NTS-80-270

Westinghouse Electric Corporation
Water Reactor Divisions

Nuclear Service Division
Box 3728
Pittsburgh Pennsylvania 15220

July 23, 1980

Mr. Paul Collins
Nuclear Regulatory Commission
Chief, Operator Licensing Branch
Division of Reactor Licensing
7920 Norfolk Avenue
Bethesda, Maryland 20010

Dear Mr. Collins:

In a recent document dated March of 1980, the United States Regulatory Commission issued criteria revisions for reactor operator training and licensing. Westinghouse Nuclear Training Services also is committed to developing an improved educational process and product; thus, this letter represents the Westinghouse response of upgrading program content and curriculum offerings to a level commensurate with the stipulated criteria.

The specific criteria and parameters germane to Westinghouse Nuclear Training Services are outlined in section A-2 (training) parts c (training programs), d (instructor certification) and e (instructor requalification program) of the NRC letter. An in-depth analysis of these concerns is as follows:

Heat Transfer. Fluid Flow, and Thermodynamics

Westinghouse Nuclear Training Services upgraded curriculum materials in heat transfer, fluid flow, and thermodynamics shortly after the TMI accident. These upgraded materials have been integrated into Phase I Module D of the current Westinghouse curriculum. A topical outline of these materials is represented in Appendix A. To date, these materials have been incorporated into all Westinghouse training programs including initial operator training, and Shift Technical Advisor training.

A task force has been assigned to develop curriculum materials congruent to the guidelines specified in the subject NRC document Enclosure 2. The task force is designing a thermodynamcis, heat transfer, and fluid flow text which shall incorporate all the criteria of Enclosure 2 as well as several other areas of concern that were deemed important by the task force. The initial draft of this text book is scheduled for editing and revision beginning August 1, 1980. The finalized text will then form the basis for a comprehensive thermodynamic, heat transfer, and fluid flow course comprising 80-120 instructor contact hours.

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Training Program for Recognition and Mitigation of Core Damage

Drawing upon industry experience in recent years with regard to accidents or situations which jeopardize and/or lead to degraded core conditions, it is no longer acceptable to have operators trained only from the standpoint of accidents which involve in-tact core consequences.

Operators continue to be relied upon and play a very important part under accident conditions in ensuring public health and safety. It is therefore prudent, and the need exists, to provide operators with improved knowledge and skill levels that enable them to:

1. Recognize, using available plant instrumentation, when the core is in a degraded mode.

2. Draw upon available resources to mitigate the consequences of core degradation.

3. Place the plant in a stable condition as soon as possible to ensure public protection.

It is the purpose of this training program to address the above concerns and provide the plant operator the necessary tools to achieve our objectives. Refer to Appendix I for program details.

Increased Emphasis Upon Reactor and Plant Transients

Westinghouse Nuclear Training Services has devoted substantial development time to the design and implementation of new courses emphasizing transient and complex casualty analysis. The following simulator courses have been developed and implemented within the past 14 month period:

1. Operator retraining programs emphasizing transient and complex casualty analysis are offered to utilities on a 3, 4 or 5 day basis. Appendix B provides a description of these courses.

2. Hot license candidates may now enroll in a two week course emphasizing complex casualty and transient analysis. A description of this course is presented in Appendix C.

3. An expanded Phase III program has been developed and implemented for cold license candidates. The supplemental two weeks of this program emphasize transient and complex casualty analysis. Appendix D describes this program.

4. An eighteen day Shift Technical Advisor program is highlighted by a final two days of simulated accident recognition and analysis. This capstone learning experience is represented in Appendix E.

Instructor SRO Certification

Westinghouse Nuclear Training Services has always focused paramount concern upon the training, experience and proficiency of its instructional staff. Knowledgeable and dedicated staff members are imperative for the success of any educational system. Westinghouse supports all endeavors to certify instructors at the SRO level.

