefly review course schedule with the students	Refer to handout; show TP-TMO-0-2, Course Schedule
2. Emphasize that this schedule is only tentative	
IV. Summary	
A. Review Objectives	Review lesson objectives with the students
B. Make problem assignment C. Make reading assignment	

STUDENT OBJECTIVES

Terminal Objectives

Upon completion of this lesson, the student will be aware of the course objectives, the conduct of the course, and the course schedule.

Enabling Objectives

1. The student will be able to list the course objectives.
2. The student will be able to list the three major topics covered by the course.
3. The student will be able to describe the format of the course.
4. The student will know how absences will be resolved.
5. The student will know the number and frequency of exams given during the course and each one's percentage of the final grade.
6. The student will know the consequences of exam or course failure or near failure.
7. The student will be able to interpret the course schedule.

ATTACHMENT 2

Response to Outstanding Issue of the
Beaver Valley Power Station Unit No. 2
Draft Safety Evaluation Report

Draft SER Section 13.2.1.1(5): Initial Training Program (excerpt)

Phase 5 - Plant Manipulations Training

This phase of the training program is approximately 13 weeks long and will provide license candidates with hands-on training in the areas of reactivity manipulations. The applicant has indicated that this training will be conducted on either one of the Beaver Valley units, the Beaver Valley simulator or an offsite simulator. However, the applicant has not provided the simulator training program for staff review.

As specified in Enclosure 1 of H. R. Denton's letter of March 28, 1980, the staff requires all license candidates to participate in a simulator training program as part of the long-range training program. Therefore, the staff requires that the applicant submit a detailed simulator training program for NRC review. The staff will report the results of its review in the final SER.

Response:

Attached is a description of the reactor operator startup certification course for experienced hot licensed candidates. This course is being used for operators now being trained for BVPS-1. Enclosure 4 of the Denton letter does not specify the topics to be covered in the initial operator training simulator course, however, it does describe the requirements for requalification training. Attached is a description of the simulator retraining course presently used, which meets the requirements of Enclosure 4 of the Denton letter except all items are performed on a two-year cycle due to the limited amount of simulator time available in the industry.

Individuals to license on Unit 2 will be either of two categories, experienced licensed operators from Unit 1 or individuals completing the initial license training program.

Beaver Valley is currently constructing a plant simulator which is planned to be available for training prior to any individuals being licensed on Unit 2. In any case, all candidates being examined for an operating license on Unit 2 will meet the requirements of the Denton letter either by being experienced on BVPS-1 and completing both simulator programs described in Paragraph 1 or by completing the license simulator training program as described in the Beaver Valley Simulator Training Plan Section III (attached).

FSAR 13.2.1.1 will be revised to clarify Phase 4 and Phase 5 of the licensed operator training program as shown on the attached Page 13.2-2.

DSIM 354 Reactor Startup Certification Simulator Course for Experienced
DSIM 354 Hot Licensed Candidates

Purpose

This course is specifically designed for hot license candidates having significant control room experience. By means of simulator training, the license candidate is exposed to a variety of conditions and transients which might not be experienced during actual operating conditions.

In order to be eligible for the NRC license exam, the hot license candidate must have achieved two criticalities during his/her training. Also, the candidate is required to take the plant reactor to critical during the NRC test. In consideration of these requirements, WNTC offers this course in order to provide the simulator operational experience as stated above. This program is specifically designed to give the hot license candidate a broad spectrum of control room operations, ranging from cold solid shutdown to plant malfunctions in the power range. Also, each trainee will perform three simulator reactor startups throughout the duration of the program.

The final day of the program consists of a startup certification examination performed on the simulator. The NRC will waive its requirements for two training startups of the plant reactor as well as the startup during the actual licensing exam if a student attends this course and passes the startup certification examination (Nu. Reg. 0094, App. F).

Description

This course lasts a duration of seven days. Specifically, the course consists of 28 hours in actual three man operation of the simulator and 28 hours in group discussions aimed at preparing for the next day's evolutions. Utilities are encouraged to have the students use their own procedures and technical specifications where applicable, especially in the areas of reactor startup, ECP and 1/M calculations.

The initial day of the course consists of control board familiarization and basic system operation with a substantial number of demonstrations by the instructor. Subsequent days allow the student to bring the simulator to criticality and to perform a wide range of operations. The final day is utilized for the Startup Certification Examination.

Objective

The student shall demonstrate upon the simulator a knowledge level and operational proficiency adequate to pass the Startup Certification Exam.

NPO 354

DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
-Course Introduction -Tech Spec Modes -Rx Startup -Rx Startup Tech Specs -Rx Startup Forms	-Review Previous Operations -Systems Review RCS CVCS RCP Seals -Plant Heatup From Cold Shutdown to Hot Standby -Self Study	-Review Previous Operations -Review Rx Startup Procedure -Explain and Compute an ECC Doubling Effect SIM 1/M Plot -Review NIS -Rx Theory Subcritical Multiplication Rx Criticality Doppler Effect Importance Factor Point of Adding Heat Rx Trips Associated with Rx Startup	-Review Previous Operations -Discuss Secondary Plant Startup and Power Increase -Constant Axial Offset Program -Automatic Rod Control System -Dropped Rod Recovery	-Review Previous Operations -Discuss and Compute SIM -Power Reduction and Plant Shutdown -Cooldown From Hot Standby to Cold Shutdown -Steam Dump System	-Review Previous Operations -Xenon Effects on Rx Startup -Emergency Boration -Rx Trip -Self Study	-Review Previous Operations -Reactivity Effects on Rx Startup -Written Examination (2 Hours)
LUNCH	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
-Control Room Tour Simulator Computer Room Instructor Booth -Rx Startup to 2% Pwr -Rx Startup to 2% Pwr (Time Permitting)	-Conduct Plant Heatup from Cold Shutdown to Hot Standby Conditions -Warmup secondary system (Time permitting)	-Conduct three Rx Startups (Perform an 1/M Plot during the First Rx Startup)	-Rx Startup/Secondary Plant Startup with Power Increase -Dropped Rod and Recovery	-Reduction in Plant Power with Rx Shutdown -Cooldown to 525°F -Compute ECC -Rx Startup	-Conduct Three Rx Startups with Maximum Xe transient conditions	-Individual Rx Startup Certification Examinations

WESTINGHOUSE NUCLEAR TRAINING SERVICES

SIM 415

SIMULATOR RETRAINING COURSE

(5 DAY OPTION)

INTRODUCTORY STATEMENT

A. OVERVIEW

The Westinghouse Simulator Retraining Course (Sim 415) is designed to refresh the licensed operator's knowledge and proficiency. Through a varied level of simulator evolutions, the reactor operator or senior reactor operator can respond to transients and malfunctions not normally encountered during actual plant operations.

B. PURPOSE

This course has been designed to satisfy all the current annual and bi-annual control manipulations required by the NRC.

C. PREREQUISITES

Participation in this course shall be limited by the following prerequisites:

1. The student should hold a current Operator or Senior Operator License, or
2. The student should have satisfactorily complete a license certification program, or
3. The student should show enrollment in a retraining program designed for renewal of an expired license, or
4. The student shall be selected by his training department for enrollment into this program.

D. COURSE ORGANIZATION

This course is comprised of five units. Each unit represents a combination of simulator sessions supplemented by classroom seminars and critiques. Each unit is outlined in separate assignment sheets (attached) containing an introduction and specific assignment. Thus, each unit specifies the student objectives, reading assignments, course presentations, and required simulator operations.

E. COURSE OBJECTIVES

Terminal Objective:

With the aid of a simulator, the student shall demonstrate an ability to identify, describe, analyze, and respond to a variety of transients and malfunctions with a level of proficiency equal to or exceeding regulatory and safety standards.

Enabling Objectives:

Upon completion of this course, the student shall be able to:

- DESCRIBE the plant response and required operator action for a large loss of coolant accident.
- DESCRIBE orally the plant response and required operator action for a large steam generator tube rupture.
- DETERMINE that adequate core cooling exists.
- DESCRIBE orally the plant response and required operator action for a major loss of secondary coolant.
- DIAGNOSE and SOLVE operational problems associated with the failure of plant protection and control systems.
- DIAGNOSE and SOLVE operational problems associated with the loss of power sources or buses.
- DIAGNOSE and SOLVE operational problems associated with the malfunctioning of automatic control systems effecting reactivity.

F. CONTENT AND SCOPE

Unit	Title
1	Reactivity Manipulations
2	Accident Assessment/Minor Plant Transients (Part 1)
3	Accident Assessment/Minor Plant Transients (Part 2)
4	Major Plant Transients
5	Major Plant Transients/Demonstrations

G. BASIS OF EVALUATION

At the end of each course, the instructor is required to write up a formal evaluation on each student. This evaluation is then reviewed by the Training Center management and then forwarded to the student's training supervisor.

The following is a list of areas considered by the instructor in making his evaluation.

- Class participation
- Individual knowledge of plant systems, controls, and operating procedures/limitation
- Use of reference materials
- Leadership (senior license personnel only)
- Control room operations
- Communication

SIM 415

DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
Intro. to Program (1 Hr) Classroom Review	Classroom Review (1 Hour)	Classroom Review (1 Hour)	Classroom Review (1 Hour)	Classroom Review (1 Hour)
Rx Startup Synchronize to Grid Increase Power to 20% Shift to Auto Systems Turbine Malfunction Plant Shutdown (3 Hours)	100% Power; Eq. Xenon Major Accident Diagnosis 100% Power; Eq. Xenon Major Accident Diagnosis 100% Power; Eq. Xenon Major Accident Diagnosis (3 Hours)	100% Power; Eq. Xenon Major Accident Diagnosis 100% Power; Eq. Xenon Major Accident Diagnosis Plant Stabilization 50% Power; Xenon building Plant Malfunction Diag. (3 Hours)	30% Power; Xenon building Continue Plant Startup <u>Malfunctions</u> Rod Control System CVCS Component Cooling Service Water Inst Air System Main Aux Feed System	100% Power; Eq. Xenon <u>Malfunctions</u> Inst. Air System Chemistry Rod Control System EHC System Makeup Control System Elect. System Aux. Feed System Plant Cooldown
LUNCH (1/2 Hour)				
Rx Startup Synchronize to Grid Increase Power to 20% Shift to Auto Systems Pressurizer Malf. Plant Shutdown (3 Hours)	Power Increase During Xenon Transient (50 - 100%) <u>Malfunctions</u> Electrical System Comp. Cooling System Main Steam System CVCS Rod Control System Nuclear Inst System Loss of Coolant (3 Hours)	Plant S/U from 10^{-8} amps <u>Malfunctions</u> Main Feed System Pressurizer System Condenser & Off-Gas Service Water System Rod Control/RPI Main Generator Rx Coolant System Plant Shutdown (3 Hours)	Plant Startup from 50% with Transients <u>Malfunctions</u> Rod Control Boric Acid System S/G System RHR System Electrical System Protection System Main Feed System (3 Hours)	Startup During Xenon Trans. <u>Malfunctions</u> Pressurizer System Main Feed System RCS Steam Generators Main Condenser 100% Power; Eq. Xenon Charging System Rad. Monitors (3 Hours)
Critique (1/2 Hour)	Critique (1/2 Hour)	Critique (1/2 Hour)	Critique (1/2 Hour)	Critique (1/2 Hour)

III. LICENSE TRAINING PROGRAM

A. Course Description

The License Training Program is a systematic training program consisting of six (6) sections totaling twenty-five (25) days (150 simulator hours).

- o Sections 1-3 are directed to programs which allow the students to operate the individual control systems of the plant in manual and automatic and observe control system functions and interrelations utilizing exercise guides and demonstrations.

  Section 1 is 2 days (12 simulator hours) in duration and will be conducted at or near the end of the secondary systems qualification lectures.

  Section 2 is 2 days (12 simulator hours) in duration and will be conducted at or near the end of the primary systems qualifications lectures.

  Section 3 is 2 days (12 simulator hours) in duration and will be conducted at or near the end of the reactor protection and control systems qualifications lectures.

  Detailed discussions of the systems covered in each of these modules will be accomplished through the system qualification lectures conducted as part of the classroom phase of the license training program. Classroom lectures during the simulator phase will be in support of the simulator activities for that day.

- Section 4 is 4 days (24 simulator hours) in duration and will be conducted following Section 3. This section will be utilized to prepare the student for and administer the startup certification portion of the license operator examination. Practice startups will be conducted from various initial conditions of burnup and xenon, with emphasis placed on core behavior, plant control and operation and interactions of applicable control and instrumentation systems. A startup examination will be administered to each candidate at the end of the section.

