U.S. Nuclear Regulatory Commission
Site-Specific
Written Examination

Applicant Information	
Name:	Region: II
Date:	Facility/Unit: TVA Sequoyah
License Level: RO	Reactor Type: W
Start Time:	Finish Time:

Instructions

Use the answer sheets provided to document your answers. Staple this cover sheet on top of the answer sheets. The passing grade requires a final grade of at least 80.00 percent. Examination papers will be collected four hours after the examination starts.

Applicant Certification

All work done on this examination is my own. I have neither given nor received aid.

_____
Applicant's Signature

Results	
Examination Value	_____ Points
Applicant's Score	_____ Points
Applicant's Grade	_____ Percent

1. Given the following plant conditions:

   - Unit 2 is operating at 95% reactor power.
   - The crew is recovering from a control rod misalignment.
   - Control rod M8 is 15 steps lower than the other rods in control bank D.
   - M8 rod has been misaligned for 20 minutes
   - Reactor engineering has determined that no restrictions exist on realignment of M8 rod.
   - The decision has been made to realign control rod M8 with control bank D.

   Which ONE (1) of the following describes the required crew actions in preparation for realignment?

   Disconnect the lift coil(s) for:

   A. the affected GROUP (except M8) and adjust the affected GROUP step counter to the misaligned rod position.

   B. the affected BANK (except M8) and adjust the affected GROUP step counter to the misaligned rod position.

   C. control rod M8 and adjust the affected GROUP step counter to the misaligned rod position.

   D. control rod M8 and adjust both control BANK D step counters to the misaligned rod position.

2. Given the following plant conditions:

   - Unit 2 is operating at 60% RTP

   Which ONE (1) of the following is required following a loss of CCS flow to the RCPs?

   A. Trip the reactor and all reactor coolant pumps within two minutes.

   B. Reduce CCS loads and increase seal injection flow if power is greater than 10%.

   C. To continue operation, restore CCS flow within five minutes to the affected Unit.

   D. Trip the reactor and the affected reactor coolant pumps when motor bearing temperature exceeds $180^{o}F$.

3. Given the following plant conditions:

   - A reactor trip has occurred on Unit 1 due to a loss of offsite power.
   - The crew is performing the actions of ES-0.2, "Natural Circulation Cooldown".
   - When adjusting steam dumping rate to control natural circulation, the operators also adjust AFW flow to all S/Gs.

   Which ONE (1) of the following explains why narrow range level is maintained in ALL S/Gs?

   A. To maintain symmetric cooling of the RCS for decay heat removal.

   B. To flood all SGs for subsequent entry into Mode 5.

   C. To prevent SG thermal shock by ensuring all SGs are kept wet prior to establishing auxiliary feedwater flow.

   D. Top of SG tubes on all SGs must be covered for natural circulation to occur.

4. Given the following plant conditions:

   - The operating crew is responding to a reactor trip without Safety Injection using appropriate emergency procedures.
   - Reactor coolant pumps are running
   - Core burnup is 15,000 MWD/MTU

   Which ONE (1) of the following describes conditions that require Emergency Boration?

   A. Tavg is 544 degrees and decreasing following closure of the steam dump and atmospheric relief valves.

   B. Tavg is 537 degrees and continuing to decrease with all rods fully inserted.

   C. Control rod C5 RPI is indicating 90 steps withdrawn and control rod M8 RPI is indicating 11 steps withdrawn. All other RPIs indicate zero steps.

   D. Control rod H4 RPI is indicating 224 steps withdrawn. All other RPIs indicate zero steps.

5. Given the following plant conditions:

   - Unit 2 in MODE 3 for maintenance
   - Panel 0-XA-55-27B-D Annunciator A-4, MISC EQUIPM SUPPLY HEADER FLOW LOW, starts alarming
   - Panel 0-XA-55-27B-D Annunciator A-6, LETDOWN HX OUTLET FLOW/TEMP ABNORMAL, starts alarming

   Which ONE (1) of the following events could cause both alarms to actuate?

   A. CCS supply header rupture.

   B. Letdown HX tube rupture.

   C. Loss of seal injection.

   D. Loss of charging flow.

6. With the Pressurizer Pressure Control System selected for PT-68-340, Channel I pressure transmitter fails LOW. The operator swaps the Pressure Control Channel Selector Switch (XS-68-340D) to operable channels per the AOP.

   Which ONE (1) of the following correctly describes which is the controlling channel and which channel is selected as the backup channel?

   A. Channel II (334) is controlling; channel III (323) is backup.

   B. Channel II (334) is controlling; channel IV (322) is backup.

   C. Channel III (323) is controlling; channel II (334) is backup.

   D. Channel III (323) is controlling; channel IV (322) is backup.

7. Given the following plant conditions:

   - Unit 2 was stable at 81% power
   - The following Panel XA-55-5C annunciators have just illuminated:

     - Window A-6 TS-68-2M/N RC LOOPS T AVG/AUCT T AVG DEVN HIGH-LOW
     - Window B-6 TS-68-2/A/B REACTOR COOLANT LOOPS DELTA T DEVN HIGH-LOW
     - Window C-6 TS-68-2P/Q REAC COOL LOOPS T REF T AUCT HIGH-LOW

   Which ONE (1) of the following plant transients could cause these three annunciators to begin alarming at the same time?

   A. Steam line break.

   B. Dropped control rod.

   C. Continuous rod withdrawal.

   D. Turbine runback

8. Given the following plant conditions:
   - A LOCA has occurred on Unit 1 and the operating crew has implemented the EOPs.
   - The crew is currently performing E-1, "Loss of Reactor or Secondary Coolant"
   - The STA reports a RED path for FR-P.1, "Pressurized Thermal Shock".

   Which ONE (1) of the following correctly describes the parameter the STA used to make his determination and the reason it was used?

   A. Tcold temperature since it most closely reflects the temperature in the beltline region of the reactor vessel.

   B. Tcold temperature since it most closely reflects the temperature in the core.

   C. Incore thermocouple temperature since it most closely reflects the temperature in the beltline region of the reactor vessel.

   D. Incore thermocouple temperature since it reflects the temperature in the core.

9. Given the following plant conditions:

   - Condenser pressure is at 2.6 psia and steadily increasing.
   - Turbine load is 75%.

   Which ONE (1) of the following would be the FIRST to occur OR be procedurally required?

   A. Automatic trip of both Main Feedwater pumps.

   B. Loss of Steam dump capability.

   C. "Condenser Vacuum Low" annunicator lit, requiring a manual turbine trip.

   D. Automatic trip of the main turbine.

10. Given the following plant conditions:

- Units 1 and 2 have experienced a Loss of All AC Power
- ECA-0.0, "Loss of All AC Power" has been implemented
- Step 13 directs the crew to place selected equipment in PULL TO LOCK or OFF

Which ONE (1)of the following describes the reason for placing the equipment in PULL-TO-LOCK or OFF position?

A. To prevent potential overload of the Shutdown Boards when they are re-energized.

B. To prevent ECCS pump starting and thermal shock to RCS penetrations.

C. To prevent ESF pump starts without proper cooling water and auxiliary support equipment available.

D. To prevent RWST inventory depletion.

11. Given the following plant conditions:

- Unit 1 has experienced a loss of 120V AC Vital Instrument Power Board 1-I.
- The operators enter AOP-P.03, "Loss of Unit 1 Vital Instrument Power Board".

Which ONE (1) of the following correctly identifies actions to be taken per AOP-P.03.

A. CHECK to see if the Reactor is Tripped. If not THEN continue with AOP-P.03.

B. CHECK to see if the Reactor is Tripped. If not THEN immediately place 1-FCV-3-103, Main FW Reg Valve, in Manual.

C. ENSURE the reactor is tripped and continue with AOP-P.03.

D. ENSURE the reactor is tripped AND GO TO E-0 WHILE continuing in AOP-P.03

12. Given the following plant conditions:

- Unit #1 is operating at 100%.
- All systems aligned normal.
- Loss ERCW Supply header 2A occurs due to a rupture in the yard.

Which ONE (1) of the following describes indications the Unit 1 operator would see in the main control room in this event? (Assume no operator actions).

A. Ice condenser chillers trip.

B. Immediate containment pressure increase.

C. General ventilation chillers trip.

D. CCS surge tank level increasing with auto makeup valve closed.

13. Given the following plant conditions:

- Unit 1 is at 100% power.
- Unit 2 is in a refueling outage.
- The shift is fully staffed.

An outage contract worker reports that a Class B fire has just started in the Auxiliary Building.

Which ONE (1) of the following types of fire should the Fire Brigade expect to fight upon arrival at the scene?

A. A fire which involves flammable liquid, oils, or grease.

B. A fire which involves combustible metals.

C. A fire which involves electrical equipment.

D. A fire which involves wood, paper, or cloth.

14. Which ONE (1) of the following conditions represents a loss of primary containment integrity per Technical Specifications 3.6.1.1, Containment Integrity?

A. With the reactor at 100% power, an electrician opens the outer airlock door.

B. With the RCS average coolant temperature 250°F, an inspection of the equipment hatch determines that the hatch is NOT sealed.

C. During an operability test of two normally open, redundant containment isolation valves at 100% power, one of the valves fails to close.

D. During an Integrated Leakage Rate Test in Mode 5, containment leakage exceeds the maximum allowable Technical Specification leakage rate.

15. Given the following plant conditions:

- The operating crew entered procedure FR-C.1, "Inadequate Core Cooling."
- All attempts to establish high pressure Safety Injection flow were unsuccessful.
- RVLIS lower range level is 28% and dropping slowly,
- Core Exit Thermocouples are reading 820 degrees F and slowly increasing.
- Reactor Coolant pumps have been secured.

Which ONE (1) of the following methods would be the NEXT step in mitigating the core cooling challenge?

A. Enter the Severe Accident Management Guidelines (SAMGs).

B. Open available pressurizer PORVs to allow RCS depressurization to the SI accumulator and SI injection pressures.

C. Depressurize all intact steam generators using Steam dumps or ARVs to 125 psig to allow RCS depressurization to the SI accumulator and SI injection pressures.

