NORTHEAST UTILITIES
THE CONNECTICUT LIGHT AND POWER COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

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February 28, 1985

Docket No. 50-423
B11472

Dr. Thomas E. Murley
Regional Administrator
Region I
U.S. Nuclear Regulatory Commission
631 Park Avenue
King of Prussia, PA 19406

References: 1. W. G. Counsil letter to R. W. Starostecki, Millstone Nuclear Power Station, Unit No. 3, "Systematic Assessment of Licensee Performance (SALP)," dated January 4, 1985.

2. W. G. Counsil letter to W. J. Dircks, Haddam Neck Plant, Millstone Nuclear Power Station, Units 1, 2 and 3, "Plant-Specific Simulators," dated January 28, 1983.

Dear Dr. Murley:

Millstone Nuclear Power Station, Unit No. 3
Simulator Training and Examination Program

Recently, we have had discussions with your Staff on the use of the Millstone Unit No. 3 plant reference simulator for the initial cold license operator exams. The purpose of this letter is to bring you up to date on the status of the simulator project and training program, and to provide you with our revised position (see Reference 1) on the use of the simulator in operator licensing exams.

In Reference 2, we made you aware of our commitment to provide plant reference simulators for each of our nuclear units. The first of these, the Millstone Unit No. 3 simulator, was delivered to the Millstone site in December, 1984. Following installation, the simulator entered a verification test phase to ensure that no shipping damage had occurred. This testing was completed on January 15, 1985.

From January 15 to February 11, 1985, the simulator was used to test the training program curriculum and to validate the simulator against this curriculum. This curriculum was developed by our training staff who worked closely with station operations personnel to produce a quality simulator training program. An outline of this training program is provided in Attachment I.

On February 11, 1985, training on the Millstone Unit No. 3 simulator commenced. Each cold license candidate will receive 5 weeks of simulator

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training which consists of 125 hours of actual simulator experience along with 75 hours of classroom training to prepare them for the NRC operator license exam.

Northeast Nuclear Energy Company feels that the Millstone Unit No. 3 simulator is ready for use as an examination tool within the bounds of the training program curriculum which has been validated. To further explain our concern, it is important to realize that the factory testing of the simulator only verified the simulator hardware and software (i.e., insert malfunction - observe result). It did not take into account the intervention of operator actions and plant procedures which may produce an entirely different, although perfectly valid training scenario. Subjecting a license candidate to a scenario which has not been validated on the simulator is unreasonable and may produce an inappropriate test. Hence, it is our position that the Millstone Unit No. 3 operating exam be limited to those scenarios which have been validated on our simulator. These scenarios are described in detail in Attachment II.

It is our objective that as our simulator training program is expanded, additional simulator capabilities will be validated and made available for the conduct of operating exams. However, we feel that the simulator capabilities available at this time are sufficiently broad and varied to provide an adequate base upon which to conduct the Millstone Unit No. 3 initial cold license exams.

We would also like to take this opportunity to discuss our understanding of some of the "ground rules" (as discussed in NUREG-1021) for the conduct of operating exams. Some of our more significant concerns are as follows:

- We request that all NRC scenarios and the evaluation criteria for each scenario be reviewed by our staff prior to the exams. We would also recommend that all test scenarios be run on the simulator prior to their use in the exams.

- Operating exams will be conducted in teams representing the actual shift composition, however, each candidate will be individually evaluated.

- Successful completion of a scenario (i.e., bringing the plant to a safe condition) should result in a satisfactory evaluation for that candidate. This should be the case even if the candidate errs at some point along the way (providing he doesn't put the plant in an unsafe condition).

- RO candidates should not be required to perform SRO functions during the operating exams.

- Examiner questioning during the exam should be secondary to simulator operations and operator responses. If the candidate feels that the questioning interferes in any way with his ability to operate the plant, he can defer answering such questions until a time where it is convenient for him to respond. This decision to defer questioning shall in no way reflect negatively on the candidate.

We are available to discuss with you any concerns you may have on the information contained herein. We suggest that a meeting be held in the near future to finalize the arrangements for the Millstone Unit No. 3 operator exams. Please contact Mr. R. Z. Test, Director of Nuclear Training, at (203) 665-3203 to arrange this meeting.

Very truly yours,

W. G. Counsil

W. G. Counsil
Senior Vice President

C Sears

By: C. F. Sears
Vice President

cc: Mr. B. J. Youngblood, Chief
NRC Licensing Branch No. 1

ATTACHMENT I

Millstone Nuclear Power Station, Unit No. 3
Outline of Initial Cold License Simulator Training Program (5 weeks)

| | | | |
|---|---|---|---|
| **Week 1** | | | |
| Day 1 | Simulator (5 Hours) | CLS(S)-1 | Steam System Warmup With Gland Seal in Service. |
| | | | Shutdown Rod Banks Fully Withdrawn. |
| | | | Students Conduct Reactor Startup, Plant Startup and Load Change to approximately 20%. |
| | Classroom (3 Hours) | CLC(R)-1 | Introduction (1 Hour) |
| | | CLC(R)-2A | GOP 3202 Reactor Startup (3/4 Hour) |
| | | CLC(R)-2B | GOP 3209A ECP Calculations (3/4 Hour) |
| | | CLC(R)-3A | GOP 3203 Plant Startup (1/2 Hour) |
| Day 2 | Simulator (5 Hours) | CLC(S)-2 | Initial Conditions Same As CLC(S)-1 with Turbine fully Warm. |
| | | | Students conduct Reactor Startup, Plant Startup and Load Change to approximately 50%. |
| | | | Take shapshot at end of session. |
| | Classroom (3 Hours) | CLC(R)-3B | GOP 3204 Load Changes (1/2 Hour) |
| | | CLC(R)-4A | GOP 3201 Plant Heatup (1 Hour) |
| | | CLC(R)-13 | Rod Control Malfunctions (1 Hour) |
| | | --- | Critique Previous Simulator Session. |

Cold License Class Simulator Training Program (5 Weeks) - cont.