  Classroom lectures will emphasize applicable operations and administrative procedures including technical specifications and limits and precautions. Reviews of related areas of reactor theory, kinetics, and control and instrumentation systems may be conducted if deemed necessary.

- Section 5 is 12 days (72 simulator hours) in duration and will be conducted following the license review training portion of the qualification program.

  Days 1-8 will be directed to combinations of normal and abnormal operating conditions. This program provides the candidate with various casualties and emergencies that could occur in the operating plant. The candidate must demonstrate the ability to recover the plant from various conditions utilizing approved procedures.

  Days 9-11 will be directed to accident mitigation. This portion of the program will provide the simulator support for the Beaver Valley Mitigating Core Damage Course taught by the Beaver Valley Classroom

Training Staff. During these three (3) days, the candidates will be given the opportunity to look at and respond to particular emergency situations that could occur in the plant and result in eventual core damage.

Day 12 will provide for operational audit exams.

The classroom instruction for Section 5 is intended to support the activities occurring on the simulator floor for that particular day.

- o Section 6 is reserved for NRC license examinations.

- o An average daily schedule would consist of the following:

Classroom Instruction/Discussion	-	2 Hours
Simulator Operation	-	6 Hours
No Scheduled Lunch Break		

B. Training Objectives

1. To provide and document the training required for a candidate to systematically acquire the basic and specific operating knowledge necessary to safely and effectively operate the Beaver Valley Nuclear Power Station Units 1 and 2 as a Reactor Operator.

2. To provide and document the training required for a candidate to systematically demonstrate the basic and specific operating skills necessary to safety and effectively operate the Beaver Valley Nuclear Power Station Units 1 and 2 as a Reactor Operator.

C. <u>Type of Training</u>

1. Classroom Instruction (Sections 1-3)

   - o 2 Hours Per day
   - o 2 Days Per Section

2. Classroom Instruction (Section 4)

   - o 2 Hours Per Day
   - o 4 Days

3. Classroom Instruction (Section 5)

   - o 2 Hours Per Day
   - o 12 Days

4. Simulator Training

   a. Systems

   - o 6 Hours Per Day
   - o 2 Days Per Section

   b. Startup Certification

   - o 6 Hours Per Day
   - o 4 Days

   c. Operations and Accident Mitigation

   - o 6 Hours Per Day
   - o 12 Days

D. Curriculum

1. The Basic Curriculum for Sections 1-3 is as follows:

- o Main Steam
- o Condensate
- o Extraction Steam
- o Heater Drains
- o Feedwater
- o Main Generator and Transformer
- o Main Turbine and Condenser
- o 4 KV Station Service Transformer
- o Reactor Coolant
- o Chemical and Volume Control
- o Boron Recovery
- o Residual Heat Removal
- o Safety Injection
- o Containment Depressurization
- o Liquid Waste
- o Gaseous Waste
- o Area Ventilation
- o Reactor Control and Protection
- o Reactor Excore Instrumentation
- o Incore Instrumentation
- o Plant Process Control
- o Main Computer

2. The Basic Curriculum for Sections 4 and 5 is as follows:

- o Subcritical Multiplication
- o Reactivity Coefficients
- o Reactivity Balance Procedure
- o Station Startup
- o Station Shutdown

- Power Operations Procedure
- Technical Specifications
- Limits and Precautions
- Accident Mitigation
- License Events Reports
- Operating Procedures
- Emergency and Abnormal Procedures
    - ECCS Actuation
    - Loss of Reactor Coolant
    - S/G Tube Rupture
    - Total Loss of Feedwater
    - Reactor Trip
    - Turbine and Generator Trip
    - Station Blackout
    - Loss of Component Cooling
    - High Reactor Coolant Activity
    - High Activity - Radiation Monitoring
    - Loss of Instrument Air
    - Loss of Containment Vacuum
    - Loss of Reactor Plant River Water
    - Loss of Reactor Coolant Flow
    - Loss of RHRS

E. Instructional Resources

1. Resources
    - NUS Thermal Science Course
    - Beaver Valley's Westinghouse NSSS Documents
    - Beaver Valley's Administrative Procedures
    - Code of Federal Regulations
    - Beaver Valley's Emergency Plan
    - Beaver Valley's Health Physics Manual
    - Beaver Valley's One-Line Diagrams
    - Beaver Valley's Flow Diagrams
    - Beaver Valley's Limits and Precautions

- Beaver Valley's FSAR
- Beaver Valley's Technical Specifications
- Beaver Valley's Alarm Response Manual
- Beaver Valley's Mitigating Core Damage Program
- License Event Reports
- I and E Bulletins
- ANSI Standards
- NRC Regulations
- Beaver Valley's System Descriptions
- NUS PWR Core Physics Course
- NUS Strength of Materials Course
- Beaver Valley's Procedures

F. <u>Schedule</u>

- The License Training Schedule is as follows:

TRAINING SCHEDULE

DAILY

PROGRAM ID License Training ______ CLASS ID PAGE ____ OF ____

WEEK: Section I DATE ________

DATE ______ ______ ______ ______ ______

CLASSROOM	Procedure Review & Discussion in Support of Simulator Evolutions				
SIMULATOR	1. Main Steam and Main Steam Isolation 2. Reheater Control System 3. Heater Drains System 4. Condenser Steam Dump 5. Feedwater and Feedwater Isolation	1. Main Turbine and Auxiliaries 2. EHC System 3. Main Generator and Voltage Regulator System 4. Emergency Diesel Generators 5. Electrical Distribution System			

TRAINING SCHEDULE

DAILY

PROGRAM ID License Training ______ CLASS ID PAGE ____ OF ____

WEEK: Section II DATE ________

DATE ______ ______ ______ ______ ______

CLASSROOM	Procedure Review and Discussion in Support of Simulator Evolutions				
SIMULATOR	1. Pressurizer Control Systems 2. Reactor Coolant Pumps and Seals 3. Chemical and Volume Control System 4. Boron Recovery System 5. Liquid and Gaseous Waste Systems	1. Residual Heat Removal System 2. Safety Injection System 3. Containment Depressurization System 4. Ventilation System			

TRAINING SCHEDULE

DAILY

PROGRAM ID License Training ______ CLASS ID PAGE ____ OF ____

WEEK: Section III DATE ________

DATE ______ ______ ______ ______ ______

CLASSROOM	Procedure Review and Discussion in Support of Simulator Evolutions				
SIMULATOR	1. Nuclear Instrumentation 2. Incore Instrumentation 3. Radiation Monitoring 4. Reactor Vessel Level Indication 5. Core Cooling Monitor 6. Plant Computer	1. Protection and Control Systems 2. Rod Control System			

TRAINING SCHEDULE

DAILY

PROGRAM ID License Training ______ CLASS ID PAGE ____ OF ____

WEEK: Section IV DATE ________

DATE ____ ____ ____ ____ ____

CLASSROOM	Procedure Review and Discussion in Support of Simulator Evolution				
SIMULATOR	1. Reactor Startups (hot standby to 10^{-8} amps) Repeat as time permits.	1. Reactor Startups (hot standby to 5% power). Repeat as time permits.	1. Reactor Startups (hot standby to 15% power). Repeat as time permits. 2. Reactor Trip Recovery.	1. Startup Certification Examinations	

TRAINING SCHEDULE

DAILY

PROGRAM ID License Training ______ CLASS ID

PAGE ____ OF ____

DATE ________

WEEK: Section V (Days 1-5)

	DATE _____	_____	_____	_____	_____
CLASSROOM	Procedure Review and Discussions in Support of Simulator Evolutions				
SIMULATOR	1. Plant Startup (cold standby to hot standby).	1. Reactor Startup and Power Increase 2. Boron Concentration Changes 3. Nuclear Instrumentation Malfunctions 4. Reactor Trip	1. Operations at Power 2. Feedwater Malfunctions 3. Condensate Malfunctions 4. Turbine Plant Cooling Water System Malfunctions	1. Operations at Power 2. Reactor Plant Cooling Water Malfunctions 3. Chemical and Volume Control System Malfunctions	1. Operation at Power 2. Pressurizer Control Systems Malfunctions 3. Rod Control System Malfunctions

TRAINING SCHEDULE

DAILY

PROGRAM ID License Training ______ CLASS ID PAGE ____ OF ____

WEEK: Section V (Days 6-10) DATE ________

DATE ______ ______ ______ ______ ______

CLASSROOM	Procedure Review and Discussion in Support of Simulator Evolutions			Accident Mitigation	
SIMULATOR	1. Operation at Power 2. RCP Malfunctions 3. Instrument Failures 4. Compressed Air System Malfunctions	1. Operations at Power 2. Electrical System Malfunctions 3. Small RCS Leaks 4. S/G Tube Leak	1. Shutdown and Cooldown 2. Loss of Shutdown Cooling 3. RHR System Malfunctions 4. Feedwater Malfunctions 5. NIS Malfunctions	1. Operations at Power 2. ATWS 3. Emergency Boration 4. Blackout	1. LOCA 2. Steam Generator Tube Rupture 3. Small Break LOCA

TRAINING SCHEDULE

DAILY

PROGRAM ID License Training ______ CLASS ID PAGE ____ OF ____

WEEK: Section V (Week 3) DATE ________

DATE ______ ______ ______ ______ ______

CLASSROOM	Accident Mitigation	Audit Examinations			
SIMULATOR	1. Total Loss of Feedwater 2. Overcooling Accidents				

TRAINING SCHEDULE

DAILY

PROGRAM ID License Training ______ CLASS ID PAGE ____ OF ____

WEEK: Section VI DATE ________

DATE ______ ______ ______ ______ ______

CLASSROOM	NRC Examinations				
SIMULATOR					

G. Training Materials

1. Classroom

- o Overhead Projector
- o Transparencies
- o Chalkboard
- o Chalk
- o Program Schedule
- o Lesson Plans
- o Student Handouts

2. Simulator

- o Site Specific Simulated Control Room
- o Simulator Drill Guides

H. <u>Prerequisites</u>

1. Prerequisites

- o The candidate must meet the extensive operating experience requirement established by ANSI 3.1 (1981).

I. <u>Performance Criteria</u>

To successfully complete the simulator portion of the License Training Program, the candidate must meet the following conditions:

- o The operational/oral audit exam results reflect a satisfactory level of competence. (Due to the subjectivity of this type of evaluation, the documentation required to determine a candidate's "level of competence" will be

reviewed by both NUS Corporation and Duquesne Light Company, and will also be determined on an individual basis).

J. Evaluation Procedure

1. Classroom

- o Written quizzes and examinations will be periodically administered by the Beaver Valley Training Department as part of the overall license training program.

- o A comprehensive written audit exam utilizing the NRC format will be administered by a knowledgeable, independent audit team at the completion of the program prior to the NRC exam.

2. Simulator

- o Reactor startup examinations will be administered by the instructor staff. A minimum of two startups will be performed by each candidate prior to the examination.

- o Oral exams will be administered, by the instructor staff, periodically throughout the program. Each candidate will receive at least two oral examinations.

- o Daily student evaluation sheets will be filled out by the instructor to document the daily surveillance of each student.

- o Overall student evaluation sheets will be filled out at the completion of the week (or section if less than 1 week).

- o A comprehensive operating audit exam utilizing the NRC format will be administered by a knowledgeable independent audit team at the completion of the program, prior to the NRC exam.

3. Test Evaluation

- o The oral quizzes, reactor ·‧‧rtup examination and daily operation. . evaluations results will be graded as "satisfactory" or "unsatisfactory." These quizzes and exams will contribute to the overall student evaluation.

- o The written ·d operational audit exams will parallel the evaluation process adopted by NRC.

K. <u>Documentation, Records, and Forms</u>

1. Documentation

- o At the completion of each week or section (if less than 1 week), student evaluation sheets will be filled out. These evaluations will include the result of:

  - o Oral Quiz Results
  - o Daily Student Evaluation Sheets
  - o Reactor Startup Examination Results

- o Daily attendance records will be kept and filed with the weekly schedule.

- o Simulated control room reactor operators log book must be kept to document reactor startup and major evolutions occurring in the control room.

- o The comprehensive written and operating audit exam results will be filed into the class files and the individual student files.