D. Restart one RCP in an idle loop to provide forced two-phase flow through the core.

16. Given the following plant conditions:

- Unit 1 has operated at 90% RTP for 45 days.
- Chem lab has been sampling RCS for Iodine every 4 hours for the past 20 hrs.
- Last RCS activity sample (1 hour ago) was 1.5 microcuries/gram Dose Equivalent Iodine.
- AOP-R.06 "High RCS Activity" was entered 20 hrs ago.

Which ONE (1) of the following actions describe the expected recommendation from the chem lab?

A. Place one (1) Mixed Bed demineralizer in service at 120 gpm and the Cation Bed in service with 120 gpm.

B. Place one (1) Mixed Bed demineralizer in service at 120 gpm and the cation bed in service at 75 gpm flow.

C. Place both Mixed Bed demineralizers in service at 120 gpm each and the cation bed at 120 gpm.

D. Place both Mixed Bed demineralizers in service at 120 gpm each and the cation bed at 75 gpm.

17. Given the following plant conditions:

- Unit 1 at 95% power and is responding to continuous rod withdrawal.
- AOP-C.01 was entered and the crew transitioned to AOP-C.02.
- AOP-C.02 directs the control room operator to check for evidence of boration flow.

Which ONE (1) of the following will provide indications of flow through emergency borate valve (FCV-62-138)?

-Flow indicated on emergency borate flow indicator, FI-62-137A AND:

A. -Red light on handswitch for FCV-62-138 on Panel M-6, LIT
-Flow indicated on emergency borate flow indicator, FI-62-137B

B. -Red light on handswitch for FCV-62-138 on Panel M-6, LIT
-NO flow indicated on emergency borate flow indicator, FI-62-137B

C. -Green light on handswitch for FCV-62-138 on Panel M-6, LIT
-Flow indicated on emergency borate flow indicator, FI-62-137B

D. -Green light on handswitch for FCV-62-138 on Panel M-6, LIT
-NO flow indicated on emergency borate flow indicator, FI-62-137B

18. Given the following plant conditons:

- Unit 1 is operating at 68% RTP.
- The control rods are in manual
- The crew is responding to a "Full Length Rods on Bottom" alarm
- Control rod M4 RPI indicates zero
- The reactor did not trip

Which ONE (1) of the following sets of parameters describes the effect of this malfunction?

A. Delta I for N41 will change from +1% to -2%, QPTR will remain the same, and Delta T for all loops will decrease from 68% to 64% and remain at 64%.

B. Delta I for N41 will change from +1% to -2%, QPTR will remain the same, and Delta T for all loops will not change.

C. Delta I for all NIS channels will not change, QPTR will change from 1.001 to 1.015, and Delta T for all loops will decrease from 68% to 64% and remain at 64%.

D. Delta I for all NIS channels will not change, QPTR will change from 1.001 to 1.015, and Delta T for all loops will decrease from 68% to 64% and return to 68%.

19. Given the following plant conditions:

- Unit 1 Reactor tripped from 100% power.
- The crew completed the first 4 steps of E-0 and transitioned to ES-0.1.
- SI occurred and crew transitioned back to E-0.
- US is in E-0 at step 9, "Monitor containment spray not actuated".
- The STA informs the US of a RED PATH on Heat Sink.

Which ONE (1) of the following describes the actions REQUIRED by the US?

A. Transition immediately to FR-H.1, "Response to Loss of Secondary Heat Sink".

B. Continue with E-0 through the event diagnostic steps and enter FR-H.1 when directed to transition to E-1, E-2, or E-3.

C. Direct the OATC to do an independent review all CSF's to determine if any higher priority RED paths exist, then transition to highest priority procedure.

D. Transition to FR-H.1 when directed in E-0 at step 14, "determine if secondary HEAT SINK available".

20. Given the following conditions:

- An automatic reactor trip and safety injection occurred on Unit 2 as a result of decreasing RCS pressure
- Reactor power was stable prior to the reactor trip and dropped following the reactor trip
- Pressurizer pressure dropped prior to and following the SI
- RCS average temperature was stable prior to and following the SI
- Pressurizer level rose prior to and following the SI
- CCP Amp meter indicated decreasing amps and CCP flow meter indicated decreasing flow prior to the SI

Which ONE (1) of the following accidents would result in these conditions?

A. Steamline break

B. Double-ended hot leg break

C. Stuck open pressurizer safety valve

D. 3 inch break on a RCS cold leg

21. A LOCA has occurred and operators have implemented E-0, "Reactor Trip or Safety Injection".

Which ONE (1) of the below statements indicates the basis for tripping ALL RCPs if minimum RCS pressure is lost and SI flow has been established?

A. Prevent damage to RCP impeller due to cavitation and pitting.

B. To further decrease RCS pressure, enhancing ESF systems ability to inject borated liquid into RCS.

C. Prevent damage to the RCP seal packages due to possibility of two-phase flow in RCS.

D. Prevent excessive depletion of RCS inventory through the break leading to severe core uncovery if the RCPs were later tripped.

22. Given the following plant conditions:

- Unit 2 is operating at 100% power when a LOCA outside containment is recognized.
- The operators initiated safety injection.

Which ONE (1) of the following best describes the procedure methodology to mitigate this condition?

A. If the LOCA can not be isolated then transition to E-1.

B. If the LOCA can not be isolated then transition to the Loss of RHR Sump Recirculation procedure.

C. When the RWST level is <27%, the operator should transfer ECCS pumps to the containment sump.

D. When the RWST level is <8%, the operator should transfer ECCS pumps to the containment sump.

23. During the performance of ES-1.2, "Post-LOCA Cooldown and Depressurization," it is desirable to have only one RCP running.

    Which ONE (1) of the following describes the reason for having only one RCP in service?

    A. One RCP provides the DELTA-P required to provide letdown. Additional RCPs would add unnecessary heat load.

    B. One RCP is desired for spray and RCS heat transport to the SGs. Additional RCPs would add unnecessary heat load.

    C. One RCP is needed for RCS heat transport to the SGs. Additional RCPs could overload the electrical power supply.

    D. One RCP is desired for spray and RCS mixing. Additional RCPs would strain the plant electrical power supply in the post-LOCA condition.

24. While performing the actions for a Loss RHR Sump Recirculation, a RED path condition is identified for the Containment Status Tree.

Which ONE (1) of the following reasons describes why the Containment Spray Pumps are operated within the guidelines of ECA-1.1, "Loss of RHR Sump Recirculation" instead of using the guidelines contained in FR-Z.1, "High Containment Pressure."

A. Ensures that the maximum heat removal system capacity that is available is used to reduce the containment pressure.

B. ECA-1.1 pump operating criteria is more restrictive, ensuring continuous containment spray system operation to reduce containment pressure.

C. ECA-1.1 pump operating criteria is less restrictive, permitting reduced containment spray operation to conserve RWST inventory.

D. Provide a more rapid means of verifying automatic actuation of the containment spray system.

25. Given the following plant conditions:

- Unit #1 has experienced a Reactor Trip and SI.
- The crew has transitioned to and performed the proper procedures and are currently performing ES-1.1 "SI Termination."
- The CRO notices that the pressure in #2 Steam Generator is decreasing rapidly out of control and notifies the SRO.

Which ONE (1) of the following describes the direction the SRO should give the crew?

A. Close all MSIVs, SG PORVs and isolate Main Feedwater, Auxiliary Feedwater, and S/G blowdown lines.

B. Transition to E-2, "Faulted Steam Generator Isolation" from the Fold Out Page.

C. Transition to E-1, "Loss of Reactor or Secondary Coolant" from the Fold Out Page.

D. Verify all Steam Dumps and Steam Generator PORVs are closed, then close all MSIVs.

26. Unit 1 control room operators are investigating a possible malfunction of the Reactor Coolant Makeup system based on abnormal indications following an RCS makeup evolution. The RO suspects the controller setting for 1-FC-62-139, Boric Acid Blender Flow Control, may have been set wrong.

Desired boron concentration is 500 ppm
BAT boron concentration at 6820 ppm
Primary water flowrate of 70 gpm
Primary Water boron concentration of 10 ppm
(BAT conc - Desired conc)xRequired B.A. flow = (Desired conc - PW conc)xPW flow

Which ONE (1) of the following would be the most correct setting for 1-FC-62-139?

A. 2.7

B. 5.4

C. 8.7

D. 11.0

27. Which ONE (1) of the following is an indication of vortexing at the suction of the RHR pump during reduced inventory conditions?

A. Erratic pump amps

B. RHR suction relief lifting

C. RHR flow decrease and stable at the lower value

D. Constant pump discharge pressure

28. Which ONE (1) of the following describes the effects on Source Range Monitor (SRM) output as detector voltage BEGINS to drift from the optimum of 870v?

    The SRM detectors operate in the:

    A. proportional region and detector output counts increase as detector voltage drifts high.

    B. proportional region and the output counts decrease as detector voltage drifts low.

    C. ionization region and the output increases as detector voltage drifts high.

    D. ionization region and the output remains constant as detector voltage drifts high.

29. Given the following plant conditions:

- The operating crew has identified a S/G tube leak.
- AOP-R.01 has been implemented.
- Letdown flow = 75 gpm.
- 1 CCP is in service with charging valves FCV 62-93 and 89 full open.
- Charging flow = 160 gpm.
- Pressurizer level is stable at 58%.
- All other parameters are normal

Which ONE (1) of the following best estimates the total primary to secondary leak rate?

A. 55 gpm.

B. 75 gpm.

C. 85 gpm.

D. 150 gpm.

30. During operation at power steam generator tube leakage is detected and estimated at 250 gpm by the reactor operator. The following plant indications existed at that time:

    - RCS pressure – 2200 psig and decreasing
    - SG Pressures – 1000 psig

    The unit is tripped and plant parameters following the trip are:

    - RCS pressure – 1700 psig and decreasing
    - SG Pressures – 1100 psig

    Using the provided equation sheet, determine which ONE (1) of the below describes the leakage following the trip.