Week 1 - cont.

| | | | |
|---|---|---|---|
| Day 3 | Simulator (5 Hours) | CLC(S)-3 | Continue Load Increase from CLC(S)-2. |
| | | | After plant stabilizes at 100% students conduct Plant and Reactor Shutdown. |
| | Classroom (3 Hours) | CLC(R)-5A | GOP 3207 Reactor Shutdown (1/2 Hour) |
| | | CLC(R)-5B | GOP 3206 Plant Shutdown (1/2 Hour) |
| | | CLC(R)-4B | GOP 3208 Plant Cooldown (1 Hour) |
| | | ___ | Critique previous Simulator session. |
| Day 4 | Simulator (5 Hours) | CLC(S)-4 | Plant in Cold Shutdown Conditions with Reactor Coolant System temperature less than $200^{\circ}F$. |
| | | | Students conduct Plant Heatup and Bubble Formation. |
| | | | (Time compressed via fast-time or advance to pre-established IC's) |
| | Classroom (3 Hours) | CLC(R)-6A, 6B, 6C | EOP-35-E-0, ES-0.1 and ES-1.1 Review (1 1/2 Hours) |
| | | CLC(R)-26 | Loss of Shutdown Cooling (Residual Heat Removal) (1/2 Hour) |
| | | CLC(R)-47 | GOP 3209A Shutdown Margin Calculation (1/2 Hour) |
| | | --- | Critique previous Simulator session. |

Cold License Class Simulator Training Program (5 Weeks) - cont.

Week 1 - cont.

| | | | |
|---|---|---|---|
| Day 5 | Simulator (5 Hours) | CLC(S)-5 | Plant in Hot Standby Conditions.<br><br>Students conduct Plant Cooldown including placing of Residual Heat Removal in Service and Pressurize Bubble Collapse. |
| | Classroom (3 Hours) | CLC(R)-16 | EOP 3503 & 3504 Shutdown/ Cooldown Outside the Control Room (1 1/2 Hours) |
| | | CLC(R)-23 | Protection System Review (1 Hour) |
| | | --- | Critique previous Simulator session. |

Week 2

| | | | |
|---|---|---|---|
| Day 1 | Simulator (5 Hours) | CLC(S)-6 | Just after a Reactor Trip Students conduct Reactor & Plant Startup.<br><br>Minor malfunctions (Reactor Operator Area) occur during Startup.<br><br>A Loss of Normal Feedwater results in Reactor Trip. |
| | Classroom (3 Hours) | CLC(R)-29 | AOP 3555 Reactor Coolant System Leak (1 Hour) |
| | | CLC(R)-10A | EOP-35-E-1 Review (1/2 Hour) |
| | | CLC(R)-10B | EOP-35-ES-1.2 Review (1/2 Hour) |
| | | CLC(R)-10C | EOP-35-E-2 Review (1/2 Hour) |
| | | --- | Critique previous Simulator session. |

Cold License Class Simulator Training Program (5 Weeks) - cont.

Week 2 - cont.

| | | | |
|---|---|---|---|
| Day 2 | Simulator (5 Hours) | CLC(S)-7 | Steady State Power Operations with minor malfunctions (Reactor Operator & Balance of Plant Areas).<br><br>Small Reactor Coolant System Leak cause Plant Shutdown.<br><br>Leak gets worse until Safety Injection occurs. |
| | Classroom (3 Hours) | CLC(R)-11A | EOP-35-E-3 Steam Generator Tube Rupture Review (1 1/2 Hours) |
| | | CLC(R)-11B | Post Steam Generator Tube Rupture Cooldown Methods (1 Hour) |
| | | CLC(R)-33 | AOP 3560 Loss of Service Water (3/4 Hour) |
| | | CLC(R)-9 | Review of Site Emergency Plan & EAL's (1 Hour) |
| | | --- | Critique previous Simulator session. |
| Day 3 | Simulator ( 5 Hours) | CLC(S)-16 | Steady State Power Operations at 50% with minor malfunctions (Reactor Operator & Blance of Plant Areas).<br><br>A Dropped Rod & Recovery are conducted.<br><br>The Students will then increase load to 100%. |
| | Classroom (3 Hours) | CLC(R)-30 | AOP 3556 Steam Generator (3/4 Hour) |
| | | --- | Critique previous Simulator session. |

Cold License Class Simulator Training Program (5 Weeks) - cont.

Week 2 - cont.

| | | | |
|---|---|---|---|
| Day 4 | Simulator (5 Hours) | CLC(S)-8 | Power Increase 20--->100% with minor malfunctions (RO Area).<br><br>Small Steam Generator Tube Rupture results in Plant Shutdown.<br><br>During Shutdown Leak gradually increases to tube rupture. |
| | Classroom (3 Hours) | CLC(R)-12 | Critical Safety Function Status Tree Review (1 1/2 Hours) |
| | | CLC(R)-42 | AOP 3571 Instrument Failure (1 Hour) |
| | | ___ | Critique previous Simulator session. |
| Day 5 | Simulator (5 Hours) | CLC(S)-10 | Power increase 20--->100% with minor malfunctions (Reactor Operator & Balance of Plant Areas).<br><br>Main Steam Line break downstream of Main Steam Line Isolation Valves. |
| | Classroom (3 Hours) | CLC(R)-43 | Sequenced Safeguards Sequencer Review (2 Hours) |
| | | CLC(R)-44 | GOP 3250 Removing Equipment From Service For Maintenance (1/2 Hour) |
| | | --- | Critique previous Simulator session. |

Week 3

| | | | |
|---|---|---|---|
| Day 1 | Simulator (5 Hours) | CLC(S)-17 | Steady State Operations at 100% Power.<br><br>Isolable Reactor Coolant Leak. |

Cold License Class Simulator Training Program (5 Weeks) - cont.