Increasing customer demands over the past 18 months have attributed to a tremendous growth of the instructional staff. Moreover, manpower needs continue to plague all facets of the industry, as fully certified and/or licensed individuals remain in small proportion to designated needs. Consequently, staff certification, although an ongoing process, has been unable to keep pace with the steady influx of new personnel.

The nuclear industry is now in a position of double jeopardy. It requires large numbers of trained operators. Most assuredly, these operators ideally should be trained by licensed or certified instructors, yet, exclusive utilization of certified instructors would severely diminish the number of trained operators that the industry now needs so desperately. In lieu of these restraints and in response to these demands, Westinghouse Nuclear Training has developed and implemented a more vigorous and comprehensive program leading to the certification of all instructional personnel. The timeline for this program is represented in Appendix F. Subsequent listings will be provided to the NRC as new personnel are integrated into the staff. Westinghouse will submit the required information for license application at a later date. This letter is intended to satisfy the August 1 requirement of submitting the instructor names requesting examinations.

Instructor Requalification and In-service Education Program

Westinghouse Nuclear Training Services strongly support the philosophy of instructor professional development. This includes keeping abreast of current operational and technical developments, as well as upgrading and acquiring new instructional skills. Separate requalifications and in-service educational programs have been developed to meet the unique and specific needs of each training group. The Westinghouse Nuclear Training Center requalification program is documented in Appendix G and the Westinghouse Site and Specialty Training Program is documented in Appendix H.

In conclusion, I again emphasize that Westinghouse Nuclear Training Services is committed to the development of a better educational process and product. The data contained in this document represent specific criteria that will ultimately engender safer and more competent reactor operators. By so doing, we all move one step closer to meeting the nation's energy needs.

Sincerely,

WESTINGHOUSE ELECTRIC CORPORATION

J. J. Evans, Manager
Nuclear Training Services

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Attachments

APPENDIX A

Thermodynamics, Heat Transfer, and Fluid Flow
Phase I-Module D

Subject Area	Approximate Instructor Contact Hours
Fundamentals of Thermodynamics	4
Applied Thermodynamics	12
Heat Transfer	4
Fluid Flow	8
Core Thermal Considerations	8
	36

APPENDIX B

Simulator Retraining Course (3, 4 or 5 day option)

Courses Sim-413, 414, 415

Purpose

The initial training of the reactor operator comprises a multitude of theoretical, operational and conceptual skills. However, in his/her day-to-day function, the operator rarely applies all of this knowledge; nor do the abnormal conditions exist that would instill such a response. The purpose of this course is to refurbish the licensed operator's knowledge and skill level. Through a varied level of simulator evaluations, the reactor operator can respond to transients and malfunctions not normally encountered during actual plant operation.

Description

The course may be scheduled for 3, 4 or 5 days. During the three day sequence, students spend eight hours a day operating the simulator through various evolutions. When scheduled for a four or five day sequence, the students spend six hours per day operating the simulator through various evolutions and two hours per day in seminar sessions. The purpose of the seminars is to discuss upcoming evolutions or to critique past operations.

Students work in three person crews. Each student rotates assignments to ensure that he/she analyzes and responds to various transients at the different control stations. It is strongly recommended that the students bring their home plant procedures with them for use in all applicable situations. This facilitates a more meaningful training process. Audit examinations are available as a component of this course should the utility request.

Objective

With aid of the simulator, the student shall analyze and respond to a variety of transients and malfunctions with a level of proficiency equal or exceeding operating standards.

APPENDIX C

Expanded Startup Training for Hot License Candidates (Option 6)
WNTC Course Sim 356

Purpose

This course was designed to provide the potential Hot license candidate with 1) reactor startup experience leading to a certification examination; and 2) increased transient and complex casualty training. The Hot license candidate must have achieved criticalities during his/her training in order to be eligible for the NRC license exam. Half of this course is structured to provide the student with a variety of startup and operational experiences. The student then performs a startup certification exam upon the simulator. Following this examination, a second portion of the course is devoted toward providing the operator with "hands-on" experience in analyzing and responding to transients and complex casualties. Thus, the purpose of this course is twofold: initially, to provide the operator with startup skills leading toward passage of a startup certification exam; and secondly, to provide the operator with the appropriate evaluation and proficiency skills to properly respond to complex casualties.