    A. one half of the initial leak rate or about 125 gpm.

    B. essentially equal to the initial leak rate or about 250 gpm.

    C. approximately 70% of the initial leak rate or about 175 gpm.

    D. One third of the initial leak rate or about 83 gpm.

31. Procedure FR-H.1, "Loss of Secondary Heat Sink", directs operators to stop all RCPs if actions to restore AFW flow are not successful.

Which ONE (1) of the following is the reason the RCPs are stopped in this situation?

A. Minimize the possibility of a tube rupture when AFW is eventually restored to the steam generators.

B. Conserve reactor coolant inventory by reducing seal leakoff.

C. Obtain increased safety injection flow by decreasing RCS cold leg pressure.

D. Conserve steam generator inventory by reducing RCS heat input.

32. Given the following plant conditions:

- Both units are at 100% power
- All systems are aligned normal

- Window A-5 is "125V DC VITAL BAT BD I ABNORMAL"
- Window A-4 is "125 V DC VITAL CHGR I FAILURE OR VITAL BAT I DISCHARGE"
- Window E-2 is "125V DC VITAL SPARE CHGR 1 FAILURE"

Which ONE (1) of the following sets of conditions would be indicative of a loss of a 125V DC Vital battery charger with the 125V DC battery supplying the board?

A. Annuciator window 1-XA-55-1C A-5 lit and 125V DC Volt meter selected to Batt I and indicating downscale to 75 Volts.

B. Annuciator window 1-XA-55-1C A-4 lit and EI-57-92 (Batt BD I AMPS) is indicating upscale from zero.

C. Annuciator window 1-XA-55-1C A-4 is lit and EI-57-92 (Batt BD I AMPS) is indicating downscale from zero.

D. Annuciator window 1-XA-55-1C E-2 is lit with 125V DC Voltmeter selected to Batt Bd I and indicating 129 Volts.

33. Given the following plant conditions:

- Unit 1 is responding to a LOCA
- ES-1.3 was completed and containment recirculation cooling is in progress
- The STA has identified an orange path on containment radiation

Which ONE (1) of the following best describes a high level action in FR-Z.3, High Containment Radiation?

A. VERIFY Containment Ventilation Isolation.

B. VERIFY ABGTS operation.

C. VERIFY Phase A isolation.

D. NOTIFY chem lab to sample the containment sump.

34. Given the following plant conditions:

- The Reactor is at 100% power.
- Pressurizer Level Transmitter 1-LI-68-339 is selected for control.
- All other systems are lined up for normal operation and in automatic.
- The REFERENCE LEG for 1-LI-68-339 is develops a leak.

Which ONE (1) of the following describes the short term (25 to 30 min.) response to this condition?

	1-LI-68-339 level Indication Will	1-LI-68-335 & 320 level Indication Will	VCT level Indication Will
A.	Increase	Decrease	Increase
B.	Decrease	Increase	Increase
C.	Increase	Decrease	Decrease
D.	Decrease	Increase	Decrease

35. Which ONE (1) of the following describes the function of the SFP bridge crane hoist "lower" limit gear operated switch?

A. Stops downward travel before the crane hook enters the water.

B. Stops downward travel before the fuel assembly reaches the bottom of the fuel cell.

C. Automatically changes hoist speed from fast to slow while the fuel assembly is in the fuel cell boundary.

D. Prevents bridge travel when the fuel assembly is within the fuel cell boundary.

36. Given the following plant conditions:

- The plant is at 100% power.
- The ERCW System is in a normal alignment.
- J-A ERCW pump is in service, in Auto, and selected for preferred start (Selector Switch 0-XS-67-225).
- Offsite power is lost to 6.9KV Start Bus 1B.
- 1A-A D/G responds to the event as designed
- Offsite power is now available to Start Bus 1B
- BO relays reset

Which ONE (1) of the following describes the operation of the J-A ERCW pump after the loss of power?

The pump breaker:

A. will trip and immediately reclose, the pump will start when D/G energizes the SD board. The pump can be normally shutdown at any time.

B. stays connected to the bus, the pump will start when the D/G energizes the board. The pump can be normally shutdown ONLY after the SD board is paralleled to offsite power.

C. will trip, the pump will start 15 seconds after the D/G energizes the SD board. The pump can be normally shutdown.

D. will trip, the pump will start 15 seconds after the D/G energizes the SD board. The pump can be shutdown ONLY after Q-A ERCW pump is selected for preferred start (Selector Switch 0-XS-67-225).

37. Given the following plant conditions:

- Unit 1 was operating at 80% power when a reactor trip occurred.
- Reactor trip breaker "A" will not open.
- PT-1-72, Turbine impulse pressure, has failed at 80% (as is)
- The Steam Dump Mode Select Switch is in the Tavg position

Which ONE (1) of the following describes the response of the Steam Dumps and Atmospheric Relief valves to these conditions?

	Atmospheric Relief valves	Steam Dump valves
A.	Opened	Opened
B.	NOT Opened	Opened
C.	Opened	Not Opened
D.	Not Opened	Not Opened

38. Given the following plant conditions:

- Unit 2 was operating at 100% power
- All controls are in automatic
- An emergency shutdown is in progress at 5%/min using AOP-C.03, due to high turbine vibration

Which ONE (1) of the following would indicate failure of the control rods to insert?

A. "REACTOR COOLANT LOOPS T-REF/T-AUCT HIGH-LOW" alarm, 1-XA-55-5A window C-6.

B. "REACTOR COOLANT LOOPS DELTA-T DEVN HIGH-LOW" alarm, 1-XA-55-5A window B-6.

C. "REACTOR COOLANT LOOP T-AVG/AUCT TAVG DEVIATION HIGH-LOW" alarm,1-XA-55-5A window A-6.

D. "ROD CONTROL SYSTEM NON-URGENT FAILURE" alarm 1-XA-55-4B window B-6.

39. Given the following plant conditions:

- Unit 1 is at 30% power
- 1B Start Bus trips out on differential relay actuation

Which ONE (1) of the following describes effect on the plant?

A. 1B-B diesel generator starts and connects to the 1B-B 6.9 kV shutdown board.

B. Control rods insert at 72 steps/minute.

C. CVCS letdown isolates.

D. Reactor trips.

40. Given the following plant conditions:

- Unit 1 is operating steady-state at 90%
- Containment Cooling system is in normal alignment for this power level
- A leak occurs on ERCW Supply Header 1A in the Auxiliary Building

Which ONE (1) of the following describes the response of the containment cooling system IF the 1A header to the Auxiliary Building is isolated to stop the leak?

A. The standby Lower Compartment Cooling Unit will automatically start on high containment temperature.

B. Motor winding temperatures on Reactor Coolant Pumps 1 & 3 will increase above the maximum limit and a unit shutdown will be required.

C. Containment temperature and pressure will rapidly increase resulting in a safety injection and Phase A containment isolation

D. CRDM suction dampers will automatically realign from the reactor vessel shroud area to lower containment on high containment temperature.

41. Given the following plant conditions:

- Unit 1 is increasing power from 50% to 100% power
- Boron concentration has been reduced from 1070 ppm to 1020 ppm
- Full load boron concentration has been calculated to be 1005 ppm

Which ONE (1) of the following describes the boron concentration differential limit between the RCS and the Pressurizer, and operator actions required to stay below this limit when changing the RCS boron concentration?

The differential limit is less than or equal to:

A. 10 ppm. It is maintained by turning on a PZR backup heater and allowing the PZR sprays to maintain RCS pressure.

B. 50 ppm. It is maintained by turning on a PZR backup heater and allowing the PZR sprays to maintain RCS pressure.

C. 10 ppm. It is maintained by "cracking open" a PZR spray valve and allowing the PZR backup heaters to cycle to maintain RCS pressure.

D. 50 ppm. It is maintained by "cracking open" a PZR spray valve and allowing the PZR backup heaters to cycle to maintain RCS pressure.

42. Given the following plant conditions:

- Unit 1 is performing a startup from Hot Standby to 100% power.
- Reactor power is 25% with RCS boron concentration of 520 ppm.

Which ONE (1) of the following describes the number of gallons of primary water needed to dilute the RCS by 75 ppm?

A. 9968 gallons $\pm$10

B. 9938 gallons $\pm$10

C. 9569 gallons $\pm$10

D. 9272 gallons $\pm$10

43. Which ONE (1) of the following supplies voltage for OPERATION of the SLAVE RELAYS in the SSPS output cabinets?

A. 15V DC from redundant power supplies in the SSPS cabinets.

B. 48V DC from a power distrubution bus in the SSPS cabinets.

C. 120V AC from redundant inverters in the SSPS cabinets.

D. 120V AC Vital Instrument Power from a distribution bus in the SSPS cabinets.

44. Given the following plant conditions:

- Unit 1 is conducting refueling operations with core ~~alterations~~ alterations in progress
- Source Range Monitors N-31 and N-32 are reading 10 cps.
- BOTH Intermediate Range Monitors are off scale LOW.
- Power Range Monitor N-41 is OOS with all appropriate BISTABLES TRIPPED.
- Power Range Monitor N-42 = 0%.
- Power Range Monitor N-43 = 0%.
- Power Range Monitor N-44 = 0%.

Which ONE (1) of the following describes the required actions if Power Range Monitor N-44 fails high?

A. Notify IMs to investigate the power range instrument failure and continue with core alterations.

B. Immediately stop all core alterations or positive reactivity changes and determine the boron concentration of the RCS at least once per 12 hours.