Week 3 - cont.

| | | | |
|---|---|---|---|
| Day 1 | Simulator (5 Hours) - cont. | | |
| | | | Reactor trip occurs due to personnel error. |
| | | | Students conduct Startup & return to full load. |
| | Classroom (3 Hours) | CLC(R)-14A, 14B, 14C | EOP-35-ECA-0.0, ECA-0.1 & ECA-0.2 Loss of AC Power Procedures (1 1/2 Hours) |
| | | CLC(R)-15 | AOP 3554 Failure of RCP Seal (1 Hour) |
| | | --- | Critique previous Simulator session. |
| Day 2 | Simulator (5 Hour) | CLC(S)-11 | Steady State Operations at 100% power. |
| | | | Reactor Coolant Pump seal failure resuts in Reactor Coolant System leakage. |
| | | | During the Shutdown a Loss of Off-Site Power occurs. |
| | Classroom (3 Hours) | CLC(R)-17 | Electrical Bus Failures (1 Hours) |
| | | CLC(R)-18 | Turbine controls & conduct of Turbine Valve Test (1 Hour) |
| | | CLC(R)-27 | AOP 3550 Turbine/Generator Trips (1/2 Hour) |
| | | --- | Critique previous Simulator session. |
| Day 3 | Simulator (5 Hours) | CLC(S)-12 | Steady State Operations at 100% with electrical malfunctions. |
| | | | Conduct Turbine Valve Test. |
| | | | Load Shed occurs without automatic Reactor Trip. |

Cold License Class Simulator Training Program (5 Weeks) - cont.

| | | | |
|---|---|---|---|
| Week 3 - cont. | | | |
| Day 3 | Classroom (3 Hours) | CLC(R)-35 | AOP 3562 Loss of Instrument Air (1 Hour) |
| | | CLC(R)-21 | AOP 3566 Immediate Boration (3/4 Hour) |
| | | CLC(S)-34 | AOP 3561 Loss of Reactor Plant Component Cooling Water (1/2 Hour) |
| | | --- | Critique previous Simulator session. |
| Day 4 | Simulator (5 Hours) | CLC(S)-14 | Steady State Operations at 100% with minor malfunctions (Reactor Operator Area). |
| | | | Loss of Instrument Air results in Reactor Trip with two stuck rods. |
| | Classroom (3 Hours) | CLC(R)-20 | Plant Transients with Pressurize Thermal Shock Impliations (1 1/2 Hour) |
| | | CLC(R)-28 | AOP 3553 High Activity in Reator Coolant System (1/2 Hour) |
| | | CLC(R)-31 | AOP 3557 Steam Generator Chemistry (1/2 Hour) |
| | | --- | Critique previous Simulator session. |
| Day 5 | Simulator (5 Hours) | CLC(S)-20 | Reactor critical at $10^{-8}$ amps and Students continue Startup to Full Load with minor malfunctions (Reactor Operator & Balance of Plant Areas). |
| | | | Main Steam Line break outside Containment & upstream of Main Steam Line Isolation Valves. |
| | Classroom (3 Hours) | CLC(R)-22 | EOP 3509 Fire Emergency (1 Hour) |

Cold License Class Simulator Training Program (5 Weeks) - cont.

Week 3 - cont.

| | | | |
|---|---|---|---|
| Day 5 | Classroom (3 Hours) - cont. | | |
| | | CLC(R)-39 | AOP 3568 Flooding (1/2 Hour) |
| | | CLC(R)-36 | AOP 3564 Loss of Protective System Channel (3/4 Hour) |
| | | --- | Critique Previous Simulator Session. |

Week 4

| | | | |
|---|---|---|---|
| Day 1 | Simulator (5 Hours) | CLC(S)-22 | Students conduct Plant Startup and Load Increase to 100% with minor malfunctions (Reactor Operator Area). |
| | | | Reactor Vessel Head leak results in safety injection during which the Turbine fails to trip. |
| | Classroom (3 Hours) | CLC(R)-24 | Review Reactor and Plant Startup precautions. (1 Hour) |
| | | CLC(R)-19B | Response to Load Rejection (1 Hour) |
| | | --- | Critique previous simulator session. |
| Day 2 | Simulator (5 Hours) | --- | Practice Audit Examinations |
| | Classroom (3 Hours) | --- | Student study time to review procedures prior to audit examinations instructions available for questions. |
| Day 3 | Simulator (5 Hours) | CLC(S)-9 with minor malfunctions | Load increase 50--->100% (Reactor Operator & Balance of Plant Areas). |

Cold License Class Simulator Training Program (5 Weeks) - cont.

Week 4 - cont.

Day 3 - Simulator (5 Hours) - cont.

| | | | |
|---|---|---|---|
| | | | Dropped control rod with flux maps taken. |
| | | | After rod recovery a Main Steam line break inside Containment occurs. |
| Day 3 | Classroom (3 Hours) | --- | Detailed critique of audit examinations. |
| | | CLC(R)-19A | AOP 3559 Loss of Condenser Vacuum (1 Hour) |
| | | CLC(R)-38 | AOP 3567 Operation with Feedwater Heater String Isolated (1/2 Hour) |
| Day 4 | Simulator (5 Hours) | CLC(S)-13 | Load decrease 100%--->40% with minor malfunctions (Reactor Operator & Balance of Plant Areas). |
| | | | Load Rejection when less than 50% and Students stabilize plant at approximately 5% power. |
| | Classroom (3 Hours) | CLC(R)-48-50 | Refueling Procedures (2 Hours) |
| | | --- | Critique previous Simulator session. |
| Day 5 | Simulator (5 Hours) | CLC(S)-15 | Load increase 20%--->100% with minor malfunctions (Reactor Operator & Balance of Plant Areas). |
| | | | Inadvertant safety injection and Students will stabilize at Hot Standby Conditions. |
| | Classroom (3 Hours) | CLC(R)-51 | GOP 3211A New Fuel Receipt (1/2 Hour) |

Cold License Class Simulator Training Program (5 Weeks) - cont.