Description

This course is scheduled for a duration of two weeks. The first week is devoted to reactor startup and operation. At the end of the first week, students perform a startup certification examination. The second week of the course is devoted entirely to transient and complex casualty analysis and response.

Students operate in three person crews, rotating control stations so that each student has the opportunity to analyze and participate in operations from various control stations. 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.

Objective

The student shall demonstrate upon the simulator a knowledge level and operational proficiency:

1) Adequate to pass the Startup Certification Exam: and
2) Adequate to respond to a variety of transients and complex casulaties.

APPENDIX D

Simulator Training Program
(Expanded Phase III)

WNTC Course:SIM 311-323

Purpose

The Simulator Training Program is designed to integrate theoretical and PWR Systems knowledge into appropriate operation skills via "hands on" simulator experience.

Description

The Simulator Training Program is an eleven week program held at the WNTC which is based upon the Zion or SNUPPS simulators. One hundred twenty-four hours is spent in the simulator control room which is structured to teach the student actual plant operations and transient characteristics. The student is part of a three-person team in the control room and thus spends one-third of the operating "hands on" as Shift Supervisor, Reactor Operator, and Balance of Plant Operator. The students rotate through these positions each day of simulation training to allow them to experience the operations at each position. Typical evolutions conducted during this program are:

1. Reactor startup with varying initial boron conditions to full power operation.
2. Plant heatup and cooldown.
3. Orderly shutdown of reactor and plant from full power.
4. Reactor startup from hot shutdown condition.
5. Transients and accidents at various plant conditions.

During these exercises, the instructor will describe the various normal, abnormal, or emergency conditions which he is about to impose upon the operation and discuss proper student response. The instructor will then cause that malfunction to occur at a random time and observe the crew's response. Use of the simulator's freeze, backup, trend, and snapshot capabilities allow the instructor to repeat any portion of the exercise to clarify or reinforce the training.

During the time students are not operating the simulator, they are involved in guided preparation of their next period in the control room. They also attend lectures concerning plant operations and other technical material necessary to certify.

The utilization of video tapes, slides, problem solving sessions, individual tutoring and group discussions are helpful aids during this program. The students receive guidance and participate in critique periods on a daily basis. Also, they will be critiqued and evaluated under plant operating conditions, both as a member of a shift crew and as individuals.

Objective

Upon completion of this sequential program, the student shall demonstrate operational skills at a Senior Reactor Operator level consistent with those required for passage of the Westinghouse certification examination.

APPENDIX E

STA Program

Simulator Accident Recognition and Assessment

Day: #17 and 18 (16 hours) at WNTC, Zion, IL

Title: Simulator Training/Augmented SRO

Objective: Observation of Actual Abnormal and Accident Conditions and the Identification of Each

Topic Summary:

(2 Hours) WNTC Control Board Familiarization

(6 Hours) Demonstrations

1. Verification of:

   a. Natural Circulation
   b. Subcooling
   c. Adequate Core Cooling

2. Major Reactivity Transients

   a. Load Rejection with Rods in Manual
   b. ATWT
   c. Continuous Control Rod Withdrawal from HZP

3. Instrument Failures

4. Small and Large LOCA's

5. S/G Secondary Breaks

6. Pressurizer PORV Open

7. One Spray Valve Open

8. Loss of All Feedwater

9. Loss of Rod Drive MG's from 6%

(6 Hours) Transient Assessment

1. Selected Instrument Failures

2. Selected Accidents

3. Selected Equipment Failures

4. Multiple Failures

(The transient assessments assume no operator action and each operator independently identifies each. An instructor will critique each transient.)