C. Ensure NR-45 recorder is selected to the intermediate range channels and continue with core alterations.

D. Immediately stop all core alterations and emergency borate per EA-68-4, "Emergency Boration".

45. Which ONE (1) of the following describes the annunciation "Reactor Coolant Saturation Margin Trouble"?

The annunciator will:

A. alarm if Reactor Coolant System pressure decreases by 40 psig while Reactor power is > 10% of rated thermal power.

B. alarm if RCS pressure decreases to 2205 psig and Reactor power is < 10% of rated thermal power.

C. alarm if RCS saturation margin is < 50 degrees and Reactor power is < 10% of rated thermal power.

D. alarm if RCS saturation margin is < 40 degrees and Reactor power is < 10% of rated thermal power.

46. Given the following plant conditions:

- Unit 1 is stable at 100% power
- Lower compartment temperature is 105 degrees F and upper compartment temperature is 95 degrees F
- 3 Lower Compartment Coolers are in service
- 3 Upper Compartment Coolers are in service
- The ICS computer has just failed

Which ONE (1) of the following describes the effect on Containment Temperature?

A. Upper compartment temperature will rapidly increase because its TCVs will fail closed when the ICS signal is lost.

B. Lower compartment temperature will rapidly decrease because its TCVs will fail open when the ICS signal is lost.

C. Upper and Lower compartment temperatures will remain approximately the same because the TCV controllers are normally operated in local manual.

D. Lower compartment temperature will remain approximately the same if the TCV controllers are NOT reset locally.

47. During outages the CRDM motor power supply may be temporarily realigned to supply receptacle power in the lower containment.

Which ONE (1) of the following describe how this condition is controlled?

With the motor breaker racked out:

A. the motor leads are lifted and re-landed on the receptacle power pack. A TACF is placed on the breaker to identify this temporary condition.

B. the motor leads are lifted and re-landed on the receptacle power pack. A Caution Order is placed on the breaker to identify this temporary condition.

C. a transfer switch is aligned to supply power to the receptacle power pack. A TACF is placed on the breaker to identify this temporary condition.

D. a transfer switch is aligned to supply power to the receptacle power pack. A Caution Order is placed on the breaker to identify this temporary condition.

48. Given the following plant conditions:

- Unit 2 is in Mode 5 for repair of an RCP motor
- Containment purge is in service to the Upper and Lower compartments
- Containment equipment hatch is closed
- Upper and Lower containment personnel airlocks are closed

Which ONE (1) of the following describes the affect on the plant if the Lower Containment Personnel Airlock was breached to carry equipment into containment?

A. Auxiliary Building pressure will increase above the Tech Spec limit due to air flow out of containment.

B. Auxiliary Building Gas Treatment System will automatically start to limit Auxiliary Building pressure increase due to air flow out of containment.

C. The Ice Condenser lower inlet doors may come open due to a pressure imbalance.

D. The Ice Condenser upper deck doors may come open due to a pressure imbalance.

49. Given the following plant conditions:

- Unit 1 was operating at 100% power.
- An inadvertent reactor trip and safety injection occurred.
- The ice condenser system glycol, that was trapped between the inside and outside containment penetration's return isolation valves, expanded due to heating.

Which ONE (1) of the following statements describes the system response to the glycol expansion?

A. The penetration's inside glycol isolation valve disks are designed to relieve trapped glycol into the containment side glycol header

B. A small bypass line with a check valve is installed around the penetration's outside isolation valve to relieve trapped glycol into the auxiliary building side glycol supply header.

C. A small bypass line with a check valve is installed around the penetration's inside isolation valve to relieve trapped glycol into the containment side glycol header.

D. A relief valve is installed around the penetration's outside isolation valve to relieve trapped glycol into the auxiliary building side glycol return header.

50. Given the following plant conditions:

- Unit 1 at 45% with startup in progress
- Two Hotwell pumps running
- Two Condensate Booster pumps (CBP) running
- 1A MFPT in service
- 1B MFPT out of service with condenser isolation valves closed
- While preparing for startup of 1B MFPT, the operator inadvertently closes the 1A MFPT condenser outlet isolation valve
- Both Hotwell pumps trip due to loss of flow path

Which ONE (1) of the following describes how this action effects the Condensate Booster pumps and Main Feedwater pumps?

A. 1A MFPT trips due to loss of Net Positive Suction Head AND both CBPs trip due to loss of injection water.

B. 1A MFPT trips due to loss of Net Positive Suction Head AND both CBPs trip due to loss of Net Positive Suction Head.

C. 1A MFPT trips due to a loss of injection water AND both CBPs trip due to loss of injection water.

D. 1A MFPT trips due to a loss of injection water AND both CBPs trip due to loss of Net Positive Suction Head.

51. Given the following plant conditions:
    - Unit 2 is starting up from cold shutdown conditions
    - Condensate and feedwater systems are shutdown

Which ONE (1) of the following describes the Caution in 2-SO-2/3-1 and basis for throttling the pump discharge valve prior to starting the first Hotwell pump?

The discharge valve is turned 25 turns from the fully:

A. open position to prevent damage to piping and hangers.

B. open position to prevent pump runout.

C. closed position to prevent damage to piping and hangers.

D. closed position to prevent pump runout.

52. Given the following plant conditions and information:

- Unit is at 100% rated thermal power
- Feedwater Master Controller and Feedwater Pump Speed Controllers are in AUTOMATIC.
- Main Feedwater Regulating Valves are in AUTOMATIC.
- All four main feedwater flows start increasing with level in all four steam generators trending upwards.

For information:
- PT-1-33 is a Main steam header pressure transmitter
- PT-3-1 is a Main feedwater header pressure transmitter

Which ONE (1) of the following describes the two instrument failures that could have caused this transient?

A. PT-1-33 has failed LOW or PT-3-1 has failed LOW.

B. PT-1-33 has failed HIGH or PT-3-1 has failed LOW.

C. PT-1-33 has failed HIGH or PT-3-1 has failed HIGH.

D. PT-1-33 has failed LOW or PT-3-1 has failed HIGH.

53. Given the following plant conditions:

- Unit 1 is operating at 100%
- All control systems are normal in automatic.

Which ONE (1) of the following describes the plant response to a trip of Main Feed Pump turbine 1A?

A. The plant runs back to 80% load, the running Main Feedwater Pump accelerates to the high speed stop, Hotwell Pump 1A trips due to closing of Main Feedwater Pump 1A condenser isolation valves and Steam Generator levels control at 33%.

B. The plant runs back to 75% load, the running Main Feedwater Pump accelerates to the high speed stop, Hotwell Pump 1A trips due to closing of Main Feedwater Pump 1A condenser isolation valves, and Steam Generator levels control at 44%.

C. The plant runs back to 75% load, the running Main Feedwater Pump accelerates to the high speed stop, the Main Feed Pump 1A condenser isolation valves close, and Steam Generator levels control at 44%.

D. The plant runs back to 80% load, the running Main Feedwater Pump accelerates to the high speed stop, the Main Feed Pump 1A condenser isolation valves close, and Steam Generator levels control at 33%.

54. Which ONE (1) of the following describes the operation of the Unit 2 TDAFW LCVs following automatic actuation of the AFW system?

A. These valves go to the full open position and remain there until the S/G level reaches 33% Narrow Range, then the valves throttle to maintain 33% until operator action is taken.

B. These valves are controlled by a level controller that automatically positions the valves to maintain S/G level at 33% Narrow Range.

C. These normally open valves remain fully open until operator action is taken.

D. These normally closed valves go to the full open position and remain there until operator action is taken.

55. Given the following plant conditions:

- Unit 1 is operating at 100% RTP
- During a modification the 125 V DC breaker supplying power to the TDAFW pump Trip and Throttle valve was broken causing the breaker to open.
- The breaker cannot be reclosed and maintenance estimates it will take 2 hours to replace the broken breaker.

Which ONE (1) of the following describes the effects on the TDAFW while repairs are in progress?

The pump will not auto start for an accident condition AND:

A. Control power will be automatically restored by auto transfer to the alternate supply.

B. Control power can be manually restored by manual transfer to the alternate supply by transfer switch located on 125 V DC Battery board # 1.

C. Control power can be manually restored by manual transfer to the alternate supply by transfer switch located on a panel just outside the TDAFW pump room.

D. Control power can be manually restored by manual transfer to the alternate supply by the Nor/Alt selector switch located in the Auxiliary Control Room (ACR).

56. Given the following plant conditions:

- Waste condensate tank A release is in progress.
- Waste condensate tank A activity is within technical specification limits.
- Trip setpoint for radiation monitor RM-90-122 was adjusted based on tank samples.
- During the release RM-90-122 setpoint is exceeded, however the alarm (0-RA-90-122A WDS LIQ EFF MON HIGH RAD) did not work and Radiation Control Valve RCV-77-43 failed to close.

Which ONE (1) of the following describes the effect of RCV-77-43 failing to automatically terminate this release?

A. The release WILL be terminated by the radwaste operator who continously monitors RM-90-122 during liquid radwaste releases.

B. The release WILL be terminated by the control room operator who continously monitors RM-90-122 during liquid radwaste releases.

C. 10CFR20 limits WILL NOT be exceeded for the nearest potable water or surface water supply in an unrestricted area.

D. 10CFR20 limits WILL be exceeded for the nearest potable water or surface water supply in an unrestricted area.

57. Given the following plant conditions:

- A gas decay tank release is in progress.
- 0-XA-55-12B, "0-RA-90-118A WDS GAS EFF MON INSTR MALFUNC" alarm just came in on 0-XA-55-12B.

Which ONE (1) of the following describes the effects of loss of power to 0-RM-90-118?

A. 0-RCV-90-119 will close, the ABGTS fan will stop, and 0-FIC-90-119 must be set to zero, at local panel 0-L-2, prior to reopening 0-RCV-90-119.

B. 0-RCV-90-119 must be manually closed, at local panel 0-L-2, to terminate the release, the ABGTS fan will stop, and 0-FIC-90-119 must be set to zero prior to reopening 0-RCV-90-119.

C. 0-RCV-90-119 will close, the ABGTS fan will remain running, and 0-FIC-90-119 must be set to zero, at local panel 0-L-2, prior to reopening 0-RCV-90-119.