2. Records

The following documents will be maintained in the class and/or individual personnel file as permanent records for the time requirement established by NRC Regulatory Guides:

- o Attendance Records
- o Daily Evaluation
- o Weekly (Section) Evaluation
- o Oral Examinations
- o Reactor Startup Exam Results
- o Program Schedule
- o Audit Exam Results, Test and Answer Key
- o Reactor Opertors Log (simulated)
- o Simulator Evolution Summary Sheets

3. Forms

- o The following are forms to be used for the License Training Program:

    - o Daily Attendance
    - o Daily Student Evaluation

- o Weekly (Section) Overall Trainee Evaluation
- o Oral Examinations
- o Reactor Startup Exam
- o Simulator Evolution Summary

o The actual forms to be used will be included in the Simulator Facility Instructions.

Individuals in the licensed operator training program receive training commensurate with their previous education, training and experience. All operating personnel required to hold a license, according to regulatory requirements stated in 10 CFR 55 such as Reactor Operators (RO) and Senior Reactor Operators (SRO), are provided the necessary training in order to qualify.

13.2.1.1 Licensed Operator Training Program

The normal training for operations personnel follows:

Phase 1 - Academic training consisting of approximately 14 weeks of formal classroom study, depending upon job position, covers training in mathematics, physics, reactor principles, heat transfer, radiological fundamentals, electrical fundamentals, materials, safety analysis, and chemistry.

Phase 2 - A study of all plant systems for approximately 30 weeks. A period of time tracing out systems, identifying specific equipment locations, observation of plant evolutions, and reviewing the station operating and equipment instruction manuals is included in this phase. The material presented in this phase is directed towards the unit on which the individual will be applying for a license.

Phase 3 - Qualification Standard Checkoffs for approximately 76 systems are performed during Phase 3. The checkoffs require detailed knowledge of BVPS systems and the ability to perform certain operations using plant control devices or demonstrating knowledge by simulation. This period requires approximately 49 weeks and is directed towards the unit on which the individual will be applying for a license.

Phase 4 - Offsite training covers a 1 week period. Offsite training will be conducted in reactor startups and shutdowns to familiarize the operator with reactor operations when the Hot License Exam is required without a start-up demonstration.

Phase 5 - Plant manipulations training provides the operator with "hands-on" training in the area of reactivity manipulations. This training will be provided on either one of the BVPS units, the BVPS simulator, or an offsite simulator. This phase requires 13 weeks.

Phase 6 - Review lectures designed to sum up the entire program are given to prepare the candidate for the licensing exam. This phase requires 8 weeks or more, depending on the individual's background.

The details of the Licensed Operator Training program are contained in Table 13.2-1. Each candidate's previous experience

ATTACHMENT 3

Response to Outstanding Issue of the
Beaver Valley Power Station Unit No. 2
Draft Safety Evaluation Report

Draft SER Section 13.2.1.1: Initial Training Program (excerpt)

In addition, the applicant has not provided information of the simulator to be used for training. As indicated in the Standard Review Plan, Section 13.2, the simulator used for training should meet the guidelines of Regulatory Guide 1.149. We will review this information when it is received and will report our findings in the final SER.

Response:

The response to Question 630.7 and the discussion provided in FSAR 1.8 provide this information.

ATTACHMENT 4

Response to Outstanding Issue of the
Beaver Valley Power Station Unit No. 2
Draft Safety Evaluation Report

Draft SER Section 13.2.1.2: Beaver Valley Operating Cross-Training Program

The applicant has indicated that the BVPS operator cross-training program is designed to prepare operators licensed or licensable on BVPS-1 for licensing on BVPS-2 to meet the needs of the operating organization. The BVPS operator cross-training program is approximately three to four months in length and includes classroom training in system differences and system checkouts on those systems with significant differences between the units. Technical specification difference lectures are also included in the program. The applicant has not provided for our review the details of the cross-training program. As described in NUREG-1021, "Operator Licensing Examiner Standard," for a reactor operator or senior reactor operator to be eligible to hold simultaneous valid licenses on more than one nuclear facility, we require the applicant to provide the justification to demonstrate that the differences between the units are not so significant that they impact the ability of the licensed personnel to operate safety and competently both facilities. Further, the applicant must submit for NRC review the details of the training and certification program. The analyses and summary of the differences that must be performed should include:

- Facility design and systems relevant to control room personnel
- Technical Specifications
- Procedures, primarily abnormal and emergency operating procedures
- Control room design and instrument location
- Operational characteristics

The applicant also should describe the expected method of rotating personnel between units and the refamiliarization to be conducted before responsibility on a new unit is assumed.

We will review the details of the applicant's cross-training program when they are received and report our findings in the final SER.

Response:

The use of NUREG-1021 as an acceptance criterion is beyond the guidelines of the standard review plan and no basis in the regulations has been provided to justify this request as an outstanding issue in the safety evaluation report. In a memorandum for all NRR employees from Harold R. Denton dated April 28, 1982, he states, "Staff reviewers should not decrease nor go beyond the scope and requirements of any specific SRP section." The memo closed by saying:

"Implementation of this approach with respect to the SRP use and revision procedure will add greater stability to the licensing process and increase confidence that requirements imposed by NRC are congruent with the regulations and are commensurate with the safety value to be expected. Your careful consideration of this memorandum and its consistent implementation should enable NRR to carry out its statutory function with full consideration of the public interest."

In the absence of (1) a description of the regulatory basis, and (2) standard review plan acceptance criteria for this item, it is necessary for NRR to implement the backfit procedure described in Generic Letter 84-08 if this is to remain a SER outstanding issue.

BVPS-2 has recognized the need for an operator cross-training program which is in draft form.

ATTACHMENT 5

Response to Outstanding Issue of the
Beaver Valley Power Station Unit No. 2
Draft Safety Evaluation Report

Draft SER Section 13.2.1.3: Requalification Training Program (excerpt)

A requalification training program conducted by the applicant for all licensed reactor operators and senior reactor operators will be implemented following the initial licensing. This program will consist of the following:

(1) Lectures

The applicant has indicated that a total of six pre-planned requalification training lectures will be scheduled throughout the year. Lecture subjects and content will be based on the results of the annual examination administered to licensed reactor operators and senior reactor operators. However, the content of the lectures described in the FSAR by the applicant does not cover all the subjects listed in Appendix A of 10CFR Part 55. We require the lectures to be modified to include the following subjects as listed in Appendix A of 10CFR Part 55 as well as in Enclosure 1 of H. R. Denton's March 28, 1980, letter:

° Theory and principles or operation

° General and specific plant operating characteristics

° Plant instrumentation and control systems

° Plant protection systems

° Engineered safety systems

° Normal, abnormal, and emergency operating procedures

(2) On-the-Job Training

The on-the-job training portion of the requalification program will consist of the following segments:

(a) Control Manipulations

The applicant has indicated that during each two year period, each licensed reactor operator is required to manipulate facility controls through at least 10 evolutions and each licensed senior operator is required to manipulate, direct, or evaluate the manipulation on controls through a like number of plant evolutions from any combination of the following evolutions:

° Reactor start-up from subcritical to the point of adding heat

° Manual control of steam generator levels during reactor start-up or shutdown

° Placing reactor in hot standby condition form at power condition

° Dilution of reactor coolant system (RCS) boron concentration to achieve a reduction of at least 100 ppm or boron

° Boration of RCS to achieve an increase of at least 100 ppm or boron

° Operation of EHC turbine governor controls during unit start-up

° Manual rod control operation prior to and during generator synchronization

° Control rod manipulation during reactor power level changes or greater than 10 percent

° Plant and reactor operation that involve emergency or transient procedures where reactivity is changing

° Rod drop timing test

We find that the above applicant's commitment of control manipulations required for licensed operators does not comply with the requirements as specified in Enclosure 4 of H. R. Denton's letter of March 28, 1980, which requires that, during each two year license period, each licensed reactor operator shall perform all of the following listed control manipulations and each licensed senior reactor operator shall perform, direct, or evaluate all of the following control manipulations:

*° Plant or reactor startup to include a range such that reactivity feedback from nuclear heat addition is noticeable and heatup rate is established

° Plant shutdown

*° Manual control of steam generators and/or feedwater during start-up and shutdown

° Boration and/or dilution during power operation

*° Any significant (> 10%) power changes in manual rod control

° Any reactor power change of 10% or greater where load change is performed with load limit control

*° Loss-of-coolant including:

a. Significant PWR steam generator leaks
b. Inside primary containment

c. Large and small, including leak-rate determination
d. Saturated reactor coolant response

° Loss of instrument air

° Loss of electrical power (and/or degraded power sources)

*° Loss of core coolant flow/natural circulation

° Loss of condenser vacuum

° Loss of service water if required for safety

° Loss of residual heat removal (RHR) system

° Loss of component cooling system or cooling to an individual component

° Loss of all normal feedwater and feedwater system failure

*° Loss of all feedwater (normal and emergency)

° Loss of protective system channel

° Mispositioned control rod or rods (or rod drops)

° Inability to drive control rods

° Conditions requiring use of emergency boration

° Fuel cladding failure or high activity in reactor coolant or offgas

° Turbine or generator trip

° Malfunction of automatic control system(s) which affect reactivity

° Malfunction of reactor coolant pressure/volume control system

° Reactor trip

° Main steam line break (inside or outside containment)

° Nuclear instrumentation failure(s)

The starred (*) items shall be performed on an annual basis; all other items shall be performed on a two-year cycle. An appropriate simulator, which reproduces the general operating characteristics of and has similar instrument and control arrangement to BVPS-2, may be used to perform these control manipulations.

Response:

Table 13.2-2 of the FSAR will be revised to specify lecture subjects which are consistent with examination categories of NUREG 1021. The content of these lectures covers those areas specified in Appendix A of 10CFR55 and includes the following:

° Theory and principles of operation

° General and specific plant operating characteristics

° Plant instrumentation and control systems

° Plant protection systems

° Engineered safety systems

° Normal, abnormal, and emergency operating procedures

The requalification training program required for licensed operators will comply with the requirements as specified in Enclosure 4 of H. R. Denton's letter of March 28, 1980, which requires that, during each two year license period, each licensed reactor operator shall perform all of the following listed control manipulations and each licensed senior reactor operator shall perform, direct, or evaluate all of the following control manipulations:

*° Plant or reactor startup to include a range such that reactivity feedback from nuclear heat addition is noticeable and heatup rate is established

° Plant shutdown

*° Manual control of steam generators and/or feedwater during start-up and shutdown

° Boration and/or dilution during power operation

*° Any significant (> 10%) power changes in manual rod control

° Any reactor power change of 10% or greater where load change is performed with load limit control

*° Loss-of-coolant including:

a. Significant PWR steam generator leaks
b. Inside primary containment
c. Large and small, including leak-rate determination
d. Saturated reactor coolant response

° Loss of instrument air

° Loss of electrical power (and/or degraded power sources)

- *° Loss of core coolant flow/natural circulation
- ° Loss of condenser vacuum
- ° Loss of service water if required for safety
- ° Loss of residual heat removal (RHR) system
- ° Loss of component cooling system or cooling to an individual component
- ° Loss of all normal feedwater and feedwater system failure
- *° Loss of all feedwater (normal and emergency)
- ° Loss of protective system channel
- ° Mispositioned control rod or rods (or rod drops)
- ° Inability to drive control rods
- ° Conditions requiring use of emergency boration
- ° Fuel cladding failure or high activity in reactor coolant or offgas
- ° Turbine or generator trip
- ° Malfunction of automatic control system(s) which affect reactivity
- ° Malfunction of reactor coolant pressure/volume control system
- ° Reactor trip
- ° Main steam line break (inside or outside containment)
- ° Nuclear instrumentation failure(s)

The starred (*) items shall be performed on an annual basis; all other items shall be performed on a two-year cycle. An appropriate simulator, which reproduces the general operating characteristics of and has similar instrument and control arrangement to BVPS-2, may be used to perform these control manipulations.

ATTACHMENT 6

Response to Outstanding Issue of the
Beaver Valley Power Station Unit No. 2
Draft Safety Evaluation Report

Draft SER Section 13.2.1.3(3): Simulator Training (excerpt)

The applicant has indicated that some or all of the licensed operators and senior operators may participate in simulator training during their requalification programs. A simulator may be used to meet the requirements of the FSAR if the simulator reproduces the general operating characteristics of BVPS-2 and the arrangement of the instrumentation and controls of the simulator is similar to that of BVPS.

We find that the applicant has not committed to the requirement as specified in Enclosure 1 of H. R. denton's letter of March 28, 1980, which requires all licensed operators to participate in a simulator training program as part of the requalification program. Therefore, we require that the applicant submit a simulator training program as part of the requalification program for NRC review. We will report the results of our review in the final SER.