APPENDIX F

WNTC Instructor Certification Schedule

Completion Date:

September, 1980 - Zion

Dave Kwiatkowski	Mike Halverson
Bob Rizzo	Bill Steinke
Mike Hall	

January, 1981 - Zion

Howard Walls	Bob Sellars
Pete Walker	Craig Mowrey
Charlie Meyer	Jim Tinlin

March, 1981 - SNUPPS

Ernie Guimond	Jim Marron
Warren Brown	Bob Wartenberg
Steve Allison	Lamont Schmidt

June, 1981 - Zion

Sam Henderson	Chuck Ferguson
Bill Hemming	Steve Frantz

July, 1981 - SNUPPS

John Garber	Halvey Perdue
James Snelson	Jeff Simon
Steve Kessinger	Tim Jenkins

September, 1981 - Zion

Dale Van Beek	Richard Fires
Don Scheef	Riley Wright
Jack Snelson	James Northness

December, 1981 - SNUPPS

Bob Harper	Mike Cullen
Dale Moses	John Daily
Doug Smith	Bob Hagerman
Greg Bahry	

INSTRUCTOR CERTIFICATION SCHEDULE

PITTSBURGH NUCLEAR TRAINING CENTER

SNUPPS

Certification Examination No. 1 - April 27, 1981

Marvin L. Bowman
Lloyd Fitzwater
Steven Kirchoff
Warren A. Potter
William F. Schmidt
Steven Simonson
Paul Sunderland
Robert Vandergrift
Kevin Patton
Frederick Turner
Steven Slavichak
Michael Cartwright
Michael Curtis

Certification Examination No. 2 - August 31, 1981

James N. Bassett
Dennis F. Bonilla
John M. Mack
Thomas G. Miller
David W. Helling
B. W. Ruth
John J. Griffin
Thomas P. Petrones
Gregory B. Jones

Certification Examination No. 3 - November 9, 1981

J. F. Kido Jr.

On Site Training Co-ordinators

These personnel will take the license examinations with the utility for which they are providing instruction. The utility will apply to the NRC for the individual license examination.

V. C. Summer Plant - South Carolina Electric & Gas

Joseph B. Moore - 1st Cold License Group
Gary D. Shartzer - 1st Cold License Group
George J. Meyer - 1st Hot License Group

J. P. Farley Plant - Alabama Power Company

John W. Patterson - February 1981
Robert J. Vanderbye February 1981

Comanche Peak - Texas Utilities Generating Company

Rick E. Wirkkala - 1st Cold License Group

General

As new personnel are hired their qualification examination dates will be forwarded.

APPENDIX G

THE
WESTINGHOUSE NUCLEAR TRAINING CENTER
PROGRAM
FOR
INSTRUCTOR REQUALIFICATION
AND
IN-SERVICE EDUCATION

INSTRUCTOR REQUALIFICATION PROGRAM

Basis

The Nuclear Regulatory Commission has outlined parameters for instructor requalification programs. In this document of February 29, 1980, Harold Denton's specific charge stated:

> Instructors shall be enrolled in appropriate requalification programs to assure they are cognizant of current operating history, problems, and changes to procedures and administrative limitations.

Westinghouse Nuclear Training Center supports this philosophy and rationale of in-service education for instructors. The Center has designed and implemented an instructor requalification program to meet the specific in-service needs of its instructors.

Design

The Westinghouse Nuclear Training Center's instructor requalification program is designed to deliver instructors and ultimately students current and timely information that is germane to the nuclear power industry. This comprehensive program is structured into three component delivery systems. These component systems operate in the following manner:

Data Dissemination System

The Staff Training Specialist is tasked with developing and implementing a system that effectively and efficiently disseminates current technical information to all instructors. The specific operational procedures of this system include:

1. identifying and soliciting sources for appropriate data;
2. monitoring and categorizing incoming materials;
3. duplicating and disseminating the materials to all instructors on a periodic basis;
4. auditing each person's progress in reading the packet/packets of materials; and

5. developing and updating a cross-reference system with the ability of recalling any specific document as necessary for future usage.