D. 0-RCV-90-119 must be manually closed, at local panel 0-L-2, to terminate the release, the ABGTS fan will remain running, and 0-FIC-90-119 automatically resets to zero so 0-RCV-90-119 can be reopened.

58. Given the following plant conditions and information:

- Unit 1 is at 210°F and is being cooled down for a refueling outage
- RCDT pump A is being used to lower level in the RCDT
- Alarm "1-RA-277A RCDT Hi Rad" just came in on panel 1-XA-55-30

For information:
- 1-RM-90-277 is "RCDT Post Accident Area Radiation Monitor"
- 1-FCV-77-9 is " Train B, RCDT pumps discharge isolation valve"
- 1-FCV-77-10 is "Train A, RCDT pumps discharge isolation valve"

Which ONE (1) of the following describes the effect of this alarm?

A. Both RCDT pumps discharge isolation valves will close to terminate flow out of the containment.

B. Both RCDT pumps discharge isolation valves will close to terminate flow to the Reactor Building Floor and Equipment drain sump.

C. Only one of the RCDT pumps discharge isolation valves will close to terminate flow out of the containment.

D. Only one of the RCDT pumps discharge isolation valves will close to terminate flow to the Reactor Building Floor and Equipment drain sump.

59. Given the following plant conditions:

- Unit 1 is operating at 100% RTP
- While transporting a container of radioactive liquid, a spill occurrs in the Auxiliary Building near the Unit 1 CCS heat exchanger
- The spill was reported to the operating crew by Radcon
- Area Radiation Monitor 1-RM-90-6 is trending up but has not yet alarmed

Which ONE (1) of the following describes the best method for the operating crew to determine the alarm setpoint for 1-RM-90-6 ?

A. Use 0-SO-90-5, Area Radiation Monitors

B. Use Tech Spec section 3/4.3.3.3.1 Radiation Monitoring Instrumentation

C. Use Annunciator Response Manual 0-AR-M12-A

D. Call instrument maintenance personnel and have them look in the setpoint and scaling document.

60. Which ONE (1) of the following combinations represents the RCS leak detection systems that are required to be OPERABLE during Mode 3 operations?

1. Upper containment atmosphere gaseous radioactivity monitor
2. Vessel flange leakoff temperature monitor
3. Containment purge air radioactivity monitor
4. Containment pocket sump level monitor
5. Lower containment atmosphere gaseous radioactivity monitor
6. Lower containment atmosphere particulate radioactivity monitor

A. 1, 2 & 5

B. 1, 3 & 4

C. 2, 3 & 6

D. 4, 5 & 6

61. Given the following plant conditions:

- Unit 2 was operating at 100% power
- A large break LOCA occurred
- Automatic reactor trip and Safety Injection occurred

Which ONE (1) of the following conditions would indicate an ECCS system misalignment during the injection phase?

A. The Charging Pump Injection Tank discharge valves FCV-63-25 and FCV-63-26 are OPEN.

B. Charging line isolation valves FCV-62-90 and FCV-62-91 are CLOSED.

C. The Volume Control Tank outlet valves are CLOSED.

D. Charging pump mini-flow valves are CLOSED.

62. Given the following plant conditions:

- All controls are in automatic
- PT-68-322, PZR pressure transmitter, had previously failed and all actions of AOP-I.04 are complete
- Pressure control is selected for PT-68-340 & 334
- PT-68-340 fails high
- The PZR Pressure Control System operates as designed after this failure

Which ONE (1) of the following describes the response of the PZR PORVs for this event? (Assume NO operator action.)

A. PCV-68-340 opens, then closes at 2315 psig actual PZR pressure, decreasing.

B. PCV-68-340 opens, then does not close at 2315 psig actual PZR pressure, decreasing.

C. PCV-68-340 and PCV-68-334 open, then close at 2315 psig actual PZR pressure, decreasing.

D. PCV-68-340 and PCV-68-334 open, then do not close at 2315 psig actual PZR pressure, decreasing.

63. Given the following plant conditions:

- All pressurizer control systems are in NORMAL configuration.
- A failure in the pressurizer Level Control system results in the following conditions:

  - FCV-62-93 "charging flow control valve"- full open.
  - "PRZR LVL LOW HEATERS OFF & LETDOWN SECURED - alarm actuated.
  - PZR heaters - deenergized.
  - All orifice valves - closed.
  - Letdown isolation valve FCV-62-69 - open.
  - Letdown isolation valve FCV-62-70 - closed.

Which ONE (1) of the following failures would cause the above conditions?

A. Channel I Level Transmitter has failed low.

B. Channel II Level Transmitter has failed low.

C. A Channel I bistable failed to actuate.

D. A Channel II bistable failed to actuate.

64. Which ONE (1) of the following describes separtion of control/indication components from RPS/ESFAS components for pressurizer pressure transmitter instrument loop PT-68-340?

A. Starting at the transmitter, the RPS/ESFAS bistables are located first in the loop. Control/indication components are located downstream of isolation amplifiers to provide separation.

B. Starting at the transmitter, pressurizer control/indication components are located first in the loop. RPS/ESFAS bistables are located downstream of isolation amplifiers to provide separation.

C. Separation between control/indication and protective components is provided by having all components in this loop qualified to the RPS/ESFAS standards.

D. Separation between control/indication and protective components is provided by having a completely independent instrument loop for each that begins at the pressure transmitter.

65. Which ONE (1) of the following describes how positive reactivity addition is minimized during a continuous rod withdrawal event?

A. Increasing the Rod Insertion Limit (RIL) as power increases.

B. Adjusting the positive rate reactor trip set point well below Tech Spec allowable values.

C. Maintaining the controlling bank slightly above the RIL to provide immediate negative reactivity.

D. Keeping rods well out of the core and above the rod insertion limit.

66. Given the following plant conditions:

- The plant is operating at 10% power during a startup
- S/G level control is in automatic on bypass regulating valves
- A significant leak develops in the reference leg for LT-3-174, S/G level input to FCV-3-35A for #1 S/G
- The condensing pot is unable to keep up with the leak.

Which ONE (1) of the following describes the response of the plant (assuming no operator action)?

A. The turbine will trip on S/G Hi-Hi level.

B. The reactor will trip on S/G Lo-Lo level.

C. The #1 S/G level will increase but MFP speed will decrease to prevent going above the S/G Hi-Hi trip setpoint.

D. The #1 S/G level will decrease but MFP speed will increase to prevent going below the S/G Lo-Lo trip setpoint.

67. Given the following plant conditions:

- LOCA inside containment has occurred
- Containment pressure is 4.8 psid
- Containment sump level is 52%
- ECCS is operating in the Recirculation Mode
- Both containment spray pumps are in service

Which ONE (1) of the following describes the design features that prevent debris from plugging containment spray nozzles?

A. Water entering the sump must flow over an elevated curb and containment spray pump discharge strainers located in the 690' pipe chase.

B. Containment spray pump discharge strainers located in the 690' pipe chase and screens covering the two 14 " drain holes in the refueling cavity (upper to lower containment drains).

C. Screens covering the two 14 " drain holes in the refueling cavity (upper to lower containment drains) and a sloping grated screen over the sump opening.

D. Water entering the sump must flow over an elevated curb and a sloping grated screen over the sump opening.

68. Given the following plant conditions:

- Unit 1 is in Mode 4.
- A containment purge is in progress in preparation for refueling.
- During a maintenance activity, RM-90-130 was placed and held in the source check postion WITHOUT placing HS-90-136A1 in the RM-90-130 position.

Which ONE (1) of the following describes the response of the containment purge system to these conditions?

A. Only Train A containment purge isolation valves isolate.

B. Only Train B containment purge isolation valves isolate.

C. Neither Train A or B containment purge isolation valves isolate.

D. Both Train A and B containment purge isolation valves isolate.

69. Given the following plant conditions:

- Refueling outage is in progress for Unit 2
- Unit 2 core offload is complete
- New fuel has been place in the Spent Fuel Pit (SFP) in preparation for core reload.

Which ONE (1) of the following would occur if the SFP was slowly diluted from a boron concentration of 2000 ppm boron to zero ppm boron?

A. Reduce SDM until criticality occurs in SFP.

B. Reduce SDM but criticality would not occur in SFP.

C. Increase Keff of SFP causing increased decay heat generation.

D. Increase Keff of SFP causing a neutron radiation hazard on the operating floor.

70. Given the following plant conditions:

- Unit 1 is operating at 50% power
- The # 1 SG controlling pressure transmitter fails HIGH

Which ONE (1) of the following describe the INITIAL feedwater flow response AND the correct operator action?

A. The feedwater flow would decrease due to the failure of the steam pressure input to the steam flow signal AND the operator should place the # 1 SG LCV in Man and restore feedflow to match steam flow.

B. The feedwater flow would increase due to the failure of the steam pressure input to the steam flow signal AND the operator should place the # 1 SG LCV in Man and restore feedflow to match steam flow.

C. The feedwater flow would decrease due to the failure of the steam pressure input to the steam flow signal AND the operator should leave the # 1 SG LCV in Auto because SG level is the dominant control signal and will restore feedflow to match steam flow.

D. The feedwater flow would increase due to the failure of the steam pressure input to the steam flow signal AND the operator should leave the # 1 SG LCV in Auto because SG level is the dominant control signal and will restore feedflow to match steam flow.

71. Given the following plant conditions:

- Unit 1 is operating at 100% power.
- The turbine building AUO is working with maintenance in the 2C MSR doghouse.
- The 2C MSR doghouse is designated as an area sensitive to portable radio operation.

Which ONE (1) of the following describes a correct method of communication between the Main Control Room operator and the Turbine building AUO in the MSR doghouse?

A. A radio with a white antenna may be used for two way communication ONLY if it is >1 meter from sensitive equipment.

B. A radio with a black antenna may be used for two way communication ONLY if it is >1 meter from sensitive equipment.

C. A radio with a black antenna may be used for receiving ONLY.

D. A radio with a white antenna may be used for transmission ONLY.

72. Given the following plant conditions:

- Unit 2 is at 60% power
- Condenser vacuum pumps A and B are in service
- Condenser vacuum pump C is in standby
- Condenser inleakage is 17 SCFM
- Condenser backpressure is 0.9 psia
- Condenser vacuum pump B just tripped

Which ONE (1) on the following describes the effect of this pump trip on the condenser and unit operation? (ASSUME no operator actions).