Response:

As discussed in Attachments 2 and 5, BVPS-2 operators will participate in a simulator requalification program.

ATTACHMENT 7

Response to Outstanding Issue of the
Beaver Valley Power Station Unit No. 2
Draft Safety Evaluation Report

Draft SER Section 13.2.1.3(4)(b): Systematic Observation and Evaluation (excerpt)

The applicant has not addressed the systematic observation and evaluation of performance and competency of licensed reactor operators and senior operators. As described in Appendix A to the 10CFR Part 55, we require the applicant to provide an evaluation program to include systematic observation and evaluation of the performance and competency of licensed reactor operators and senior reactor operators by supervisors and/or training staff members including evaluation of actions taken or to be taken during actual or simulated abnormal and emergency conditions. We will review the applicant's modification of the program to include these subjects and report our findings in the final SER.

Response:

The performance and competence of licensed operators and Senior Operators is evaluated at least annually by observation or a critique of the manner in which the operators responded in recognizing and managing such events as abnormal occurrences and response to off normal operating conditions or simulated emergency or abnormal operating conditions. Final evaluation is accomplished by observation while using the control panel of the Beaver Valley Power Station or station simulator control panel.

ATTACHMENT 8

Response to Outstanding Issue of the
Beaver Valley Power Station Unit No. 2
Draft Safety Evaluation Report

Draft SER Section 13.2.1.3(5): Accelerated Requalification Program (excerpt)

The applicant has not provided the criteria for requiring a licensed individual to participate in an accelerated requalification program. We require an accelerated requalification program to be implemented when the performance of a licensed reactor operator or senior reactor operator falls below the following criteria:

- As specified in Enclosure 1 of H. R. Denton's March 28, 1980, letter, the passing grade for the written examination shall be 80% overall and 70% in each category.
- As required in Appendix A to the 10CFR Part 55, where the performance evaluations conducted pursuant to the above section (4)(b), "Systematic Observation and Evaluation," clearly indicate the need.

We will review the applicant's commitment to the above criteria for requiring a licensed reactor operator or senior reactor operator to participate in an accelerated requalification training program, and will report our findings in the final SER.

As indicated in the above, we find that the applicant's requalification training program for licensed reactor operators and senior reactor operators does not fully conform to the requirements as specified in the Appendix A to 10CFR Part 55 and in the letter from H. R. Denton to all power reactor applicants and licensees dated March 28, 1980. Therefore, we have not been able to conclude that the applicant's requalification training program is acceptable.

Response:

A licensed operator or Senior Operator whose scoring is less than 80% in any section of the comprehensive annual examination shall be required to attend lectures in those sections of the exam. Should the licensed operator or Senior Operator fail to attain an average of at least 80% overall, with a minimum of 70% percent in each category in the annual examination, he shall be removed from shift duties and shall participate in accelerated requalification programs under the direction of the Station Supervisor of Training. He will be returned to shift duties after retesting and achieving an overall average of 80 percent. Lectures will be scheduled in those areas in which a grade of less than 80% was achieved. The NRC will be notified of satisfactory completion of training prior to the individual's return to licensed duties. Provisions have also been made for licensed operators and senior operators to participate in an accelerated requalification program when the results of the systematic observation and evaluation program required by 10CFR55, Appendix A, Paragraph 4.c, clearly indicate the need.

ATTACHMENT 9

Response to Outstanding Issue of the
Beaver Valley Power Station Unit No. 2
Draft Safety Evaluation Report

Draft SER Section 13.2.1.4 (I.A.2.1): Immediate Upgrading of Reactor Operator and Senior Reactor Operator Training and Qualification (excerpt)

The applicant's training program includes topics in heat transfer, fluid flow, and thermodynamics. However, the applicant has not provided a program for the instructions of these topics in accordance with Enclosure 2 of H. R. Denton's March 28, 1980, letter. We require the applicant to provide this program for us to review, and we will report our findings in the final SER.

The applicant's training program does not include topics in reactor and plant transients. As described in Enclosure 1 of H. R. Denton's March 28, 1980, letter, we require the applicant to modify the training program to provide emphasis on reactor and plant transient. We will review the applicant's modification to the training program to include these topics when it is received and report our findings in the final SER.

The applicant has submitted an outline of a program for training in mitigating core damage. We have reviewed it and find that the outline does not provide us sufficient information to determine that the applicant's program is comparable in scope and depth of training in various subjects to the mitigating core damage training program as outlined in Enclosure 3 of H. R. Denton's March 28, 1980, letter. Therefore, we require the applicant to provide for us to review a detailed description of the program in accordance with the guidance as specified in the above cited enclosure of H. R. Denton's March 28, 1980, letter. We will review the applicant's program when it is recieved and report our findings in the final SER.

Based on our review, we have not been able to conclude that the applicant of BVPS-2 has satisfied the requirements of this item of the TMI Action Plan.

Response:

Refer to Attachment 1 with regard to heat transfer, fluid flow and thermodynamics. The current lesson plan LP-ATA/MCD-0 (attached), "Transient and Accident Analysis/Mitigating Core Damage -- Introduction," provides an outline of subjects which satisfy the topics of (1) training in the use of plant systems to control or mitigate an accident in which the core is severely damaged and (2) reactor and plant transients required by Enclosure 1 of the Denton letter. The portion of this lesson devoted to mitigating core damage would consist of approximately 65 hours of training for new operators, 45 hours for requalification of operators, and 20 hours for other plant staff. Lesson plans LP-NOMCD-1 and LP-NOMCD-15 describe the subject areas of gas generation and radiation monitoring, respectively.

194	04,CG3,004						

DUQUESNE LIGHT COMPANY
Nuclear Division
Training Manual

Figure 0.7

LESSON PLAN

Transient and Accident Analysis/Mitigating Core Damage - Introduction
Course

120
Course Hours

Laughlin/Russell
Instructor

January 26, 1984
Date

Approved By:

LP-ATA/MCD-0 (1 Hr.)
Lesson Plan No. (Sequentially From 1)

References To Be Quoted: INPO Standards

Items Issued: (Attach copy of all passouts, quizzes, etc.)

1) Text: BVPS Mitigating Core Damage 2) Course Letter; 3) INPO Standards: 4) Course Schedule; 5) Lesson Plan Handouts.

Introduction:

1. **Purpose:**

To delineate the objectives, content, and schedule for the BVPS Transient and Accident Analysis/Mitigating Core Damage Course

2. **Motivation: (Discuss how you plan to motivate students)**

Explain that a lack of knowledge can lead to serious safety problems and a significant fraction of the NRC SRO and RO Licensing Exam covers these areas.

3. **General Outline: (List detailed outline Section I)**

Course objectives, course content, course schedule.

4. **General Student Goals: (List detailed student objectives Section II)**

Upon completion of this lesson, the student will be aware of: the course objectives, how the course will be conducted, and the course schedule.

DUQUESNE LIGHT COMPANY
Nuclear Division
Nuclear Support Services Department

APPROVAL SHEET - LESSON PLAN AND TEXT REVISIONS

Document Title: LP-ATA/MCD-0

Rev. No.	Subjects Revised (Brief Description)	Revised by	Approval	
			Signature	Date
1	Added ATA/MCD course introduction lesson plan.	P. Russell Paul A Russell	[signature]	Jan. 26, 1984

STUDENT OBJECTIVES

Terminal Objectives

Upon completion of this lesson, the student will be aware of the course objectives, the conduct of the course, and the course schedule.

Enabling Objectives

1. The student will be able to list the course objectives.
2. The student will be able to list the two major topics covered by the course.
3. The student will be able to describe the format of the course.
4. The student will know how absences will be resolved.
5. The student will know the number and frequency of exams given during the course and each ones percentage of the final grade.
6. The student will know the consequences of exam or course failure or near failure.

Lesson Plan Outline	Instructor Notes and References
I. Issue of Materials	Students may keep; tell them to read the course letter now.
A. Text	
B. INPO Standards	
C. Course Schedule	
II. Introduction of Instructor(s)	
A. Name(s)	
B. Office location(s)	
C. Background(s) (if asked)	
III. Introduction to Course	
A. Scope of the Course	
1. Meet or exceed INPO standards	
a. Technical Specifications are also covered.	
2. Help students understand the plant response	
a. During transients	
b. During accidents	
3. Help students understand how to mitigate various accidents.	
4. Prepare students for NRC exams	
a. Both RO and SRO exams cover the plant response during transients and accidents and accident mitigation.	
B. Course objectives (upon completion of this course)	
1. Students should be able to describe the plant response to various transients.	
2. Students should be able to describe the plant response to various accidents.	

Lesson Plan Outline	Instructor Notes and References
3. Students should be able to explain how to mitigate the consequences of various plant transients and accidents.	
C. Course content: Transient and Accident Analysis and Mitigating Core Damage	
1. Transient and Accident Analysis	
a. Fundamentals Review	
b. Power Distribution	
c. Transient Analysis	
1) Normal	
2) Abnormal	
d. Accident Analysis	
1) Reactivity Addition Accident	
2) LOCA's	
3) Miscellaneous	
2. Mitigating Core Damage	
a. Post Accident Cooling	
b. Potentially Damaging Operating Conditions	
c. Small Break Loss of Coolant with No High Head Safety Injection	
d. E-0 Procedural Review	
e. E-1 Procedural Review	
f. Loss of Feedwater Induced Loss of Coolant Accident	
g. Main Steam Break Review	
h. Steam Generator Tube Rupture Review	
i. Excerpt from Incident Evaluation Ginna SGTR	
j. Steam Generator Overfill	

Lesson Plan Outline	Instructor Notes and References

k. Loss of All A.C., EOP-7

l. Incore Thermocouple Maps

m. Vital Process Instrumentation

n. Instrument Qualification and Accident Response

o. Accident Response of Excore Instrumentation

p. Accident Response of Incore Instrumentation

q. Post Accident Primary Radiochemistry

D. Conduct of the Course

1. The course is broken up into two areas: Transient and Accident Analysis and Core Mitigating Damage

2. Lessons are presented as a lecture

   a. Prior to the lecture(s) on a lesson, the student will be issued lesson objectives and may be given a text reading assignment.

   b. Each lecture is approximately one hour long followed by a ten minute break.

   c. During the lecture(s), the student should take notes

3. Prior to each exam, a review will be conducted.

E. Exams

1. Total of three (3) exams during course

   a. Exam 1 - Transient Analysis
      Exam 2 - Accident Analysis
      Exam 3 - Mitigating Core Damage and Transient and Accident Analysis Comprehensive.

   b. Exam weighting

      1) Exam 1 and 2-20% each

Lesson Plan Outline	Instructor Notes and References
3) Exam 3 - Transient and Accident Analysis - 20% Mitigating Core Damage - 40%	
c. Exam conduct	Refer to handout on the Conduct of Training Dept. Exams
d. Exam content	
1) Essays	
2) Short answers	
3) Calculations and graphs	
F. Performance	
1. Failure of the course will result in an Academic Warning (< 70%)	
2. Failing any exam (< 70%) will result in a Report of Counseling.	
G. Absence	
1. Students will have to makeup for lost time	Stress that it is the students responsibility to meet with his instructor on the day he returns to work. Together they will arrive at a schedule for completion of missed work.
2. Catch-up time will be on a one for one basis (no overtime!)	
a. e.g., a student who missed four (4) days of class will have four (4) days after his return to work to make-up all he missed. Concurrently he must learn the new material taught during this make-up period.	
H. Course schedule	
1. Breifly review course schedule with the students.	Refer to handout; show Course Schedule.
2. Emphasize that this schedule is only tentative	
IV. Summary	
A. Review Objectives	Review lesson objectives with the students.

COURSE LETTER

Transient and Accident Analysis and Mitigating Core Damage

The Nuclear Support Services Department of the Duquesne Light Company is committed to meet the INPO Guidelines for Qualification and Training of Licensed Operators. The Transient and Accident Analysis and Mitigating Core Damage Course has been designed to meet or exceed these guidelines.

The Transient and Accident Analysis and Mitigating Core Damage course is presented in a lecture format. Questions and discussion are encouraged during the lectures. The BVPS Mitigating Core Damage Text is the reference book used for this course. However, the text is supplemented with handouts taken from Westinghouse WCAP's, BVPS Technical Specifications, BVPS Setpoint Study and BVPS updated FSAR.

There are a total of three (3) exams given during this course. These include the final exam which is comprehensive. There is a review session prior to each exam. Subsequent to each exam, the correct answers to the exam questions are presented to the students.