Week 4 - cont.

| | | | |
|---|---|---|---|
| Day 5 | Classroom (3 Hours) - cont. | | |
| | | CLC(R)-52 | GOP 3212 Spent Fuel Handling (1/2 Hour) |
| | | CLC(R)-25 | EOP 3502 Fuel Handling Accident (1/2 Hour) |
| | | CLC(R)-40 | Severe Weather (1/2 Hour) |
| | | --- | Critique previous Simulator session. |
| Week 5 | | | |
| Day 1 | Simulator (5 Hours) | CLC(S)-18 | Load increase 40%---100% with minor malfunctions (Balance of Plant Area). |
| | | | Steam Generator Tube Rupture after full power obtained. |
| | Classroom (3 Hours) | CLC(R)-53 | Probabilistic Risk Assessment (2 Hours) |
| | | --- | Critique previous Simulator session. |
| Day 2 | Simulator ( 5 Hours) | CLC(S)-19 | Plant Shutdown from 100% with minor malfunctions (Reactor Operator Area). |
| | | | LOCA from Pressurize Steam Space Manway. |
| | Classroom (3 Hours) | CLC(R)-45 & 46 | Inactive Loop Operations (2 Hours) |
| | | --- | Critique previous Simulator session. |
| Day 3 | Simulator (5 Hours) | CLC(S)-21 | Load changes with minor malfunctions (Reactor Operator & Balance of Plant Area). |

Cold License Class Simulator Training Program (5 Weeks) - cont.

Week 5 - cont.

| | | | |
|---|---|---|---|
| Day 3 | Simulator (5 Hours) - cont. | | |
| | | | Total Loss of Feedwater occurs without restoration for thirty minutes. |
| | Classroom (3 Hours) | CLC(R)-41 | AOP 3570 Earthquake (1/2 Hour) |
| | | CLC(R)-32 | AOP 3558 Condenser Tube Leak (1/2 Hour) |
| | | CLC(R)-37 | AOP 3565 Loss of Containment Vacuum/Integrity (3/4 Hour) |
| | | --- | Critique previous Simulator session. |
| Day 4 | Simulator (5 Hours) | CLC(S)-23 | Steady State Operations at 100% with minor malfunctions (Reactor Operator & Balance of Plant Areas). |
| | | | Reactor Coolant Pump Thermal Barrier failure results in isolable LOCA and Plant Shutdown. |
| | Classroom | --- | Critique previous Simulator session. |
| | | --- | Students review procedures with procedures with instructors available for questions. |
| Day 5 | --- | --- | Audit Examinations |

ATTACHMENT II

Millstone Nuclear Power Station, Unit No. 3

Detailed Training Program Curriculum Validation Description

## A. EXERCISE 1 (CLC(S)-1)

### 1. Initial Conditions (IC-4)

Tave = 555°F, RCS pressure = 2229 psig, reactor power = 0%, boron concentration = 1510 ppm, xenon reactivity = 0 pcm, just prior to critical approach, shutdown rods withdrawn, BOL.

### 2. Exercise Brief

The reactor is at hot standby with the steam lines warmed up. A vacuum is established in the condenser and the turbine is on the turning gear. The students will calculate an ECP and perform a reactor startup. Once power is stabilized at 3% and a turbine heatup is established, the simulator is reinitialized at IC-32 (same plant conditions with the exception that the turbine is hot and xenon has started to build in (-17 pcm)). The students will then conduct a turbine startup, synchronize to the grid and increase load to 20%.

### 3. Malfunctions

None.

## B. EXERCISE 2 (CLC(S)-2)

### 1. Initial conditions (IC-21)

Tave = 555°F, RCS pressure = 2216 psig, reactor power = 0%, boron concentration = 970 ppm, xenon reactivity = 0 pcm, 100 hrs. post trip from full power, shutdown rods withdraw, just prior to critical approach, MOL.

### 2. Exercise Brief

The reactor is in hot standby with condenser vacuum established. The students will calculate an ECP, conduct a reactor startup and stabilize reactor power at 3-4%. Turbine heatup will be commenced. Once the turbine heatup is established, the simulator will be reinitialized at IC-33 (same plant conditions with the exception that the turbine is hot and xenon has started

to build in (-8pcm)). The students will then continue turbine startup and synchronize to the grid. Plant power will be raised to at least 50% (power raised as high as time permits). A temporary IC will be snapshot at the end of this exercise to be used as the starting point for Exercise 3.

3. Malfunctions

None.

C. EXERCISE 3 (CLC(S)-3)

1. Initial Conditions (IC-Temp)

The plant conditions which existed at the end of Exercise 2.

2. Exercise Brief

Students will continue to increase reactor power to full rated power. Once the plant has been stabilized at full power, the students will conduct a plant and reactor shutdown to hot standby.

3. Malfunctions

None.

D. EXERCISE 4 (CLC(S)-4)

1. Initial Conditions (IC-23)

Tave = 101$^{o}$F, TCS pressure = 148 psig, reactor power = 0%, boron concentration = 1996 ppm, xenon reactivity = 0 pcm, pressurizer water solid, shutdown control rods withdrawn, BOL.

2. Exercise Brief

The plant is in cold shutdown with all systems and reactor coolant chemistry ready to support a plant heatup. The students will commence a reactor coolant system heat up. Once heatup rate has been established and stabilized, the simulator will be reinitialized at IC-24 (same conditions as IC-23 except Tave = 206$^{o}$F, reactor coolant pressure = 358 psig, pressurizer temperature = 412$^{o}$F, ready to draw a steam bubble in the pressurizer). The students will establish pressurizer steam bubble pressure control and continue to heatup the reactor coolant system and secondary steam plant.