Weekly Staff Seminars

The instructional support group conducts a one hour seminar each week. Topics selected for the seminar are considered timely and germane to the instructor's job function. This includes presentations on both technical matters and instructional methods. The following details depict the operational format and structure of the seminar.

1. Seminar topic schedules and agendas are disseminated to all staff members prior to the seminar.
2. Instructor attendance is documented at all seminars.
3. Seminar minutes and lesson materials are distributed to all staff members not in attendance.

Integration of Data

The ultimate purpose of the instructor requalification program is to engender a better learning process and product. That is, the competency level of the student serves as the focal point for all of these endeavors. Certain safeguards have been designed to insure that this ultimate goal is achieved.

1. The Materials Specialist receives and closely monitors all technical data disseminated by the Staff Training Specialist. As curriculum and reference materials are updated, the Materials Specialist incorporates pertinent data into the revised edition.

2. All students, including operator candidates, operator retrainees, and shift technical advisors, are exposed to complex casualty training upon the simulator. These evolutions are designed to reflect current problems, concerns, and procedures. The essence of the instructor requalification program is to facilitate increased communicatior between instructor and students concern-

ing such recent operational problems, procedures, and limitations. Specifically, as the various evolutions unfold, the instructor can correlate the simulated events to current industry concerns. This one-on-one communication, describing how various simulator evolutions represent recent industry events or concerns, shall engender the increased competence and proficiency of the student.

Implementation

The instructor requalification program was initiated with the first staff seminar on April 30, 1980. Development of new information linkages for technical data was begun on April 28, 1980, and the first technical information packet was distributed to all instructors on May 5, 1980. To date, information packets have been disseminated on a weekly basis; however, the quantity of incoming information rather than select dates shall dictate the frequency for information dissemination.

The program is monitored by the Staff Training Specialist and/or his designee. Weekly seminar attendance is recorded with lecture materials and minutes going to all instructors not in attendance. In addition, the Staff Training Specialist audits each instructor's progress regarding the review of technical information packets. Finally, the Materials Specialist monitors all technical information and incorporates appropriate updates into curriculum revisions.

APPENDIX H

THE

WESTINGHOUSE

NUCLEAR TRAINING PITTSBURGH

PROGRAM

FOR

INSTRUCTOR REQUALIFICATION

INSTRUCTOR REQUALIFICATION PROGRAM

PURPOSE

In response to the revised training criteria established recently by the NRC, Westinghouse Nuclear Training Pittsburgh implements the below described program supporting this new industry standard. The intent of this program is to address as a minimum, those concerns set forth by Mr. Denton's February 29, 1980, letter regarding Qualifications of Reactor Operators. More specifically, the Westinghouse Nuclear Training Pittsburgh Instructor Requalification Program establishes a positive means for:

1. Maintaining the proficiency and competence of instructor personnel at a level consistant with enabling Westinghouse to provide quality instructional services to the industry.

2. Transmitting new plant design changes and updated Transient and Accident Studies to instructor personnel.

3. Providing an update and review of current plant operating data and procedures to instructor personnel.

4. Reviewing significant License Event Reports.

ADMINISTRATION

The administration of the Instructor Requalification Program is designed to be executed effectively by designated personnel charged with specific responsibilities at various management and training engineer levels. Of most significant interest are ensuring participation in the program as delineated herein, ensuring the Requalification program meets the intent of current regulatory agency requirements on instructor requalification, maintenance of all documentation demonstrating compliance, and coordinating the execution of the Requalification program.