Accompanying this letter are a copy of the INPO Guidelines for training to recognize and mitigate the consequences of core damage, and the Course Schedule.

Course Objectives

Upon successful completion of this course, the student will be able to: describe the plant response to various transients, describe the plant response to various accidents, and explain how to mitigate the consequences of various plant transients and accidents.

Course Description

Topics include:

Fundamentals Review

Power Distribution

Transient Analysis

1. Normal
2. Abnormal

Accident Analysis

1. Reactivity Addition Accident
2. LOCA's
3. Miscellaneous

Mitigating Core Damage

1. Post Accident Cooling
2. Potentially Damaging Operating Conditions
3. Small Break Loss of Coolant with No High Head Safety Injection
4. E-0 Procedural Review
5. E-1 Procedural Review
6. Loss of Feedwater Induced Loss of Coolant Accident
7. Main Steam Break Review
8. Steam Generator Tube Rupture Review
9. Excerpt from Incident Evaluation Ginna SGTR
10. Steam Generator Overfill
11. Loss of All A.C., EOP-7
12. Incore Thermocouple Maps
13. Vital Process Instrumentation
14. Instrument Qualification and Accident Response
15. Accident Response of Excore Instrumentation
16. Accident Response of Incore Instrumentation
17. Post Accident Primary Radiochemistry

Course Temporal Breakdown

Course length	120 hours
Lectures	72 hours
Student reading, study	36 hours
Student examinations	9 hours
Examination reviews	3 hours

CLASS SCHEDULE

TRANSIENT AND ACCIDENT ANALYSIS

MITIGATING CORE DAMAGE

Day 1	Introduction Fundamentals Review Power Distribution
Day 2	Power Distribution (Cont.) Reactor Trip Review
Day 3	I&C Review Introduction to Transient Analysis Normal Transient Analysis
Day 4	Normal Transient Analysis (Cont.) Abnormal Transient Analysis
Day 5	Abnormal Transient Analysis (Cont.) I&C Failures
Day 6	Study/Review Quiz 1
Day 7	Introduction to Accident Analysis Reactivity Addition Accidents
Day 8	Reactivity Addition Accidents (Cont.) LOCA's
Day 9	LOCA's (Cont.) Miscellaneous Accidents
Day 10	Study/Review Quiz 2

Day 11	Core Cooling Mechanics Potentially Damaging Core Conditions
Day 12	Small Break LOCA with no HHSI Procedural Review E-0 and E-1 Loss of Feedwater Induced LOCA
Day 13	Steam Break E-2 SGTR E-3 Review of Ginna SGTR SG Overfill
Day 14	Loss of All AC EOP-7 Incore Thermocouple Maps Vital Process Instrumentation
Day 15	Instrument Qualification Accident Response of Excore Instrumentation Accident Response of Incore Instrumentation Post Accident Radiochemistry
Day 16	Study/Review
Day 17	Final Exam

BUD.CD.	RECORD TYPE	UNIT	RECORD TYPE YR. MO. DAY	KEY CD.	KEY DATA	SOURCE	DESTINAT.
194	C4 CC3 004						

DUQUESNE LIGHT COMPANY
Nuclear Division
Training Manual

Figure 0.7

LESSON PLAN

MCD - Post Accident Cooling
Course

2
Course Hours

Laughlin/Russell
Instructor

May 7, 1984
Date

Approved By:

LP-NOMCD-1 Rev. 1
Lesson Plan No. (Sequentially From 1)

References To Be Quoted: SNUPPS, FSAR, Chapters 4, 6, and 16 (Technical Specifications); WCAP-9600, Sections 2.6, 2.9; NSAC Report "Analysis and Evaluation of St. Lucie Unit 1 Natural Circulation Cooldown,"; "Long Term Core Cooling-Boron Considerations," letter from West. Elec. Corp. the USNRC, CLC-NS-309.

Items Issued: (Attach copy of all passouts, quizzes, etc.)

Tab 1 of Beaver Valley Mitigating Core Damage Textbook

Introduction:

1. Purpose:

   To make the student aware of various post accident cooling mechanisms.

2. Motivation: (Discuss how you plan to motivate students)

   To understand the role the operator plays on the success or failure of post accident cooling.

3. General Outline: (List detailed outline Section I)

   Introduction, Operator's role in plant safety, core thermal limits, natural circulation, non-condensable gas formation and effects.

4. General Student Goals: (List detailed student objectives Section II)

   Understand operator's role, know ECCS acceptance criteria, understand natural circulation cooling.

DUQUESNE LIGHT COMPANY
Nuclear Division
Nuclear Support Services Department

APPROVAL SHEET - LESSON PLAN AND TEXT REVISIONS

Document Title: LP-NOMCD-1

Rev. No.	Subjects Revised (Brief Description)	Revised by	Approval	
			Signature	Date
1	Developed lesson plan from MCD manual. No change to manual.	P. Russell Paul A Russell		

POST ACCIDENT COOLING

Student Objectives

TERMINAL OBJECTIVE

The student should understand the key role he plays in mitigating the consequences of any accident that could lead to core damage. In addition, he should understand what effects his actions can have on the success or failure of post accident cooling mechanisms.

ENABLING OBJECTIVES

After studying the text in conjunction with other specified references and the lecture, the student should be able to:

1) Explain the operator's role, and the role of technical specifications, in ensuring plant safety.

2) List the ECCS acceptance criteria, and explain how each item relates to long term core cooling.

3) Understand the operator's relationship with the ECCS acceptance criteria.

4) Discuss how the operator can determine the status of natural circulation, and what factors can promote/retard the effectiveness of core cooling via natural circulation.

Lesson Plan Outline	Instructor Notes and References
Post Accident Cooling	
I. Introduction	
A. Discuss various aspects of core cooling.	
B. Know what cooling mech. are available or should be available and what function he performs to enhance or alter these cooling mech.	
C. Associated Technical Specs. ECCS acceptance criteria, natural circulation.	
D. Operator must be able to recognize when the plant is not responding as predicted.	
II. Operator's Role in Plant Safety	
A. FSAR Analysis	
1. Plant operating in a given band via proper control systems.	
2. Plant assumed to be in steady state prior to the transient.	
3. Plant operated within Tech. Spec. limits	
B. Operation Within Band	LP-NOMCD-1.1
1. Operator acts as backup to auto control system.	
2. Plant operation within certain deviations allowed.	
3. Key deviations	
- RCS leakage	
- RCS activity	
- Power distribution	
- Safeguards equipment out of service	

Lesson Plan Outline	Instructor Notes and References
4. Example	
a. 100% power with several S/G safeties inoperable	LP-NOMCD-1.2
- Complete loss of load (condition II)	
- Plant will overpressurize	
5. Tech. Specs. assist the operator in ensuring the FSAR results remain valid.	
6. Even with these operating restraints it is possible degraded core conditions could exist.	
a. Operator must then take corrective action.	
III. Core Thermal Limits	
A. 10 CFR 50.46 acceptance criteria (5)	LP-NOMCD-Table 1.1
B. Cladding oxidation - drives the success with which the other four are met.	LP-NOMCD-Table 1.2
1. Reaction - ZR	
$ZR + 2H_2O \rightarrow ZRO + 2H_2 + \text{Heat}$	
2. Baker - Just Eq.	
a. $d\pi/dt = .3937/\pi \; e^{\cdot\, E/RT}$	
π - clad thickness oxidized T - clad temp in °K R - 1.987 cal/g-mole-°K t - time in seconds E - 45,500 cal/g-mole	
3. Important point is oxidation rate increases exponentially with temperature.	
a. 1800°f - significant rate	
b. 2000°f - 17% cladding oxid. limit within 1 hour.	
c. 2200°f - rate is accellerated rapidly	
d. 4800°f - "auto-catalytic"	

Lesson Plan Outline	Instructor Notes and References
4. 17% oxidation of clad thickness	
a. Loss of strength and ductility	
b. Consider thermal shock during SI	
C. H_2 Generation - < 1% of the theoretical vol. of H_2 that could be generated if all the cladding reacted.	
1. Westinghouse 312 ~ 34,000 pounds of ZR	
a. Potentially 270,000 ft^3 of H_2 (at STP) in RCS would recombine due to radiation but in containment during LOCA could mix with free oxygen.	LP-NOMCD-1.3
b. 4% flammable	
c. 18-54% explosive	
d. 54-75% flammable	
e. > 75% not enough oxygen	
2. Other H_2 Sources	LP-NOMCD-Table 1.3
a. Stainless steel	
- $3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$ + Heat	
- Accelerate at 2300°f (Negligable until this temperature)	
- 5000 BTu/lbmFe	
- does not surround fuel so not as big of a concern	
- Melts at 2500°f	
b. Aluminum ~ 2000 lbs	
- $Al + 3H_2O \rightarrow Al_2O_3 + H_2$	
- 300°f - accelerated	
- Conduit, coolers	

Lesson Plan Outline	Instructor Notes and References

- $2al + 2NaOH \rightarrow Al_2 + 3H_2$ (room temp) (spray suppression syst)

- produce large amounts of H_2 but the amount of Al. is limited inside containment.

c. Radiolysis of coolant in system and in sump - significant source.

d. H_2 expanded from RCS inventory (25-35 cc/KG in RCS)

D. Boron Precipitation

1. Fourth and fifth limits of Table 1 require long term coolable geometry.

2. Assume LOCA and loss of natural circulation in good loops - would have core boiling with steam loss to ambient as heat removal.

a. Boric acid concentration would ↑ to due to low voletility.

b. Flow blockage, and heat transfer,

c. Hot leg recirc. - 14.5 hours after LOCA to reverse core flow and quench boiling flushes out cold leg.

d. If hot leg break, would still quench boiling.

e. Computer calculation performed to predict boron concentration in core at 24 hours after cold leg break.

f. Assumptions

- Core vol. up to Th leg lip considered

- Any H_2BO_3 volatility ignored

- ↑ in specific gravity as concentration ↑ is ignored (this would cause boric acid to settle to lower plenum).

LP-NOMCD-Table 1.4

LP-NOMCD - 1.4

Lesson Plan Outline	Instructor Notes and References
IV. Natural Circulation	
A. Flow due to fluid density difference within the fluid.	
B. Requires several conditions	LP-NOMCD-1.5
1. Heat source	
2. Heat sink - (Temp. would equalize)	
3. Height difference	
C. Thermal Driving Head - pressure difference due to columns of fluids at different densities.	LP-NOMCD-1.6
1. $TDH = g/g_c \int \rho(z)\, dz$ for constant source and sink $TDH = -g/g_c\ (\Delta\rho\Delta Z)$ $\Delta\rho = \rho_c - \rho_H$	
2. Head is defined as ρ/ρ $Head_{N.C} = TDH/\rho_{Avg}$ ft lbf/ lbm $TDH/\rho_{avg} = K_{Loop} \cdot \dot{V}^2$ K_{Loop} = flow resistance	
D. $\dot{V}_{Loop} = \frac{TDH}{\rho_{avg} K_{Loop}} = \frac{g/g_c\ \Delta\rho\Delta Z}{\rho_{avg} K_{Loop}}$	
1. The following equations can be found from the above equation.	
a. $TDH \propto \Delta T$	
b. $\dot{M} \propto \Delta T^{1/2}$	
c. $\dot{Q} \propto \Delta T^{3/2}$	
E. Another obvious requirement for nat. circ. flow is a complete unobstructed loop for flow.	
1. $\Delta h \sim 20'$ - T_H nozzle to tube sheet	
2. Show TDH Z/ρ curve - discuss overfeeding S/G.	

Lesson Plan Outline	Instructor Notes and References

F. Design criteria to ↑ efficiency of N.C

1. PZR level $\geq$ 50%

2. PZR press. > 2000 PSIA

3. S/G level in narrow range in at least one S/G.

   a. 2000 psia results in at least 15° subcooled at core exit for 100% power T_H value, this ensures no voids forming so PZR level is a valid indication that the core is water filled.

   b. The S/G requirement ensures a heat sink. (narrow range ind. above the tubes).

G. Indications of heat removal

1. RCS $\Delta t \leq$ full power Δt

   a. $\dot{Q} \propto \Delta t^{3/2}$

   b. $\Delta t \propto \dot{Q}^{2/3}$

   c. $\dot{Q} = \dot{m} \, C_p \, \Delta t$

   - (8%) = (10%) (.8%) actual for N.C.