3. Malfunctions

None.

E. EXERCISE 5 (CLC(S)-5)

1. Initial Conditions (IC-30)

Tave = 556°F, RCS Pressue = 2245 psig, reactor power = 0%, boron concentration = 735 ppm, xenon reactivity = -4685 pcm, plant shutdown for 14 hours, ready to commence a plant cooldown, MOL.

2. Exercise Brief

The plant is in hot standby with the main condenser and motor driven main feedwater pump available. The students will commence a plant cooldown including collapsing the pressurizer steam bubble and placing the residual heat removal system on service.

3. Malfunctions

None.

F. EXERCISE 6 (CLC(S)-6)

1. Initial Conditions (IC-22)

Tave = 557°F, RCS pressure = 2247 psig, reactor power = 0%, boron concentration = 900 ppm, xenon reactivity = 3875 pcm, 1 hour following a trip from full power, motor driven main feedwater pump out of service, BOL.

2. Exercise Brief

The plant is in hot standby ready for a trip recovery startup. The students will calculate an ECP, conduct a reactor startup, and bring the plant up to full load. During the startup, control bank B group rod position indication will fail. Also during the startup, source range high voltage will fail to deenergize. At approximately 30-40% power, the running main feed pump speed controller will fail and the standby pump will fail to start. The resulting loss of feed will result in a reactor trip on low steam generator water level.

3. Malfunctions

| Time | Malfunction | Severity | Ramp |
|---|---|---|---|
| T-0 | NI04 Source Range High Voltage Fails to Deenergize | N/A | |
| T-0 | RD14G CDD Group Rod Position Indication Failure | N/A | |
| T-0 | FW07(C) "B" Steam-Driven Feed Pump Trip | N/A | |
| T-0 | FW07(A) Motor Driven Feed Pump Trip | N/A | |
| T-VAR | FW27(A) Main Feed Pump Speed Control Failure | 100% | |

G. EXERCISE 7 (CLC(S)-7)

1. Initial Conditions (IC-10)

Tave = 590°F, RCS pressure = 2231 psig, reactor power = 100%, boron concentration = 1035 ppm, xenon reactivity = -2864 pcm (equilibrium), all plant equipment operable, BOL.

2. Exercise Brief

The plant is initially at full power steady state. The operating charging pump (3CHS*PIA) will trip resulting in a loss of normal charging. The students will have to start the standby charging pump (3CHS*PIB) and align the swing charging pump (3CHS*PIC) to train A. After charging is restored, a high differential pressure will develop on traveling water screen "A" resulting in a trip of circulating pump "A" (3CWS-PIA). The students will align condenser "A" to be supplied with circulating water from circulating pump "B" (3CWS-PIB). After the condenser problem is corrected, an unidentified reactor coolant leak will develop. After identifying the magnitude of the leak (greater than technical specification limits), a plant shutdown will be started. During the plant shutdown, the leak increases until safety injection occurs.

3. Malfunctions

| Time | Malfunction | Severity | Ramp |
|---|---|---|---|
| T-25 | CV11A Charging Pump A Trip | N/A | N/A |
| T-50 | CW04A Traveling Screen A High DP | 100% | N/A |
| T-90 | RC05 Reactor Vessel Head Vent Leak | 1% | N/A |
| T-VAR | RC05 Reactor Vessel Head Vent | 100% | 30 Min. |

H. EXERCISE 8 (CLC(S)-8)

1. Initial Conditions (IC-19)

Tave = 563°F, RCS pressure = 2245 psig, reactor power = 19%, boron concentration = 431 ppm, xenon reactivity = -1282 pcm (equilibrium), EOL.

2. Exercise Brief

The plant is at 20% power following a startup from xenon free. The students are directed to commence a load increase to full load. Soon after the load increase begins, one of the instrument buses fails. After the students recover the instrument bus by shifting power supplies, one of the power range nuclear instrument indications on the main board fails. At 60-70% power, a steam generator tube leak of 20 gpm starts. During the subsequent plant shutdown, the tube leak increases to a rupture (approximately 600 gpm).

3. Malfunctions

| Time | Malfunction | Severity | Ramp |
|---|---|---|---|
| T-20 | ED08 Loss of Instrument Bus | N/A | N/A |
| T-VAR | SG01D Steam Generator Tube Rupture | 2% | N/A |
| T-VAR | SG01D | 6% | 2 Min. |
| T-VAR | SG01D | 15% | 2 Min. |
| T-VAR | SG01D | 20% | 2 Min. |
| T-VAR | SG01D | 60% | 2 Min. |

4. Overrides

| Time | Override |
|---|---|
| T-VAR | PR NI Channel N-43 Indication on MB4 Fails Low |

I. EXERCISE 9 (CLC(S)-9)

1. Initial Conditions (IC-31)

Tave = 571°F, RCS pressure = 2249 psig, reactor power = 50%, boron concentration = 918 ppm, xenon reactivity = -2280 pcm (equilibrium), MOL.

2. Exercise Brief

The plant is at 50% power. The students will commence a load increase to full power. As the load increase begins, a reactor coolant system cold leg temperature transmitter fails high, resulting in a high Tave signal. After students recover plant control by defeating the failed transmitter, the load increase can continue. Next, one feedwater regulating valve freezes in a midposition. At approximately 75-80% power, a control rod drops. After the dropped control rod is recovered and load increase resumes, a main steam line break occurs inside containment.