The Instructor Requalification Program consists of two component parts:

1. Formal planned lectures

2. Required reading assignments

Formal Planned Lectures

On a biweekly basis formal, planned lectures will be provided for at least two (2) hours duration at a predesignated time. Lessons will cover a scope and depth consistant with maintaining satisfactory instructor knowledge level in all areas of Senior Reactor Operator licensing, as well as instructional methods. Each new lecture topic will be videotaped during the initial presentation. The videotape will provide a means for the lecture to be repeated the week following the live presentation for personnel missing the original due to schedular commitments. Site training coordinators will be sent copies of the videotapes

for immediate viewing and return within a specified time frame. A training instructor who attended the original presentation will be present to field questions and provide necessary amplification of subject matter.

The lecture schedule, approved by the Programs Manager, will be distributed to all instructors in the Requalification Program by the Staff Training Specialist. In addition, the Staff Training Specialist will maintain schedules, attendance records, training materials such as handouts and videotapes as part of compliance records.

Required Reading Assignments

The required reading will be assigned to all Training Instructors and On-Site Training Coordinators on a weekly basis by the Staff Training Specialist in order to augment the Requalification Training Program. The required reading assignments will include material that as a minimum:

1. Enhances and/or supplements the formal biweekly lecture topics.

2. Reflects design changes and transient and accident analyses updates that affect plant operations and/or response.

3. Reviews significant transient events and related License Event Reports.

The specific reading materials will be copied for and disseminated to each instructor on a regular basis after they are screened and selected from various incoming material sources based upon their relevance to program objectives.

The Staff Training Specialist will maintain a copy of these materials and instructor progress records for compliance.

APPENDIX I

TRAINING PROGRAM

RECOGNITION AND MITIGATION OF CORE DAMAGE

INTRODUCTION

Training materials for instruction and presentations on topics outlined should be at a depth and scope consistant with providing operators and appropriate staff and management personnel with the knowledge to cope with degraded core situations. Prevention of severe accident consequences remains an important part of the program scope.

In forming a well rounded program it is necessary to call upon the following resources as an integral part of program construction:

1. Plant specific systems related to or have effect upon recognizing and mitigating core damage.

2. Theoretical concepts that form a foundation for better understanding accident processes and necessary remedial action.

3. The most recent studies in accident analyses with regard to inadequate core cooling conditions, response times, critical parameters, optimum core cooling methods, and others which address long and short term processes.

The above resources would embody presentations of each topic area outlined as applicable to enhance understanding of material presented. A major part of the third resource must be provided from within Westinghouse engineering groups and cooperation from equipment vendors.

It is assumed in the construction of this outline that the student has sufficient background in PWR systems, large PWR core physics, reactor theory, heat transfer, fluid flow and thermodynamics at a depth consistant with the objectives of the program.

TOPIC AREAS

Core Cooling Mechanics

Provides:

- Description of different means available to cool the core to prevent degradation and the mechanics of these processes.

- Methods most effective for specific plant conditions.

- Symptoms, causes and affects of gas or steam in RCS.

Subject Areas:

1. Injection Flow paths
    a. hot leg versus cold leg injection
2. Natural Circulation
3. Heat removal paths and heat sinks
4. Steam and water cooling
5. Effects of boron precipitation in core
6. Quenching effects on fuel cladding
7. Core limitations:
    a. clad oxidation and melt
    b. fuel melt
    c. core boiling
8. Gas/Steam binding effects
    a. sources of gas/steam during accidents
    b. symptoms and effects of binding in RCS locations

Compromising Operating Conditions

Provides training enabling the trainee to recognize operating conditions in which the plant is most vulnerable to multiple failures and potential inadequate core cooling conditions. Operator errors will be utilized as a failure mode.

Conditions:

1. Single safety bus remaining
2. Extended station blackout
    a. water and air supplies
3. Stuck open pressurizer relief and/or safety valve
4. Losses of DC control power to ESF bus.

Recognizing Core Damage/Conditions For Core Damage

Provides the trainee with:

- The analytical tools necessary to determine/estimate core damage.
- The knowledge of how available instrumentation can be used to determine conditions where core damage may occur or estimate core degradation.