2. Core Exit T/C's constant or ↓

3. S/G press. → or ↓ at a rate equiv. to rate of RCS temps. ↓ while maintaining S/G levels.

   - If N.C. stopped - steam press. would ↓ quickly as S/G cools RCS water which is not flowing.

H. It is desirable to maintain RCS press. with PRZ heaters or with bubble in head controlling.

I. Voids are a concern if they collect in tube bend area, this could block flow. AFW should condense steam voids if level in narrow band.

Lesson Plan Outline	Instructor Notes and References
J. St. Lucie Unit 1, July 11, 1980	
1. Elect. failure lost cooling water to RCP's	
2. Rx trip and RCP's secured - natural circulation cooldown.	
a. 15-20 min. establish N.C.	LP-NOMCD-1.7
b. 35 min. commensed cooldown	LP-NOMCD-1.8
c. PRZ level irregular at 7 AM - CE engineers agree steam bubble in head.	LP-NOMCD-1.9
3. "T_H Plants", W recommends a cooldown rate of 25°f/hour compared to 60°f/hour that they had - "T_c" Plants" W recommends 50°f/hour C/D rate maximum.	
4. If it is apparent that expansion of the steam bubble is blocking N.C. flow, ↓ cooldown rate to collapse bubble by cooling head more effectively.	
5. The steam bubble in the head will control press at sat (5 - 6:30 a.m.) - press was attempted to be↓ to use low head systems but the steam void held P→.	LP-NOMCD-1.10
K. If flow is ↓, the Δt would ↑, T_H would approach sat. - but TDH ↑ (ΔP) this figure assumes T_H at sat.	LP-NOMCD-1.11
1. Ex. if T_C at 300°f and RCS press. at 800 psia system > psf TDH.	
2. If these T_C cond. existed, T_H would be below T_{sat} since only ∿ 100 PSF TDH is required for natural circulation flow.	
3. If N.C. flow was impeded the ΔT would ↑ until boiling at T_H.	
L. What could impede natural circulation flow?	
1. Non-condensable gas formation.	

Lesson Plan Outline	Instructor Notes and References
a. TMI - severely affected - plant specific problem -	LP-NOMCD-1.12

b. Collect in high points of system (RCS head, PRZ, U-tubes of S/G)

c. S/G req'd for heat removal

- 2" brk - needed for ∿ 1 hour
- 1" brk - needed for ∿ 1 day

V. Sources of Noncondensable Gases

A. Dissolution of H_2 - P + H_2 released assumed released when press. reaches saturation and H_2 concentration is assumed at 50 cc/KG. (25 - 35 cc/KG).

B. Radiolysis

1. $2H_2O \overset{\gamma,N}{\rightleftarrows} 2H_2 + O_2$

2. Starts at 5 cc/KG concentration

3. Sump assumed negligable

C. PRZ Vapor Space -

1. 600 scf H_2

2. Assumed ideal gas law expansion

D. ZR - Water Reaction

1. Temp dependent

2. Computer calculated core temps. used.

E. Accumulator N_2

1. Assumed released under ideal expansion

F. Fission Gasses

1. Released if fuel rods burst

2. Calculation in computer code.

Lesson Plan Outline	Instructor Notes and References

G. Helium

1. If clad bursts

H. Dissolution of gasses from S.I. flow.

1. Assumed to be air saturated (18 cc/Kg of various gasses).

I. Conservative assumptions for computer code.

1. Perfect mixing of S.I. and RCS (max gas reaches core)

2. No reabsorption of released gas.

3. All non-cond. gasses released at point of saturation.

J. Breakdown

Time	Event
90 sec	dissolution begins
144 sec	radiolysis starts (5cc/Kg)
190 sec	PRZ empty
1350 sec	$Zr-H_2O$ begins
2100 sec	min. RCS press. (no more gasses released)
4050 sec	Bkr removes all decay heat

* accum. did not inject <u>at</u> <u>all</u>.

1. Calculates 1648 ft^3 at STP - corrected for ∿ 800 psia yields ∿ 50 ft^3. — LP-NOMCD-Table VI

2. Model 51 ∿ 70 ft^3 of bend radius (600 ft^3 total volume of tubes).

3. If all gas was distributed evenly ∿ 23% of total bend area would be lost.

K. Noncondensable Gas Generation

Lesson Plan Outline	Instructor Notes and References

Mechanisms	% Production
Boiling, flashing, dissociation	26.5%
Radiolysis	39.1
PRZ Vapor Space	18.2
$ZR-H_2O$ Reaction	16.2
Accum. N_2	0
Fission gas - helium	0

L. TMI-2 problem — LP-NOMCD-1.12

1. Noncondensable collected in essentially noncoolable section of RCS (bend)

2. Compare to Westinghouse design.

VI. Summary

A. Self Assessment

BUD.CO.	RECORD TYPE	UNIT	RECORD TYPE YR. MO. DAY	KEY CO.	KEY DATA	SOURCE	DESTINAT.
194	C4 CC3 004						

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Figure 0.7

LESSON PLAN

MCD - Post Accident Primary Radio Chemistry — 2
Course — Course Hours

Laughlin/Russell — May 18, 1984
Instructor — Date

[signature]
Approved By: — LP-NOMCD-15 Rev. 1
Lesson Plan No. (Sequentially From 1)

References To Be Quoted: Water Cool. Tech. of Power Reactors; PWR Tech. Manual; Radiation Analysis Design Manual; Amer. Nat. Stan. Source Term Spec.; NSAC-1; Tech. Staff Anal. Report of Core Damage; Wash-1400, Appendix VII; USNRC Reg. Guide 1.109, Appendix I

Items Issued: (Attach copy of all passouts, quizzes, etc.)

Tab 15 of Beaver Valley Mitigating Core Damage Textbook.

Introduction:

1. Purpose:

   To make the student aware of the impact of core damage on primary radio-chemistry.

2. Motivation: (Discuss how you plan to motivate students)

   To understand the potential hazards and information obtainable from primary samples following an accident.

3. General Outline: (List detailed outline Section I)

   Introduction, Baseline data, Incore releases, Rod bursts, Radiological hazards.

4. General Student Goals: (List detailed student objectives Section II)

   Describe incore release mechanisms. Discuss radiological hazards associated with primary samples.

DUQUESNE LIGHT COMPANY
Nuclear Division
Nuclear Support Services Department

APPROVAL SHEET - LESSON PLAN AND TEXT REVISIONS

Document Title: LP-NOMCD-15

Rev. No.	Subjects Revised (Brief Description)	Revised by	Approval	
			Signature	Date
1	Developed lesson plan from MCD manual. No change to manual.	P. Russell Paul A Russell		

LP-NOMCD-15

Post Primary Radiochemistry

STUDENT OBJECTIVES

Terminal Objective

The student should understand the key role primary samples can play in determining the consequences of any accident that could lead to core damage. In addition, he should understand the radiological hazards associated with post accident primary samples.

Enabling Objectives

After studying the text in conjunction with other specified references and the lecture, the student should be able to:

1. Describe the incore release mechanisms for fuel failure and their effects on primary radiochemistry.
2. Estimate the effects of rod burst on β-γ activity.
3. Estimate the effect of fuel melt on β-γ activity.
4. Discuss the radiological hazards of sampling and how the hazards vary with time.
5. Relate consequence of transferring primary water outside the containment following core damage.

Lesson Plan Outline	Instructor Notes and References
I. Introduction	
A. Two levels of core damage	
1. Fuel rod cladding cracked or ruptured	
a. Gap release or rod rupture accident	
2. Partial fuel meltdown	
B. 10% of fuel rods incore damaged	
II. Baseline Plant and Assumptions	
A. Assumptions	
1. Core power rating (Mwt) 2900	
2. Specific thermal power (MW/MTU) 40	
3. Number of reactor coolant loops 3	
4. System water volume (ft^3) 8910	
5. Normal operating pressure (psia) 2250	
6. Average temperature in core 590°F	
7. Core time in life Middle	
8. Design basis failed fuel fraction 0.01	
B. Tables	
1. Table 1 these assumptions.	LP-NOMCD-Table 15.1
2. Table 2 normal activity levels by isotope	LP-NOMCD-Table 15.2
a. One-tenth of design basis	
3. Table 3 total core radionuclide inventory	LP-NOMCD-Table-15.3
4. Based on ORIGEN computer code	
a. Time dependent concentrations of	

Lesson Plan Outline	Instructor Notes and References
- 256 activation products	
- 461 fission products	
- 82 transuranics (elements having atomic number greater than Uranium (92))	
5. Total core inventory of all fission products if distributed evenly in coolant is 100Ci/ml	
6. Principal contributors to normal activity	
a. Iodine	
b. Cesium	
c. Sum approximately 1 micro Ci/gram	
- Actual plants experience .1 micro Ci/gram	LP-NOMCD-Table 15.4
7. Baseline will be 1 micro Ci/gram	
III. Incore Release and Escape Mechanisms	
A. Normal release mechanism is by diffusion from fuel to gap (release fraction) then through manufacturing or corrosion defects in cladding (escape fraction)	
B. Escape Coefficients	LP-NOMCD-Table 15.5
1. Magnitude dependents on volatility of nuclide	
a. Gaseous higher	
2. Iodine nuclides gaseous and fuel rod temperatures but very reactive with zirconium and cesium	
3. Strontium nuclides exist in metallic or oxide form and do not readily escape through cladding defects.	

Lesson Plan Outline	Instructor Notes and References

IV. Rod Burst Effects on Coolant Radiochemistry

A. Local fuel rod temperatures reach point where internal pressure causes rod to rupture

1. Fuel does not lose integrity

B. Increase in Coolant Activity for 10% fuel rupture — LP-NOMCD-Table 15.6

$$CA = \frac{(NI(EF)(FF)}{V}$$

where

CA = coolant activity in uCi/ml
NI = nuclide inventory in the core
EF = escape fraction for nuclide class
V = coolant volume (or mass at 590°F, 2250 psia)
FF = failed-fuel fraction

Gap Release Fraction = .03 (only 3% escapes to gap from fuel pellet).

Gap Escape Fraction (EF) = .03 since 100% of the gas released from the fuel will escape to the coolant for a rupture of the fuel cladding.

For Xe, Kr

$NI = 30.85 \times 10^7$ Ci (data from coolant inventory list, Table 3; total of Kr, Xe isotopes)

$$V = 8.91 \times 10^3 \text{ ft}^3 \times 2.83 \times 10^4 \text{ cc/ft}^3 \times .72 \text{ g/cc}$$

$V = 1.82 \times 10^8$ grams of coolant at 590°, 2250 psia

$$CA = \frac{(30.85 \times 10^7 \text{ Ci})(.03)(.10)}{1.82 \times 10^8 \text{ g}} = .005 \text{ Ci/g} = 5 \times 10^{-3} \text{ Ci/g}$$

Lesson Plan Outline	Instructor Notes and References
or 5×10^3 uCi/ml (at sample temperatures) of noble gases in coolant. Much of this noble gas concentration is due to very short half-life nuclides like Kr^{85m}, Kr^{87}, Kr^{88}, and Xe^{135}. Kr^{85} and Xe^{133} will likely be the only nuclides present at sampling time and thus the actual noble gas concentration will be about 2.5×10^3 uCi/ml. This calculation is summarized in Table 7, with the results showing that for ten percent failed fuel the Kr/Xe activity increases by about 10^4.	LP-NOMCD-Table 15.7

For Iodine:

$$CA = \frac{(6.5 \times 10^8 \text{ Ci})(.017)(.1)}{1.82 \times 10^8 \text{ g}} = .006 \text{ Ci/g}$$

or

6×10^3 uCi/ml of Iodine isotopes at sample conditions.

For Cesium:

$$CA = \frac{(13.8 \times 10^6 \text{ Ci})(.05)(.1)}{1.82 \times 10^8 \text{ g}} = .0004 \text{ Ci/g}$$

or

4×10^2 uCi/ml of Cs at sample conditions.

The Cs contribution is still an order of magnitude below that from the I isotopes. The contributions of other isotopes such as Sr, Ba, and Te are not calculated for the gross activity since the estimated escape fractions are much lower for these nuclides and their total inventory is slightly lower. For example, consider Sr:

$$CA = \frac{(1.9 \times 10^8 \text{ Ci})(.000001)(.1)}{1.82 \times 10^8 \text{ g}} =$$

0.1 uCi/ml, at sample conditions

indicating that contributions due to Sr are low compared to the I and Cs activity.