3. Malfunctions

| Time | Malfunction | Severity | Ramp |
|---|---|---|---|
| T-25 | RX04 Narrow Range Cold Leg Temperature Transmitter Failure (High) | 100% | N/A |
| T-50 | FW08(B) Feedwater Regulating Valve Failure | Fail As Is | N/A |
| T-VAR | RD03 Dropped Control Rod | N/A | N/A |
| T-270 | MS01 Main Steam Line Rupture Inside Containment | 100% | N/A |

J. EXERCISE 10 (CLC(S)-10)

1. Initial Conditions (IC-26)

Tave = 565°F, RCS pressure = 2254 psig, reactor power = 18%, boron concentration = 771 ppm, xenon reactivity = -4034 pcm, 3 hours after plant trip from full power, xenon increasing, MOL.

2. Exercise Brief

The plant is at 18% power following a trip recovery. The students will commence a load increase to full power. As load increase begins, automatic rod control fails. At approximately 40% power, the lead service water pump on train "A" trips. At approximately 60% power, one of the running condensate pumps trips and the standby pump fails to start. The students will reduce load to 50% power to maintain adequate feedwater flow. Once the problem with the standby condensate pump has been corrected, the load increase can continue. During the final phase of the load increase, a main steam line break occurs downstream of the main steam isolation valve. A safety injection will occur, and the "A" emergency diesel generator and "B" safety injection pump will fail to start.

3. Malfunctions

| Time | Malfunction | Severity | Pump |
|---|---|---|---|
| T-0 | EG06A Diesel Generator Fails to Start | N/A | N/A |
| T-0 | SI04B Safety Injection Pump Fails to Start | N/A | N/A |
| T-0 | FW03C Condensate Pump Trip | N/A | N/A |
| T-20 | RD05 Control Rods Fail to Move in Auto | N/A | N/A |
| T-VAR | SW01A Service Water Pump Trip | N/A | N/A |
| T-VAR | FW03B Condensate Pump Trip | N/A | N/A |
| T-165 | MS03 Main Steam Line Rupture Downstream of MSIV | 70% | N/A |

K. EXERCISE 11 (CLC(S)-11)

1. Initial Conditions (IC-14)

Tave = 590°, RCS pressure = 2234 psig, reactor power = 100%, boron concentration = 777 ppm, xenon reactivity = 2935 pcm (equilibrium), MOL.

2. Exercise Brief

The plant is at 100% power. RCP "C" #1 seal fails which requires students to decrease load to secure the pump. Just prior to securing the pump, the #2 and #3 seals fail, causing high pump vibration. The vibration results

in a failure of the drain line from #2 seal to the CDTT, resulting in an 80 gpm leak to containment (simulated by an 80 gpm head vent leak). The students will commence a normal shutdown while investigating the magnitude of the leak. Once the main turbine is shut down, a loss of all offsite power occurs. The students will establish natural circulation to remove decay heat.

3. Malfunctions

| Time | Malfunction | Severity | Ramp |
|---|---|---|---|
| T-25 | CV13C Reactor Coolant Pump #1 Seal Failure | 100% | 10 Min. |
| T-VAR | CV14C Reactor Coolant Pump #2 Seal Failure | 100% | 10 Min. |
| T-VAR | RC05 Reactor Vessel Head Vent Leak | 4% | N/A |
| T-VAR | ED02B Unit Station Service Transformer Failure | N/A | N/A |
| T-VAR | ED01 Loss of Offsite Power (Coincident With ED02) | N/A | N/A |

L. EXERCISE 12 (CLC(S)-12)

1. Initial Conditions (IC-10)

Tave = 590°F, RCS pressure = 2231 psig, reactor power = 100%, boron concentration = 1035 ppm, xenon reactivity = -2864 pcm (equilibrium), BOL.

2. Exercise Brief

The plant is at 100% power. A loss of 480V bus 32K occurs. After students reenergize bus 32K, a failure of generator hydrogen cooling occurs. Once the hydrogen cooling problem is corrected, the students will commence a load reduction for turbine valve testing. During the load reduction, an oscillation develops in the auto voltage regulator. During the load increase following the valve test, the EHC throttle pressure compensation transmitter fails, resulting in a rapid load shed and reactor trip. No automatic reactor trip will occur.

3. Malfunctions

| Time | Malfunction | Severity | Ramp |
|---|---|---|---|
| T-0 | RP10 Automatic Reactor Trip Failure | N/A | N/A |
| T-20 | ED05J Loss of 480V Bus 32K | N/A | N/A |
| T-50 | TP04 Main Generator Hydrogen Cooling Failure | 75% | 1 Min. |
| T-VAR | EG09 Main Generator Auto Voltage Reg. Failure | 25% | N/A |
| T-VAR | TC10B EHC Input Transmitter Failure | 75% | N/a |

M. EXERCISE 13 (CLC(S)-13)

1. Initial Conditions (IC-14)

Tave = 590°F, RCS pressure = 2234 psig, reactor power = 100%, boron concentration = 777 ppm, xenon reactivity = -2935 pcm (equilibrium), MOL.

2. Exercise Brief

The plant is at 100% power. The students will commence a load reduction to 40% to support maintenance on a main condenser water box. During the load reduction, the "A" RPCCW temperature controller fails closed. At 40% power, the gland seal regulator fails shut requiring students to bypass the regulator. Next, leakage occurs through the low pressure feed heater bypass valve, resulting in a feedwater heater temperature decrease. Finally the generator exciter field breaker trips, resulting in a generator trip and load rejection. Students should stabilize the plant at approximately 10% power.

3. Malfunctions

| Time | Malfunction | Severity | Ramp |
|---|---|---|---|
| T-30 | CC06(A) RPCCW Outlet Temperature Controller Failure | 100% | 1 Min. |
| T-VAR | MS08 Gland Seal Regulator Failure | 0% | N/A |
| T-VAR | FW26 LP Heater Bypass Valve Leakage | 100% | 2 Min. |
| T-180 | EG04 Main Generator Exciter Breaker Failure | N/A | N/A |

N. EXERCISE 14 (CLC(S)-14)

1. Initial Conditions (IC-10)

Tave = 590°F, RCS pressure = 2231 psig, reactor power = 100%, boron concentration = 1035 ppm, xenon reactivity = -2864 pcm (equilibrium), BOL.