A. Tripping B condenser vacuum pump will not have any effect on condenser operation, because this air inleakage is within the capacity of one condenser vacuum pump.

B. Condenser backpressure would increase and condenser vacuum pump C would automatically start.

C. Condenser backpressure would increase and XA-55-4A window E-6 "C-9 CONDENSER INTERLOCK" light will go out.

D. Condenser backpressure would increase, megawatt load will decrease and the turbine would trip on low vacuum.

73. Which ONE (1) of the following statements correctly describe the requirement(s) for safety grounds when used on plant equipment, in conjunction with a clearance?

A. Prior to being issued a clearance, the person responsible for the work MUST ensure all safety grounds have been placed and numbered ground discs attached as required.

B. After a clearance released, the person responsible for the work MUST ensure all safety grounds have been removed and numbered ground discs returned to their storage cabinet.

C. Operations personnel picking up a clearance on the 6.9 KV Unit Board are REQUIRED to open the compartment doors and verify removal of three phase ground wires.

D. Following the issue of a clearance requiring three-phase grounds, a ground disc on the ground side of each phase is required except where a single device provides a 3-phase ground.

74. Which ONE (1) of the following describes the relationship between the Vital Battery # 1 and Vital Battery charger # 1?

Information:
EI-57-92 is the main control room amp meter for 125V DC Vital Battery # 1.

A. Negative 20 amps indicated on EI-57-92 indicates amp flow into the battery from the charger.

B. Negative 20 amps indicated on EI-57-92 indicates amp flow out of the battery to the 125V DC Vital Battery Board # 1.

C. Positive 20 amps indicated on EI-57-92 indicates amp flow into the battery from the charger.

D. Direction of amp flow cannot be determined using EI-57-92 because amp flow is independent of direction.

75. Given the following plant conditions:

- Unit 1 was operating at 100% power.
- A Loss of Offsite Power occurred.
- All four diesel generators started and connected to their shutdown boards.
- 1A-A diesel generator automatic voltage regulator FAILS to respond as loads are sequenced on to the 1A-A shutdown board.

Which ONE (1) of the following describes the effects of this failure on ESF equipment powered from the 1A-A shutdown board?

A. Voltage adjustments WILL be made by the operator after selecting manual voltage control; no significant effect on ESF equipment.

B. The degraded voltage relays WILL NOT load shed ESF equipment because they are removed from service following an emergency start.

C. When voltage drops to degraded voltage relays setpoint, ESF equipment WILL load shed.

D. Shutdown board voltage WILL NOT drop to degraded voltage setpoint as long as DG load is maintained <4000 KW.

76. Given the following information:
    - Work is to be performed in a high radiation area.
    - Dose rate in the work area as 1.2 R/hr.
    - Worker's maximum dose is 200 mRem.

Which ONE (1) of the following describes the maximum work time for the workers without exceeding the their maximum dose?

A. 100 minutes

B. 10 minutes

C. 6 minutes

D. 1.67 minutes

77. Given the following plant conditions:

- Both units were operating at 100% power.
- A failure of Chickamaugea Dam locks causes river level at the plant to decrease to the 667' elevation.

Which ONE (1) of the following components will be lost and require procedural guidance to restore the feature?

Loss of cooling water :

A. to the auxiliary control air compressors.

B. to the ice condenser chiller packages.

C. control building electrical board room air conditioner units.

D. 480V Shutdown Board room 1A-A and 2A-A air conditioner units.

78. Given the following plant conditions:

- Air receiver #1 pressure is 96 psi and steady
- Air receiver #2 pressure is 99 psi and steady
- Service air receiver pressure is 78 psi and decreasing

Which ONE (1) of the following describes the cause of decreasing service air receiver pressure?

A. Loss of compressors A & B sequencer power.

B. Stuck open blowdown valve on air dryer A tower # 1.

C. Pressure control valve 0-PCV-33-4 failed open.

D. Loss of power to pressure control valve 0-PCV-33-4.

79. Given the following plant conditions:

- High pressure fire protection water spray was used to extinguish a fire in the turbine building.
- During fire fighting activities, a large volume of water was sprayed directly on a 480V limitorque motor operated valve (MOV).

Which ONE (1) of the following is correct regarding water damage to this MOV from this water spray?

A. No damage. Limitorque motors and valve position limit switches are in sealed water tight housings to prevent water from contacting electrical components.

B. No damage. Water may enter the housing that surround the motor and limit switches, however, electrical components are designed to operate submerged in water.

C. Potential damage. Valve position limit switches are in sealed water tight housings to prevent water from contacting electrical components, however, limit torque motors are not sealed and spray water contacting the motor windings could cause a short and damage the motor.

D. Potential damage. Limitorque motors are sealed to prevent water from contacting the motor, however, valve position limit switches are located outside the sealed housing and shorted out limit switches could cause inadvertent component operation.

80. Which ONE (1) of the following describes the method used to cool the Pressurizer Relief Tank (PRT)?

A. Spray from Primary Water into the top of the PRT and drain to the Reactor Coolant Drain Tank (RCDT) pump suction line.

B. Spray from Primary Water into the bottom of the PRT and drain directly to the Reactor Coolant Drain Tank (RCDT).

C. Spray from CVCS charging line into the top of the PRT and drain to the Reactor Coolant Drain Tank (RCDT) pump suction line.

D. Spray from CVCS charging line into the bottom of the PRT and drain directly to the Reactor Coolant Drain Tank (RCDT).

81. Given the following plant conditions:

- Unit 1 is operating at 100% power.
- CCS surge tank level was increasing but is now stable.
- "1-RA-90-123A CCS LIQ EFF MON HIGH RAD" Alarm is LIT.
- Surge tank vent valve is closed.

Which ONE (1) of the following describes the control board indications that are consistent with the above conditions?

The thermal barrier containment isolation inlet and outlet valves:

A. to the affected RCP close (the non-affected RCPs isolation valves remain open), and the thermal barrier booster pumps trip.

B. to the affected RCP close (the non-affected RCPs isolation valves remain open), the inlet and outlet CCS valves to the RCP oil coolers close, and the thermal barrier booster pumps continue to run with miniflow valves open.

C. to all 4 RCPs close, the inlet and outlet CCS valves to the RCP oil coolers remain open, and the thermal barrier booster pumps trip.

D. to all 4 RCPs close, the inlet and outlet CCS valves to the RCP oil coolers are not affected, and the thermal barrier booster pumps continue to run with miniflow valves open.

82. Given the following plant conditions:

- Unit 1 is in a refueling outage
- Core unloading is in progress

Which ONE (1) of the following describes the movement of a fuel assembly from the reactor core to the Rx side upender?

A. The manipulator crane bridge travels South (right) until out of the core region. Then the trolley travels East(forward) to the cavity wall. Then the bridge travels South (right) to the upender.

B. The manipulator crane trolley travels South (right) until out of the core region. Then the bridge travels East (forward) to the cavity wall. Then the trolley travels South(right) to the upender.

C. The manipulator crane trolley moves East (forward) to cavity wall. Then the bridge travels South (right) to the upender.

D. The manipulator crane bridge travels South (right) until it aligns with the upender. Then the trolley travels East (forward) to the upender.

83. Given the following plant conditions:

- Unit 1 is in Hot Standby following controlled shutdown.
- Tavg is 547°F.
- RCS pressure is 2235 psig.
- Cooldown has been just been initiated using steam dumps in pressure mode.
- One steam dump valve fails full open.
  Loop #2 S/G MSIV fails to close.
- No other operator action is taken.

Which ONE (1) of the following describes the plant response as a result of these conditions?

A. An SI and Steamline isolation will be generated from a low steamline pressure signal (rate sensitive).

B. An SI and Steamline isolation will be generated from a high negative steamline pressure rate signal.

C. ONLY a Steamline isolation will be generated from a high negative steamline pressure rate signal.

D. A Steamline isolation signal will be generated on high steam flow coincident with low steamline pressure.

84. Given the following plant conditions and information:

- Unit 1 is at 16% power and a startup to 100% power is in progress.
- "GEN STATOR COOL SYS FAILURE" alarm just came in on panel 1-XA-M1-A.

For information:

- Turbine generator trips from the stator cooling system have a 15% built in load reference.

Which ONE (1) of the following describes the source of the load reference signal?

A. Generator full load amps.

B. Main turbine impulse pressure.

C. Auctioneered high NIS power range signal.

D. "B" LP Turbine steam inlet pressure.

85. Given the following plant conditions and information:

- Unit 1 was operating at 100% power
- A Safety Injection just occurred on Unit 1

For information:
- 0-FCV-67-152 is the CCS HX 0B1 and 0B2 outlet valve
- 1-FCV-67-146 is the CCS HX 1A1 and 1A2 outlet valve

Which ONE (1) of the following describes the operation of the ERCW outlet valves from the CCS heat exchangers as a result of the SI signal?

A. 0-FCV-67-152 automatically goes to the full open position.
1-FCV-67-146 automatically goes to the full open position.

B. 0-FCV-67-152 automatically goes to the 35% position.
1-FCV-67-146 automatically goes to the 35% position.

C. 0-FCV-67-152 automatically goes to the 35% position.
1-FCV-67-146 remains in it's current position.

D. 0-FCV-67-152 remains in it's current position.
1-FCV-67-146 automatically goes to the 35% position.

86. Given the following plant conditions:

- Both units were operating at 100% power.
- A loss of offsite power occurred.
- Both units automatically shutdown.
- All four DG started and energized their respective shutdown boards.

Which ONE (1) of the following describes the required actions to restore the air system service prior to restoration of offsite power?