Lesson Plan Outline	Instructor Notes and References
C. Total I and Cs activity	
1. Approximately 7×10^3 micro Ci/ml	
2. 7000 times normal	
D. Sample results vary with time after accident	
1. Iodine decrease by factor of 3 after one day	
E. Compare with TMI-2	LP-NOMCD-Table 15.8
1. Results are comparable	
V. Mechanisms for Extensive Core Damage Radiochemistry Effects	
A. Fuel rods clad with zirconium alloy metal	
1. At high temperatures react with water	
$Zr + 2H_2O \rightarrow ZrO_2 + 2H_2$	
2. Produces heat and hydrogen	
B. Oxidation limit for cladding can be reached in one hour at cladding temperatures of 2000°F.	
C. At 3450°F oxidized Zr can melt.	
1. UO_2 may dissolve in liquid oxidized zirconium and release its activity	
2. Significant since melting temperature of UO_2 is 5200°F.	
D. Increase in coolant activity for 10% fuel meltdown	LP-NOMCD-Table 15.9
For Xe and Kr:	
$CA = \frac{(30.85 \times 10^7 \text{ Ci})(.9)(.1)}{1.82 \times 10^8 \text{ g}} = .153 \text{ Ci/g}$	
or	
1.53×10^5 uCi/ml of noble gas in the coolant.	

Lesson Plan Outline	Instructor Notes and References

For Iodine:

$$CA = \frac{(6.5 \times 10^8\ Ci)(.9)(.1)}{1.82 \times 10^8\ g} = .32\ Ci/g$$

or

3.2×10^5 uCi/ml at sample conditions.

For Cesium:

$$CA = \frac{(13.8 \times 10^6\ Ci)(.8)(.1)}{1.82 \times 10^8\ g} = .006\ Ci/g$$

or

6.0×10^3 uCi/ml at sample conditions.

For Strontium:

$$CA = \frac{(1.9 \times 10^8\ Ci)(.1)(.1)}{1.82 \times 10^8\ g} = 0.1\ Ci/g$$

or

1×10^4 uCi/ml at sample conditions

E. Sr contribution more than Cs since Sr escape fraction changed by several orders of magnitude.

1. Helps determine fuel rupture or melt.

F. Gross degassed activity increase by factor of 300,000

G. Serious accident will also release U-235 and Pu-299

1. Use spectral analysis

2. Check for alpha activity

H. Dilution by safety injection water not included

1. Reduce by up to factor of 5

Lesson Plan Outline	Instructor Notes and References
I. The previous calculations also did not account for the effects of half-life between the time of the fuel damage and the time of sampling. The short-lived nuclides of Kr and Xe would reduce noble gases by a factor of 2, short-lived I nuclides would reduce I by a factor of 4, and short-lived Sr nuclides would reduce Sr concentrations by about 25 percent if the sample were taken one day after the accident.	
J. TMI-2	
1. Significant Sr fraction	
2. Indicates some fuel melting	
VI. Radiological Hazards of Sampling	
A. Assumptions	
1. 100 ml depressurized sample collected	
2. Fuel rupture accident 10% fuel	
3. Noble gas in coolant about 5×10^3 micro Ci/ml.	
B. Radiological dose calculation	LP-NOMCD-Table 15.10
For a sample taken one day after the accident, the activity will be primarily Xe-133 with a level of about 2.5×10^3 uCi/ml. Total noble gas in the sample is thus:	
Total Activity = 2.5×10^3 uCi/ml x 100 ml = 2.5×10^5 uCi = .25 Ci	
This gas will escape the coolant and fill the sampling room (3m x 3m x 4m or 36 m^3) giving a noble gas concentration of (assuming no ventilation):	
.25 Ci/36 m^3 = .007 Ci/m^3	

Lesson Plan Outline	Instructor Notes and References

From Table 10 the direct whole body dose rate from a semi-infinite cloud of Xe-133 is 2.94 x 10^{-4} mrem-m^3/pCi-yr and so the dose rate to the sampler can be calculated:

$$\text{Dose Rate} = (7 \times 10^9 \text{ pCi/m}^3)(2.94 \times 10^{-4} \text{ mrem-m}^3\text{/pCi-yr})$$

$$\text{Dose Rate} = 21 \times 10^5 \text{ mrem/yr}$$

The total dose to the operator can be calculated assuming he spends 15 minutes in the area.

$$\text{Dose} = \frac{15 \text{ min.} \times 21 \times 10^5 \text{ mrem/yr}}{60 \text{ min/hr} \times 24 \text{ hr/day} \times 364 \text{ day/yr}}$$

Dose = 60 mrem or .06 Rem.

The direct radiation dose to the operator from the 100 ml sample bottle can be estimated from the Curie-Meter-Rem rule, or if the isotopes are known, from the equation:

$$\text{Dose Rate (R,} \quad = \frac{6CE}{d^2}$$

The total activity in the sample considering just the I and Cs activity, as previously calculated, is (one day after accident):

$$\text{Total Activity} = 6 \times 10^3 \text{ uCi/ml} \times 100 \text{ ml} = 6 \times 10^5 \text{ uCi}$$

or .6 Ci (note that only Cs activity was considered since I has only low energy gammas and Sr^{90} is a beta emitter).

Using the Curie-Meter-Rem rule the dose rate would be .6 Rem/hr at one meter. This assumes the activity to be due to Co-60 (this gives conservative results). If the operator is actually one foot from the sample bottle the dose rate is:

$$D = D_o \left(\frac{r_o}{r}\right)^2 = .6\left(\frac{3}{1}\right)^2 = 5.4 \text{ Rem/hr}$$

Lesson Plan Outline	Instructor Notes and References

and the operator can receive 1.4 Rem from this source during a 15 minute exposure.

Using the expression D.R. = $6CE/d^2$ the dose rate would be 2.4 R/hr, assuming the sample bottle activity was predominantly due to Cs with a gamma energy of .66 Mev.

C. Dose rates very high special precautions are required.

D. Sample Spill

LP-NOMCD-Table 15.10
LP-NOMCD-Table 15.11
LP-NOMCD-Table 15.12

1. I-131, I-133, and Cs primary nuclides of concern.

2. Some go off with gases but 98.5% remain.

3. Assume 100 ml bottle spills one half of its contents over a 2 x 2 meter area.

I-131 contamination level is:

$$\text{Total Activity} = V_{sample} \times CA = \frac{(7.7 \times 10^7 \text{ Ci})(.017)(.1)}{1.83 \times 10^8 \text{ g of coolant}} \times 100 \text{ g of sample}$$

Total Activity = .07 Ci

The contamination level is:

$$\text{Contamination} = \frac{(1/2)(.07)(1 \times 10^{12} \text{ pCi/Ci})}{2m \times 2m}$$

$$= .9 \times 10^{10} \text{ pCi/m}^2$$

The direct radiation dose rate is calculated using the appropriate conversion factor from Table 11.

$$\text{Dose rate} = (.9 \times 10^{10} \text{ pCI/m}^2)(2.8 \times 10^{-9} \text{ mrem-m}^2\text{/pCi-hr})$$

Dose rate = 25 mrem/hr

Lesson Plan Outline	Instructor Notes and References

In 15 minutes the operator would receive 6 mrem due to I-131 activity. Calculations for other nuclides (i.e. I-133, Cs-136, C2-137) are left to the student.

Another exposure pathway is inhalation of particulate radioactivity which gets into the air following the spill. Again, continuing as above, the airborne level is:

$$\text{Airborne} = \frac{\text{Activity spilled x fraction airborne}}{\text{Volume of room}}$$

where fraction airborne is .001 for a cold spill.

Thus for I-131 (assuming no ventilation):

$$\text{Airborne activity} = \frac{.035 \text{ Ci} \times .001}{3\text{m} \times 3\text{m} \times 4\text{m}} = 1 \times 10^{-6}$$

uCi/ml

For the inhalation case it is important to remember that different nuclides have different critical organs. For I-131 the critical organ is the thyroid and the annual dose to the thyroid per picocurie inhaled is 1.5×10^{-3} mrem/pCi inhaled (Table 12). The breathing rate for an adult is assumed to be 1.5×10^{4} ml/min.

$$\text{Total inhaled} = 1 \times 10^{-6} \text{ uCi/ml} \times 1.5 \times 10^{4} \text{ ml/min} \times 15 \text{ min}$$

$$= .23 \text{ uCi or } .23 \times 10^{6} \text{ pCi}$$

and the total dose to the thyroid is:

$$TD = .23 \times 10^{6} \text{ pCi} \times 1.5 \times 10^{-3} \text{ mrem/pCi}$$

$$= .34 \text{ Rem.}$$

VII. Summary

A. Key Points

Lesson Plan Outline	Instructor Notes and References
1. Estimates of the extent and nature of a fuel damaging accident can be made from the results of radiochemical samples following the accident.	
2. Varying mechanisms exist for fission product radionuclides to reach the coolant. These include diffusion through crack or pinhole defects during operation, release through oxidized or melted fuel elements and cladding, and leaching from broken and oxidized fuel rods.	
3. There are extensive hazards associated with the sampling operation. These hazards must be minimized by using special sampling equipment which will contain the fission product gases and particulates and will shield the operator from the direct radiation dose from the sample bottle itself.	
B. Self-assessment	

ATTACHMENT 10

Response to Outstanding Issue of the
Beaver Valley Power Station Unit No. 2
Draft Safety Evaluation Report

Draft SER Section 13.2.1.4 (I.A.2.3): Administration of Training Program (excerpt)

As specified in Enclosure 1 of H. R. Denton's March 28, 1980, letter, we require that all instructors who teach systems, integrated responses, transient, and simulator corses shall be SRO certified and will continue to participate in appropriate requalification programs. Vendor-supplied instructors who teach the above subjects shall also be similarly certified. Other members of the permanent or nonpermanent training staff who are responsible for teaching technical subjects, such as reactor theory, heat transfer, fluid mechanics, thermodynamics, health physics, chemistry, and instrumentation are not expected to have an RO or SRO license. Guest lecturers considered to be used on a limited bases shall be monitored by a qualified instructor. These guest lecturers are exempt from the SRO criterion.

Based on our review, we find that the applicant of the BVPS-2 has not committed to comply with the above requirements of this item of the TMI Action Plan.

Response:

Beaver Valley training meets the requirements specified in Enclosure 1 of the Denton letter. All instructors who teach integrated responses, transients, and simulator courses are SRO certified or licensed. Instructors who teach systems are either SRO certified, licensed, or designated and qualified system experts. SRO licensed or certified instructors are enrolled in appropriate requalification programs.

ATTACHMENT 11

Response to Outstanding Issue of the
Beaver Valley Power Station Unit No. 2
Draft Safety Evaluation Report

Draft SER Section 13.2.2: Shift Technical Advisor Training

The applicant has provided a training program for the Shift Technical Advisors (STA). We have reviewed the program and find that it is not comparable in scope and depth of training in various subjects to the STA training program as outlined in NUREG-0737, Appendix C. Therefore, we require the applicant to provide for our review a detailed training program for STA in accordance with the guidance as specified in NUREG-0737, Appendix C. We will report our findings in the final SER.

Response:

The STA training program is comprised of the following attributes as required by NUREG-0737, Appendix C.

6.1 Education

6.1.1 Prerequisites Beyond High School Diploma

It is assumed that many candidates may have received the previous training and are qualified to begin the coursework prescribed in 6.1.2. Prerequisite education considered necessary for successful completion of the advanced coursework is identified below. This coursework may be waived without formal documentation of specific course completion.