2. Exercise Brief

The plant is at 100% power. The plant will suffer a loss of normal letdown due to the outside containment isolation valve failing shut. The students may continue to operate by shifting to excess letdown. Once on excess letdown, a pressurizer spray valve will fail open and during the pressure decrease, 1 set of backup heaters fails to energize. Once plant pressure control is regained, a piping break inside the auxiliary building causes a loss of instrument air. During the subsequent reactor trip, 2 control rods stick out requiring an immediate boration. One of the intermediate range nuclear instruments is undercompensated which prevents reenergizing the source range.

3. Malfunctions

| Time | Malfunction | Severity | Ramp |
|---|---|---|---|
| T-0 | RX07D Pressurize Heater Failure | 100% | N/A |
| T-0 | RD04 Stuck Control Rods | N/A | N/A |
| T-0 | NI06B IR Channel Improper Compensation | 10% | N/A |
| T-20 | NI07D PR Channel Failure | 0% | N/A |
| T-115 | RX06B Pressurizer Spray Valve Auto Control Failure | 100% | N/A |
| T-150 | IA03 Loss of Instrument Air | 100% | 1 Min. |

O. EXERCISE 15 (CLC(S)-15)

1. Initial Conditions (IC-26)

Tave = 565°F, RCS pressure = 2254 psig, reactor power = 18%, boron concentration = 771 ppm, xenon reactivity = -4034 pcm, 3 hours after trip from full power, MOL.

2. Exercise Brief

The plant is at 18% power; BTRS is out of service. The students will commence a load increase to full load. The letdown pressure transmitter fails causing a loss of letdown flow. At approximately 50% power, automatic rod control fails. Next, a service water header is lost due to the lead pump tripping and the follow pump failing to start. Due to a technician's error, a safety injection occurs.

3. Malfunctions

| Time | Malfunction | Severity | Ramp |
|---|---|---|---|
| T-0 | SW02C Service Water Pump Pic Fails to Auto Start | N/A | N/A |
| T-VAR | CV05 Letdown Pressure Transmitter Failure | 0% | 1 Min. |
| T-VAR | RD05 Control Rods Fail to Move in Auto | N/A | N/A |
| T-VAR | SW01A Service Water Pump Trip | N/A | N/A |
| T-210 | RP05 Safety Injection Actuation | N/A | N/A |

P. EXERCISE 16 (CLC(S)-16)

1. Initial Conditions (IC-25)

Tave = 572°F, RCS pressure = 2240 psig, reactor power = 49%, boron concentration = 1185 ppm, xenon reactivity = -2257 pcm (equilibrium), BOL.

2. Exercise Brief

The plant is at 50% power to complete repairs to a condenser water box. A slow inadvertent dilution starts with auto rod failure. Oscillation of the B feedwater regulating valve will require manual control of B steam generator level. A rod drop will occur and the students will have to recover the droped rod. The students will then be able to restore circulating water and return to 100% power. During the power increase, the controlling pressurizer level channel will fail high.

3. Malfunctions

| Time | Malfunction | Severity | Ramp |
|---|---|---|---|
| T-0 | RD05 Auto Rod Failure | N/A | N/A |
| T-VAR | CV07 Uncontrolled Dilution | 2% | N/A |
| T-VAR | FW30B Feed Regulating Valve Oscillation | 100% | N/A |
| T-VAR | RD03 Dropped Rod (L5) | N/A | N/A |
| T-VAR | RX10A Pressurizer Level Failure | 100% | N/A |

Q. EXERCISE 17 (CLC(S)-17)

1. Initial Conditions (IC-20)

Tave = 588°F, RCS pressure = 2229 psig, reactor power = 100%, boron concentration = 147 ppm, xenon reactivity = -2905 pcm (equilibrium), EOL.

2. Exercise Brief

The plant is at 100% power. A reactor vessel head flange leak occurs at approximately 4 gpm. Due to personnel error, a reactor trip occurs. The plant is stabilized and a reactor startup is begun. The main generator is started and power increase is conducted.

3. Malfunctions

| Time | Malfunction | Severity | Ramp |
|---|---|---|---|
| T-20 | RC04A Reactor Vessel Head Flange Leak - Inner Seal | N/A | N/A |
| T-60 | RP02 Reactor Trip Actuation | N/A | N/A |

R. EXERCISE 18 (CLC(S)-18)

1. Initial Conditions (IC-26)

Tave = 565°F, RCS pressure = 2254 psig, reactor power = 18%, boron concentration = 771 ppm, xenon reactivity = -4034 pcm, 3 hours after a trip from full power, xenon increasing, MOL.

2. Exercise Brief

The plant is at 18% power. The students will conduct a power increase to 100% power. When the second steam driven feed pump is to be started, it will fail to start. At 65% power, a running TPCCW pump will trip and the standby pump will fail to start in auto (it will start manually). At approximately 80% power, the waste building radiation monitor will fail high. At 100% power, a steam generator tube rupture occurs in "D" S/G. On the safety injection, the "B" safety injection pump will fail to start.

3. Malfunctions

| Time | Malfunction | Severity | Ramp |
|---|---|---|---|
| T-0 | SI04B SI Pump Trip | N/A | N/A |
| T-0 | FW07C Feedwater Pump Trip | N/A | N/A |
| T-0 | TP02C TCCW Pump Fails to Auto Start | N/A | N/A |
| T-VAR | TP01A TPCCW Pump Auto Trip | N/A | N/A |
| T-VAR | RM02L Waste Bldg Rad Monitor Failure | 100% | N/A |
| T-240 | SG01D Steam Generator Tube Rupture | 60% | N/A |

S. EXERCISE 19 (CLC(S)-19)

1. Initial Conditions (IC-14)

Tave = 590°F, RCS pressure = 2234 psig, reactor power = 100%, boron concentration = 777 ppm, xenon reactivity = -2935 pcm (equilibrium), MOL.