Subject Areas:

1. Excore Nuclear Instrumentation (NIS)
   a. Review of Source Range instrumentation
   b. Use of Excore NIS to determine void formation and Reactor coolant levels.
   c. Void location basis for Excore NIS response as a function of core temperatures and density changes.
   d. Reliability - long and short term
2. Incore Thermocouples
   a. Review of Thermocouple system
   b. Use of core thermocouples for determining extent of core damage and geometry changes.
   c. Range needed for adequate use
   d. Methods for direct readings at terminals
   e. Reliability - long and short term
3. Incore Movable Detectors (MIDS)
   a. Review of Movable Detector system
   b. Use of MIDs for determining extent of core damage and geometry changes
   c. Reliability - long and short term
   d. Recorders and readouts.
4. Plant Computer
   a. Data acquisition and readout capabilities
   b. Relevant analytical functions
   c. Application to Incore system
   d. Reliability - long and short term

5. Post Accident Monitoring

   a. What a PAMS can provide

   b. How PAMS information can be useful

   c. Reliability - long and short term

6. Plant Chemistry

   a. Review of normal sample analyses, expected results

   b. Determination of extent of core damage

      1) Isotopic analyses of samples

      2) Expected results of samples

   c. Use of "Failed Fuel" detector system

   d. Consequences of transferring small quantities of liquid outside containment

      1) Sampling

      2) Importance of using leak-tight systems

7. Radiation Monitoring/Hazards

   a. Response of RMS to core damage conditions

   b. Determining radiation/contamination levels

   c. Saturated detector conditions

   d. Available methods for "direct reading" the detectors

   e. Determining extent of damage with RMS

   f. Methods of determining dose rate inside containment from measurements taken outside.

   g. Areas normally used that may become high radiation areas

   h. Sampling hazards and precautions

   i. RMS reliability

Gas Hazards During Severe Accidents

Provides training which develops student understanding of Hydrogen, Oxygen, and other gas sources that may be present in the RCS and containment during accident conditions as well as explosive potential and methods of control.

Operational Considerations and Cooling Mode Selection

Provides the trainee an insight to those operational factors that affect his ability to mitigate severe consequences of core damage over the short and long term. Included would be determining the best methods of core coding for various situations.

Subject Areas:

1. Loss feedwater to steam generators
    a. Auxiliary Feedwater delayed start
    b. Primary feed and bleed with PORV
2. Criteria for Reactor Coolant Pump operation
3. Inadequate Core Cooling Scenario
    a. Plant instrumentation response
    b. Core recovery techniques
4. Reliability of selected core cooling methods
    a. Heat sink
    b. Equipment
    c. Power supplies
5. Post-accident offsite releases
    a. Probabilities
    b. Methods
6. Corrosion of equipment in containment
    a. Methods of corrosion
    b. Susceptible materials
    c. Corrosion control
    d. Expected times to failure

Subject Areas:

1. Hydrogen and Oxygen sources during normal and accident conditions
2. Flamability and explosive limits
3. Methods of measuring gas concentrations
    a. Normal
    b. Containment isolated
4. Combustible gas control systems/methods
5. Radioactive gas sources/accumulation in containment following LOCA.
6. Control/disposal of radioactive gases from containment

Vital Instrumentation

Provides training in the factors that affect the reliability and potential failure of instrumentation associated with critical parameters. Probable failure modes and accuracy in post-accident environments will be considered as well as alternate means of determining values.

The following parameters, as a minimum, will be deemed critical parameters for the purposes of this program:

- RCS pressure and temperature
- Pressurizer pressure and level
- Containment pressure, temperature, and level
- Steam generator level

Subject Areas:

1. Instrumentation system review
    a. Type of detector
    b. Electrical circuit
    c. Control, indication and protection function
2. Instrument failure modes under normal conditions
3. Effects of post-LOCA environment
    a. Temperature, pressure, moisture effects
    b. Time to failure
    c. Reliability
4. Alternate methods of measurement if primary method has failed.