	Contact Hours
Mathematics	90
Trigonometry, Analytical Geometry, College Algebra	
Chemistry	
Inorganic Chemistry	30
Physics	150
Engineering Physics (heat, mechanics, light sound, electricity and magnetism)	
TOTAL:	270

6.1.2 College Level Fundamental Education

	Contact Hours
Mathematics	90

Engineering mathematics through the introduction to ordinary differential equations and the utilization of Laplace transforms to interpret control response

Reactor Theory	100

Atomic and Nuclear Physics Statics, through 2-group Diffusion Theory Dynamics, Point Kinetics, Reactivity Feedback

Reactor Chemistry	30

Inorganic Chemistry (as related to reactor systems) Corrosion - Reaction Rates

Nuclear Materials	40

Strength of Materials
Reactor Material Properties (phase diagrams, fuel densification)

Thermal Sciences (for nuclear systems)	120

Thermodynamics
- Laws of Thermodynamics
- Properties of Water and Steam
- Steam Cycles and Efficiency

Fluid Dynamics
- Bernoulli's Equation
- Fluid Friction and Head Loss
- Elevation Head
- Pump and System Characteristics
- Two Phase Flow

Heat Transfer
- Methods of Heat Transfer
- Boiling Heat Transfer
- Heat Exchangers

Electrical Sciences	60
Electronics (Circuit theory, digital electronics)	
Motors, Generators, Transformers, Switchgear	
Instrumentation and Control Theory	
Nuclear Instrumentation and Control	40
Radiation Detectors	
Reactor Instrumentation	
Reactivity Control and Feedback	
Nuclear Radiation Protection and Health Physics	40
Biological Effects	
Radiation Survey Instrumentation	
Shielding	
TOTAL	520

6.2 Applied Fundamentals - Plant Specific

In addition to the general education requirements described in Section 6.1, all STA's shall complete the following training at the college level tailored to the specific plant at which the STA is assigned or a plant of similar design. It may be presented separately from or may be integrated with the education described in Section 6.1

Subject/Topics	Contact Hours
Plant Specific Reactor Technology (including core physics data)	
Plant Chemistry and Corrosion Control	
Reactor Instrumentation and Control	
Reactor Plant Materials	
Reactor Plant Thermal Cycle	
TOTAL	120

6.3 Management/Supervisory Skills

Subject	Contact Hours
Leadership	
Interpersonal Communication	
Motivation of Personn'	
Problem and Decisional Analysis	

Command Responsibilities and Limits
Stress
Human Behavior

TOTAL	40

6.4 <u>Plant Systems</u>

The training program shall cover the following systems along with others considered necessary for a specific plant.

System	Contact Hours
Emergency Core Cooling	
Emergency Cooling Water	
Emergency Electrical Power, AC and DC	
Reactor Protection	
Reactor Coolant	
Reactor Coolant Inventory and Chemistry Control	
Containment System (including Containment Cooling)	
Closed Cooling Water	
Nuclear Instrumentation	
Non-Nuclear Instrumentation	
Reactor Control	
Containment Hydrogen Monitoring and Control	
Radioactive Waste Disposal (liquid, gas, solid)	
Emergency Control Air	
Condensate and Main Feedwater	
Auxiliary Feedwater	
Steam Generator Level Control	
Main Steam	
Loose Parts Monitoring	
Status Monitoring (including Process Computer)	
Seismic Monitoring	
Residual Heat Removal	
Radiation Monitoring	
Plant Ventilation	
Main Turbine and Generator	
TOTAL	200

6.5 Administrative Controls

Subject	Contact Hours
Responsibilities for Safe Operation and Shutdown	
Equipment Outages and Clearance Procedures	
Use of Procedures	
Plant Modifications	
Shift Relief Turnover and Manning	
Containment Access	
Maintaining Cognizance of Plant Status	
Physical Security	
Control Room Access	
Duties and Responsibilities of the STA	
Radiological Emergency Plan	
Code of Federal Regulations (appropriate sections)	
Plant Technical Specifications (including bases)	
Radiological Control Instructions	
TOTAL	80

6.6 General Operating Procedures

Subject	Contact Hours
Startup	
At Power Operations	
Shutdown	
Xenon Following While on Standby	
ECP and S.D. Margin Calculation	
TOTAL	30

6.7 Transient/Accident Analysis and Emergency Procedures

Subject	Contact Hours
Transient and Accident Analyses	
Plant Abnormal and Emergency Procedures	
TOTAL	30

6.8 Simulator Training

The plant evolutions, transients and events listed below shall be conducted along with any others deemed necessary. The primary objective should be to demonstrate plant and operator response to a given condition or event and not necessarily to develop the control manipulation expertise of the trainee. The trainee/instructor ratio should not exceed 4:1.

Simulator exercises should be preceeded by a period of discussion of the planned exercises addressing expected response of the plant and applicable plant procedures to be used. Approximately 100 contact hours are required with about 50 hours in the classroom and 50 hours on the simulator.

Following each exercise demonstrating a transient or emergency event, an incident critique discussion should be held to enhance the trainees' understanding of that particular exercise. When the simulator is not plant-specific, the training shall be tailored to the specific plant as much as practical.

Simulator Exercises

Reactor and Plant Startup
Load Changes at Power
Shutdown to Cold Condition
Demonstration of Steam Generator Level Manual Control
Load Rejections of Greater than 10%
Failure of Rod Control System
Failure of Automatic Steam Generator Level Controls
Failure of Pressurizer Level and Pressure Automatic Controls
Turbine Trip from Full Power
Reactor Trip from Full Power
Loss of Normal Feedwater at Full Power
Failure Open of Power Operated Relief Valve
Stuck Open Pressurizer Safety Valve
Loss of Reactor Coolant Pumps at Full Power and Demonstration of Natural Circulation
Failure Open of One or More Turbine Bypass Valves While at (a) Full Power, (b) Hot Standby
Loss of All Feedwater (normal and emergency)
Loss of Reactor Coolant (small and DBA)
Steam Generator Tube Rupture (small and large)
Loss of RHR Shutdown Cooling with the RCS Temperature 200° to 300°F
Inadvertent Safety Injection While at Power
Loss of Offsite Electrical Power
Loss of One Train of Onsite Electrical Power

6.9 Annual Requalification Training

Subject	Hours Req'd.
Review of transient and accident analyses of FSAR condition III and IV events emphasizing the individual's role in accident assessment. Review selected industry events and LER's that could have led to more serious incidents.	40 (lecture)
Simulator exercises related to the transients in Section 6.8 conducted so as to emphasize the role of the STA.	40 (simulator)
TOTAL	80

ATTACHMENT 12

Response to Outstanding Issue of the
Beaver Valley Power Station Unit No. 2
Draft Safety Evaluation Report

Draft SER Section 13.2.2: Fire Protection Training

The applicant has established a fire protection training program to ensure that the capability to fight potential fires is maintained. However, the applicant has not provided the details of the program for us to review. We require the applicant to provide a fire protection program which will fully comply with the guidelines in SRP Section 13.2.2 and BTP CMEB 9.5-1. We will review the program when it is received and report our findings in the final SER.

Response:

As specified in 10CFR50, Appendix R, and SRP 13.2.2, the fire brigade training program ensures that the capability to fight potential fires is established and maintained. The program consists of an initial classroom instruction program followed by periodic classroom instruction, fire fighting practice, and fire drills:

1. Instruction

   a. The initial classroom instruction shall include:

      1) Indoctrination of the plant fire fighting plan with specific identification of each individual's responsibilities.

      2) Identification of the type and location of fire hazards and associated types of fires that could occur in the plant.

      3) The toxic and corrosive characteristics of expected products of combustion.

      4) Identification of the location of fire fighting equipment for each fire area and familiarization with the layout of the plant including access and egress routes to each area.

      5) The proper use of available fire fighting equipment and the correct method of fighting each type of fire. The types of fires covered should include fires in energized electrical equipment, fires in cables and cable trays, hydrogen fires, fires involving flammable and combustible liquids or hazardous process chemicals, fires resulting from construction or modifications (welding), and record file fires.

      6) The proper use of communication, lighting, ventilation, and emergency breathing equipment.

7) The proper method for fighting fires inside buildings and confined spaces.

8) The direction and coordination of the fire fighting activities (fire brigade leaders only).

9) Detailed review of fire fighting strategies and procedures.

10) Review of the latest plant modifications and corresponding changes in fire fighting plans.

NOTE: Items (9) and (10) may be deleted from the training of no more than two of the non-operations personnel who may be assigned to the fire brigade.

b. The instruction shall be provided by qualified individuals who are knowledgeable, experienced, and suitably trained in fighting the types of fires that could occur in the plant and in using the types of equipment available in the nuclear power plant.

c. Instruction shall be provided to all fire brigade members and fire brigade leaders.

d. Regular planned meetings shall be held at least every 3 months for all brigade members to review changes in the fire protection program and other subjects as necessary.

e. Periodic refresher training sessions shall be held to repeat the classroom instruction program for all brigade members over a two-year period. These sessions may be concurrent with the regular planned meetings.

2. Practice

Practice sessions shall be held for each shift fire brigade on the proper method of fighting the various types of fires that could occur in a nuclear power plant. These sessions shall provide brigade members with experience in actual fire extinguishment and the use of emergency breathing apparatus under strenuous conditions encountered in fire fighting. These practice sessions shall be provided at least once per year for each fire brigade member.

3. Drills

a. Fire brigade drills shall be performed in the plant so that the fire brigade can practice as a team.

b. Drills shall be performed at regular intervals not to exceed 3 months for each shift fire brigade. Each fire brigade member should participate in each drill, but must participate in at least two drills per year.

A sufficient number of these drills, but not less than one for each shift fire brigade per year, shall be unannounced to determine the fire fighting readiness of the plant fire brigade, brigade leader, and fire protection systems and equipment. Persons planning and authorizing an unannounced drill shall ensure that the responding shift fire brigade members are not aware that a drill is being planned until it is begun. Unannounced drills shall not be scheduled closer than four weeks.

At least one drill per year shall be performed on a "back shift" for each shift fire brigade.

c. The drills shall be preplanned to establish the training objectives of the drill and shall be critiqued to determine how well the training objectives have been met. Unanounced drills shall be planned and critiqued by members of the management staff responsible for plant safety and fire protection. Performance deficiencies of a fire brigade or of individual fire brigade membes shall be remedied by scheduling additional training for the brigade or members. Unsatisfactory drill performance shall be followed by a repeat drill within 30 days.

d. At 3 year intervals, a randomly selected unannounced drill shall be critiqued by qualified individuals independent of the licensee's staff. A copy of the written report from such individuals shall be available for NRC review.

e. Drills shall as a minimum include the following:

1) Assessment of fire alarm effectiveness, time required to notify and assemble fire brigade, and selection, placement and use of equipment, and fire fighting strategies.

2) Assessment of each brigade member's knowledge of his or her role in the fire fighting strategy for the area assumed to contain the fire. Assessment of the brigade member's conformance with established plant fire fighting procedures and use of fire fighting equipment, including self-contained emergency breathing apparatus, communication equipment, and ventilation equipment, to the extent practicable.

3) The simulated use of fire fighting equipment required to cope with the situation and type of fire selected for the drill. The area and type of fire chosen for the drill should differ from those used in the previous drill so that brigade members are trained in fighting fires in various plant areas. The situation selected should simulate the size and arrangement of a fire that could reasonably occur in the area selected, allowing for fire development due to the time required to respond, to obtain equipment, and organize for the fire, assuming loss of automatic suppression capability.

4) Assessment of brigade leader's direction of the fire fighting effort as to thoroughness, accuracy, and effectiveness.

4. Records

Individual records of training provided to each fire brigade member, including drill critiques, shall be maintained for at least 3 years to ensure that each member receives training in all parts of the training program. These records of training shall be available for NRC review. Retraining or broadened training for fire fighting within buildings shall be scheduled for all those brigade members whose performance records show deficiencies.

Training is also provided to satisfy additional guidelines of CMEB 9.5-1 Paragraph C.3.d, Items (k) and (l) which are in excess of Appendix R and SRP 13.2.2. Local fire companies are invited to attend the training program. Although this training is primarily offered to the designated immediate response units, representatives from other units participating in the Mutual Aid Plan may also be invited to participate. The program covers the following topics:

1) Interface with the Site Security Force during emergencies.

2) Basic health physics indoctrination and training.

3) Beaver Valley Power Station facility layout.

4) Onsite Fire Protection equipment (permanent and portable).

5) Differences between onsite fire fighting equipment and fire company supplied equipment.

6) Communications Systems.

7) Review of the appropriate sections of the Beaver Valley Power Station Emergency Preparedness Plan and Implementing Procedures.

8) The onsite emergency organization with specific emphasis on the interface between the Beaver Valley Power Station emergency squad and the fire company personnel.

Training related to fire protection is also provided to other station employees as part of their initial Station Orientation Training and periodic General Employee Refresher Training (GERT). These training sessions include the following subject areas:

1) Station Orientation

a. Fire Chemistry, Parts of Fire, Extinguishing of Fire
b. Types of Fires
c. Methods of Extinguishing
d. Use of Extinguishers
e. Misuse of Equipment

f. Fire Doors and Fire Penetrations
g. Procedure for Reporting or Fighting Fires
h. Industrial Safety CO_2 and Halon Systems

2) GERT Module I

a. Reporting a Fire
b. Fire Doors
c. Fire Barriers and Pipe Penetrations
d. Fire Prevention

Training related to evacuation of outlying buildings is presented in the Fire Marshall Training Program. Designated fire marshalls receive training in such other areas as firstaid, fire protection, and fire protection systems within their areas of responsibility.