2. Exercise Brief

The plant is at 100% power. The students are directed to conduct a plant shutdown and cooldown for a planned outage. During the shutdown, a failure of the VCT level transmitter occurs. After the level transmitter problem is corrected (approximately 50% power), a letdown break outside containment occurs. The break requires shifting to excess letdown. At 15-20% power, a pressurizer steam space manway leaks begins. This will result in a safety injection actuation on low pressure.

3. Malfunctions

| Time | Malfunction | Severity | Ramp |
|---|---|---|---|
| T-VAR | CV10 VCT Level Transmitter Failure | 100% | 2 Min. |
| T-VAR | CV02 Letdown Line Leak Outside Containment | 50% | 1 Min. |
| T-VAR | RC17 Pressurizer Steam Space Manway Leak | 5% | N/A |

T. EXERCISE 20 (CLC(S)-20)

1. Initial Conditions (IC-17)

Tave = 557°F, RCS pressure = 2225 psig, reactor power = 15[8] amps, boron concentration = 130 ppm, xenon reactivity = -4572 pcm, 13 hours after trip from full power, BOL.

2. Exercise Brief

Reactor critical following post trip startup. Students will conduct a plant startup and load increase to 100% power. During turbine roll high vibration is experienced on #3 turbine bearing. A bank D rod (control bank) will stick during power increase. A main steam line break outside containment and upstream of the main steam isolation valves will occur at 220 minutes into the session. An RHR pump will fail to start on the safety injection actuation.

3. Malfunctions

| Time | Malfunction | Severity | Ramp |
|---|---|---|---|
| T-0 | RH01A RHR Pump "A" Trip | N/A | N/A |
| T-VAR | TU02C Turbine High Vibration | 100% | N/A |
| T-VAR | RO04 Stuck Rod (M4) | N/A | N/A |
| T-220 | MS02B Main Steam Rupture | 65% | N/A |

U. EXERCISE 21 (CLC(S)-21)

1. Initial Conditions (IC-19)

Tave = 563°F, RCS pressure = 2245 psig, reactor power = 19%, boron concentration = 431 ppm, xenon reactivity = -1282 pcm (equilibrium), EOL.

2. Exercise Brief

The plant is at 19% power with one turbine driven feed water pump out of service for repairs. Estimated repair time is 6 hours. Students will conduct a load increase to 100% power using the other turbine driven feed pump and the motor driven feed pump. The motor driven feed pump will not start and students will be restricted to maximum power for 1 feed pump. An intermediate range drawer will fail high; operation may continue but source range instruments will not reenergize on a trip. The running feed pump will trip on overspeed causing a loss of feed reactor trip. AFW discharge manual valves are closed and it will take the PEO 15-25 minutes to locate and correct the loss of auxiliary feedwater flow.

3. Malfunctions

| Time | Malfunction | Severity | Ramp |
|---|---|---|---|
| T-0 | FW07A Motor Driven Feedwater Pump Trip | N/A | N/A |
| T-0 | FW21A/B/C AFW Discharge Valves Closed | 100% | N/A |
| T-90 | NI05B Intermediate Range Channel Fails High | 100% | N/A |
| T-180 | FW27A Turbine Driven Feed Water Pump Overspeed | 100% | N/A |

V. EXERCISE 22 (CLC(S)-22)

1. Initial Conditions (IC-4)

Tave = 555°F, RCS Pressure = 2229 psig, reactor power = 0%, boron concentration = 1510 ppm, xenon reactivity = 0 pcm, BOL.

2. Exercise Brief

The plant is shut down in hot standby. The students will conduct a reactor and plant startup and increase load to 100%. Intermediate range nuclear instrument N35 is under-compensated and will result in a termination of the startup until corrected. During load increase, a loss of coolant occurs due to a reactor vessel head vent leak. This results in a safety injection during which the turbine fails to trip automatically.

3. Malfunctions

| Time | Malfunction | Severity | Ramp |
|---|---|---|---|
| T-0 | NI06 Intermediate Range Channel Improper Comp. | 100% | N/A |
| T-0 | TC03A Turbine Fails to Trip | N/A | N/A |
| T-VAR | RC05 Reactor Vessel Head Vent Leak | 70% | 1 Min. |

W. EXERCISE 23 (CLC(S)-23)

1. Initial Conditions (IC-14)

Tave = 590°F, RCS pressure = 2234 psig, reactor power 100%, boron concentration = 777 ppm, xenon reactivity = -2935 pcm (equilibrium), MOL.

2. Exercise Brief

The plant is at 100% power. A fourth point heater drain pump trips whch will require a load reduction. Next, reactor plant chilled water is lost to the containment. A safety injection accumulator will start to slowly lose level due to a leak. Filling the accumulator will keep up with the leak, but accumulator must be declared out of service and a shutdown commenced. During shutdown, a reactor coolant pump thermal barrier tube fails requiring shutdown of the pump when reactor power permits. Plant will be shut down and a cooldown commenced.

3. Malfunctions

| Time | Malfunction | Severity | Ramp |
|---|---|---|---|
| T-20 | FW16B Fourth Point Heater Drain Pump B Trip | N/A | N/A |
| T-VAR | CH07A RP Chilled Water Valve CTV39A Fails Shut | 100% | N/A |
| T-VAR | CH07C RP Chilled Water Valve CTV39B Fails Shut | 100% | N/A |
| T-VAR | SI02D Safety Injection Accumulator Level Decrease | 10% | N/A |
| T-VAR | CV16 RCP Thermal Barrier Tube Failure | 10% | 1 Min. |