A. No action is necessary, air compressors A, B, C, and D will be sequenced back on by the Blackout Sequencer.

B. Air compressors A, B, C, and D can be reset and started locally at any time.

C. Air compressors A and B can be reset and started locally at any time.

D. Air compressors A and B can be reset and started locally after the Blackout Relays are reset.

87. Which ONE (1) of the following describes the system isolation / component actuations that will occur upon MANUAL actuation of 2-HS-30-68A and 2-HS-30-68B, Phase B Actuation handswitches?

A. Main Steam Isolation Valves will close.

B. Emergency Gas Treatment Fans will start.

C. CVCS Excess Letdown out of containment will close.

D. Containment Spray Pump 2A-A Room Cooler will start.

88. Engineering has developed a graph of VCT Level versus VCT pressure that will be used as an Operator Aid.

Which ONE (1) of the following positions represents the MINIMUM level of approval for posting this as an operator aid?

A. Any individual holding a Senior Reactor Operator license.

B. Shift Manager

C. Operations Manager

D. Plant Manager

89. Given the following plant conditions:

- Unit 1 Reactor Power is 13%
- The main turbine is latched and ready for rolling
- HP turbine inlet metal temperature is 160°F
- LP turbine inlet metal temperature is 100°F

Which ONE (1) of the following describes the turbine-generator acceleration and loading restrictions?

A.
- 47 minutes to roll from 0 rpm up to 1800 rpm (± 2 min)
- 83 minutes hold at 5% load (± 2 min)
- 176 minutes to increase load from 5% to 100% (± 2 min)

B.
- 47 minutes to roll from 0 rpm up to 1800 rpm (± 2 min)
- 36 minutes hold at 5% load (± 2 min)
- 93 minutes to increase load from 5% to 100% (± 2 min)

C.
- 23 minutes to roll from 0 rpm up to 1800 rpm (± 2 min)
- 53 minutes hold at 5% load (± 2 min)
- 145 minutes to increase load from 5% to 100% (± 2 min)

D.
- 23 minutes to roll from 0 rpm up to 1800 rpm (± 2 min)
- 30 minutes hold at 5% load (± 2 min)
- 92 minutes to increase load from 5% to 100% (± 2 min)

90. Unit 1 is presently in a power ascension per 0-GO-5, "Normal Power Operation." The unit is at 40% load and condenser backpressure is at 4 psia. The Unit Supervisor has stated that "If condenser backpressure cannot be restored to < 2.7 psia within 5 minutes, then trip the reactor."

Which ONE (1) of the following correctly describes the basis for this statement?

A. To prevent high vibratory stresses and fatigue damage to the last stage turbine blading.

B. To ensure adequate heat sink.

C. To prevent the affects of #3 governor valve vibration.

D. To prevent exceeding turbine differential expansion limits

91. Which ONE (1) of the following describes the Main Generator output voltage for Units 1 and 2?

	Unit 1	Unit 2
A.	500KV	500KV
B.	161KV	500KV
C.	161KV	161KV
D.	500KV	161KV

92. Which ONE (1) of the following would require a TACF per SPP-9.5 "Temporary Alterations?"

A. An annunciator is temporarily disabled.

B. A temporary pressure indicator is installed on the discharge of the 1A CCP.

C. A temporary repair is made by furmanite on a steam valve near the MFPT.

D. A temporary scaffold is erected blocking a fire door in the auxiliary building.

93. Which ONE (1) of the following explains when a clearance may be released, by the SM, with persons still holding that clearance per SPP-10.2? "Clearance Program?"

A. Plant emergency conditions exist when immediate action is needed to protect the health and safety of the public and plant personnel.

B. The Radiological Emergency Plan is implemented and the Site Emergency Director authorizes the release.

C. A National Emergency exists as defined in 10 CFR 50.54.

D. The clearance is on a 161KV or 500KV breaker and the CLD can't be contacted.

94. Which ONE (1) of the following must authorize emergency dose limits in accordance with EPIP-15?

A. Radcon Superintendent

B. Shift Manager

C. Plant Manager

D. Site Emergency Director

95. Which ONE (1) of the following statements is correct concerning the SQN ALARA program?

A. The SQN Plant Manager must approve all lower containment entries inside the polar crane wall when the unit is in Mode 1.

B. The SQN Site Vice President must approve all lower containment entries inside the polar crane wall when the unit is in Mode 1 or 2.

C. The SQN Plant Manager must approve all lower containment entries inside the polar crane wall when the unit is in Mode 1 or 2.

D. The SQN Site Vice President must approve all lower containment entries inside the polar crane wall when the unit is in Mode 1.

96. 0-SO-30-3 contains the following precaution: "IF operating the containment purge system in Mode 5 or 6 WHILE the other unit is in MODES 1 through 4 THEN, an operator shall be available to stop the containment purge system in the event of an ABI."

Which ONE (1) of the following describes the basis for this precaution?

A. During containment purge system operation with the unit in MODE 5 or 6 its isolation function on a high rad condition is blocked and an operator is required to isolate the system.

B. The volume of air, that could pass from the unit being purged to the ABSCE via the containment purge fans and the open blast doors, would exceed the capacity and design basis of the EGTS.

C. The volume of air, that could pass from the unit being purged to the ABSCE via the containment purge fans and the open blast doors, would exceed the capacity and design basis of the ABGTS.

D. During MODE 5 and 6 operations the purge system dampers are blocked to prevent unnecessary automatic closure on spurious signals, the operator is required to shutdown the fans in the event of a valid isolation signal.

97. Which ONE (1) of the following symptoms would REQUIRE the initiation of a manual reactor trip AND safety injection if neither had occurred automatically?

A. Containment pressure = 1.0 psig and stable.

B. Steam generator pressure = 690 psig and stable, all SG levels = 25%.

C. Pressurizer pressure = 1850 psig and stable, pressurizer level = 40%.

D. High steam flow (> programmed setpoint) and LoLo Tavg on 2/4 RCS loops.

98. Given the following plant conditions:

- Unit 1 was operating at 100% RTP
- Manual reactor trip and SI due to a small-break LOCA
- During performance of E-0, "Reactor trip or Safety Injection", a Phase B Isolation occurred at 2.81 psid containment pressure
- RCPs are stopped
- Adverse Containment values are used during the performance of E-1 and ES-1.2, "Post LOCA Cooldown".
- Containment pressure is 1.9 psid and decreasing.
- Containment spray system is placed in standby

Which ONE (1) of the following is the appropriate method to return to normal containment instrument values in the EOPs?

A. Whenever containment pressure decreases below 2.81 psid.

B. Whenever containment pressure decreases below 2.0 psid.

C. Use adverse containment values unless a TSC evaluation supports otherwise.

D. Use adverse containment values until transition to a normal plant operating procedure.

99. Given the following plant conditions:

- Unit 2 is operating at 100% RTP.
- Channel A annunciators are inoperable due to scheduled maintenance in the 3KVA annunciator inverter cabinet.
- All other plant parameters are normal.
- Window 32 "ANN DIAGNOSTIC ERROR" on 2-XA-55-6D is half lit.
- All channel A annunciator windows are dark.
- Two hours after shift change the OATC notices all lit channel B annunciator windows change to the dark condition.

Which ONE (1) response below describes the proper operating crew action which should be performed for the given conditions.

A. Perform AOP-P.O8, "Loss Of Control Room Annunciators."

B. Perform 2-AR-M6-D, "Annunciator Response", corrective actions, THEN GO TO AOP-P.08, "Loss Of Control Room Annunciators."

C. Perform 0-PI-OPS-301-001.0, "Plant Computer Point Disablement", section 6.1.2 step [6] to reset channel B annunciator system.

D. Perform 0-SO-55-1, "Annunciator System", section 8.2 for determination of channel failure.

100. Given the following plant conditions:

- Unit 2 is operating at 100% RTP
- Condenser Vacuum Pump air exhaust monitor high Radiation alarm come in
- PZR level chart recorder indicates a slight decrease in level trend, followed by a return to normal
- RCS leak calculation shows RCS leakage has increased by 9 gpm
- The affected SG has been identified

Which ONE (1) of the following describes the NEXT operation required by the crew?

A. Commence plant shutdown and be in HOT STANDBY within 10 hours.

B. Shut the MSIV on the affected S/G and commence plant shutdown.

C. Isolate blowdown from the affected S/G to prevent contamination and continue power operation.

D. Increase S/G blowdown from the affected S/G to remove any radioactivity accumulation and continue power operations.

THERMODYNAMICS, HEAT TRANSFER, FLUID FLOW

Basic Formulae and Conversions

April 16, 1992

(Continued, page 5)

FLUID FLOW:

$$\frac{\dot{V}_2}{\dot{V}_1} = \frac{N_2}{N_1}$$

$$\frac{H_2}{H_1} = \left(\frac{N_2}{N_1}\right)^2$$

$$\frac{P_2}{P_1} = \left(\frac{N_2}{N_1}\right)^3$$

N = Speed of the pump

$\dot{V}$ = Flowrate

H = Head

P = Power Required

$$h = f\frac{L}{D}\frac{\bar{v}^2}{2g} = K\frac{\bar{v}^2}{2g}$$

Net Positive Suction Head:

$NPSH = P_{suc} - P_{sat}$

$= (P_{cover\ gas} + P_{static} - h_L) - P_{sat}$ where P_{suc} = parameters in ( )

CONVERSION FACTORS:

TEMPERATURE:

$°F = \frac{9}{5}\,°C + 32$ $\qquad$ $°R = °F + 460$

$°C = \frac{5}{9}(°F - 32)$ $\qquad$ $°K = °C + 273$

EQUATIONS

$\dot{Q} = \dot{m} c_p \Delta T$

$\dot{Q} = \dot{m} \Delta h$

$\dot{Q} = UA\Delta T$

$\dot{Q} \propto \dot{m}^3_{Nat\ Circ}$

$\Delta T \propto \dot{m}^2_{Nat\ Circ}$

$K_{eff} = 1 / (1 - \rho)$

$\rho = (K_{eff} - 1) / K_{eff}$

$SUR = 26.06 / \tau$

$$\tau = \frac{\bar{\beta} - \rho}{\bar{\lambda}_{eff} * \rho}$$

$$\rho = \frac{\ell^*}{\tau} + \frac{\bar{\beta}}{1 + \lambda_{eff}\tau}$$

$\ell^* = 1 \times 10^{-4}$ seconds

$\lambda_{eff} = 0.1$ seconds^{-1}

$\beta_{eff} = \beta_i I$

$P = P_0\, 10^{SUR(t)}$

$P = P_0\, e^{(t/\tau)}$

$A = A_0\, e^{-\lambda t}$

$CR_{S/D} = S / (1 - K_{eff})$

$CR_1 (1 - K_{eff1}) = CR_2 (1 - K_{eff2})$

$1/M = CR_1 / CR_X$

$DRW \propto \phi^2_{tip} / \phi^2_{avg}$

$F = PA$

$\dot{m} = \rho A \bar{v}$

$\dot{W}_{pump} = \dot{m} \Delta P v$

$E = IR$

Eff. = Net Work Out / Energy In

$$v(P_2 - P_1) + \frac{\bar{v}_2^2 - \bar{v}_1^2}{2g_c} + \frac{g(z_2 - z_1)}{g_c} = 0$$

CONVERSIONS

1 MW	=	3.41×10^6 Btu/hr	1 Curie	=	3.7×10^{10} dps
1 hp	=	2.54×10^3 Btu/hr	1 kg	=	2.21 lbm
1 Btu	=	778 ft-lbf	1 gal $_{water}$	=	8.35 lbm
°C	=	(5/9) (°F - 32)	1 ft^3 $_{water}$	=	7.48 gal.
°F	=	(9/5) (°C) + 32	ρH_2O = 62.4 lbm / ft^3 = 1 gm / cm^3 @ STP		
°R	=	°F + 460	1 EFPH = 1.6 MWD / MTU		
°K	=	°C + 273	g_c = 32.2 lbm-ft / lbf-sec^2		

TABLE 5
Page 5 of 8

PRIMARY SYSTEM TEMP (DEG F) = 400.0 PRESSURE (PSIG) = 2235.0 PRESSURIZER LEVEL (%) = 24.7
MAKEUP WATER TEMP (DEG F) = 70.0 PRESSURE (PSIG) = .1 BORON CONCENTRATION (PPM) = .0
BORIC ACID TEMP (DEG F) = 70.0 PRESSURE (PSIG) = .1 BORON CONCENTRATION (PPM) = 6820.0

GALLONS OF ACID FOR BORATION OR WATER FOR DILUTION

BORON	1 PPM		2 PPM		5 PPM		10 PPM		20 PPM		50 PPM		100 PPM	
PPM	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE
425	11.3	171.3	22.5	343.1	56.3	860.7	112.6	1731.8	225.3	3505.8	564.7	9103.3	1133.8	19511.1
430	11.3	169.3	22.5	339.1	56.3	850.7	112.7	1711.4	225.5	3464.0	565.1	8990.6	1134.7	19251.4
435	11.3	167.4	22.5	335.2	56.4	840.8	112.8	1691.5	225.7	3423.3	565.6	8880.7	1135.6	18998.5
440	11.3	165.5	22.6	331.3	56.4	831.2	112.8	1672.1	225.9	3383.5	566.0	8773.4	1136.5	18752.2
445	11.3	163.6	22.6	327.6	56.4	821.8	112.9	1653.1	226.0	3344.5	566.5	8668.7	1137.4	18512.2
450	11.3	161.8	22.6	324.0	56.5	812.6	113.0	1634.5	226.2	3306.5	566.9	8566.5	1138.3	18278.4
455	11.3	160.0	22.6	320.4	56.5	803.7	113.1	1616.3	226.4	3269.4	567.4	8466.7	1139.2	18050.4
460	11.3	158.3	22.6	316.9	56.6	794.9	113.2	1598.5	226.6	3233.0	567.8	8369.1	1140.1	17828.0
465	11.3	156.6	22.6	313.5	56.6	786.3	113.3	1581.2	226.8	3197.5	568.2	8273.8	1141.0	17611.1
470	11.3	154.9	22.7	310.2	56.7	777.9	113.4	1564.2	226.9	3162.7	568.7	8180.6	1141.9	17399.4
475	11.3	153.3	22.7	306.9	56.7	769.6	113.5	1547.5	227.1	3128.7	569.1	8089.6	1142.8	17192.8
480	11.3	151.7	22.7	303.7	56.8	761.6	113.6	1531.2	227.3	3095.4	569.6	8000.5	1143.7	16991.1
485	11.4	150.1	22.7	300.5	56.8	753.7	113.6	1515.3	227.5	3062.8	570.0	7913.4	1144.7	16794.0
490	11.4	148.6	22.7	297.5	56.8	746.0	113.7	1499.7	227.7	3030.9	570.5	7828.1	1145.6	16601.5
495	11.4	147.1	22.8	294.5	56.9	738.4	113.8	1484.4	227.8	2999.6	571.0	7744.7	1146.5	16413.4
500	11.4	145.6	22.8	291.5	56.9	731.0	113.9	1469.4	228.0	2969.0	571.4	7663.0	1147.4	16229.5
510	11.4	142.7	22.8	285.8	57.0	716.6	114.1	1440.3	228.4	2909.6	572.3	7504.7	1149.2	15873.8
520	11.4	140.0	22.8	280.3	57.1	702.7	114.3	1412.3	228.7	2852.6	573.2	7352.8	1151.1	15533.5
530	11.4	137.4	22.9	275.0	57.2	689.4	114.5	1385.4	229.1	2797.7	574.1	7207.0	1152.9	15207.5
540	11.5	134.8	22.9	269.9	57.3	676.6	114.6	1359.5	229.5	2744.9	575.1	7066.8	1154.8	14894.9
550	11.5	132.4	23.0	265.0	57.4	664.2	114.8	1334.6	229.8	2694.1	576.0	6932.0	1156.6	14595.0
560	11.5	130.0	23.0	260.2	57.5	652.3	115.0	1310.5	230.2	2645.1	576.9	6802.3	1158.5	14307.0
570	11.5	127.7	23.0	255.6	57.6	640.8	115.2	1287.3	230.6	2597.8	577.8	6677.3	1160.3	14030.1
580	11.5	125.5	23.1	251.2	57.7	629.7	115.4	1264.9	230.9	2552.2	578.8	6556.8	1162.2	13763.8
590	11.5	123.4	23.1	247.0	57.8	619.0	115.6	1243.3	231.3	2508.2	579.7	6440.6	1164.1	13507.4
600	11.6	121.3	23.1	242.8	57.9	608.6	115.8	1222.4	231.7	2465.7	580.6	6328.4	1166.0	13260.4
610	11.6	119.3	23.2	238.9	57.9	598.6	115.9	1202.2	232.1	2424.6	581.6	6220.1	1167.9	13022.4
620	11.6	117.4	23.2	235.0	58.0	588.9	116.1	1182.6	232.4	2384.8	582.5	6115.5	1169.8	12792.7
630	11.6	115.5	23.2	231.3	58.1	579.5	116.3	1163.7	232.8	2346.4	583.5	6014.3	1171.7	12571.0
640	11.6	113.7	23.3	227.6	58.2	570.4	116.5	1145.4	233.2	2309.1	584.4	5916.4	1173.6	12356.9
650	11.7	112.0	23.3	224.1	58.3	561.6	116.7	1127.6	233.6	2273.0	585.4	5821.6	1175.5	12150.0
660	11.7	110.3	23.4	220.7	58.4	553.1	116.9	1110.4	234.0	2238.1	586.3	5729.8	1177.4	11949.9
670	11.7	108.6	23.4	217.4	58.5	544.8	117.1	1093.7	234.3	2204.1	587.3	5640.9	1179.4	11756.4
680	11.7	107.0	23.4	214.2	58.6	536.8	117.3	1077.5	234.7	2171.2	588.2	5554.7	1181.3	11568.9
690	11.7	105.5	23.5	211.1	58.7	529.0	117.5	1061.8	235.1	2139.3	589.2	5471.1	1183.2	11387.4

TABLE 6
Page 5 of 8

PRIMARY SYSTEM TEMP (DEG F) = 500.0 PRESSURE (PSIG) = 2235.0 PRESSURIZER LEVEL (%) = 24.7
MAKEUP WATER TEMP (DEG F) = 70.0 PRESSURE (PSIG) = .1 BORON CONCENTRATION (PPM) = .0
BORIC ACID TEMP (DEG F) = 70.0 PRESSURE (PSIG) = .1 BORON CONCENTRATION (PPM) = 6820.0

GALLONS OF ACID FOR BORATION OR WATER FOR DILUTION

BORON	1 PPM		2 PPM		5 PPM		10 PPM		20 PPM		50 PPM		100 PPM	
PPM	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE
425	10.4	158.0	20.7	316.3	51.9	793.6	103.8	1596.7	207.8	3232.4	520.6	8393.4	1045.4	17989.7
430	10.4	156.1	20.8	312.6	51.9	784.3	103.9	1577.9	207.9	3193.9	521.1	8289.5	1046.2	17750.2
435	10.4	154.3	20.8	309.0	52.0	775.3	104.0	1559.6	208.1	3156.3	521.5	8188.2	1047.1	17517.0
440	10.4	152.6	20.8	305.5	52.0	766.4	104.0	1541.7	208.3	3119.6	521.9	8089.3	1047.9	17289.9
445	10.4	150.9	20.8	302.1	52.0	757.7	104.1	1524.1	208.4	3083.7	522.3	7992.7	1048.7	17068.7
450	10.4	149.2	20.8	298.7	52.1	749.3	104.2	1507.0	208.6	3048.7	522.7	7898.5	1049.5	16853.0
455	10.4	147.5	20.8	295.4	52.1	741.0	104.3	1490.3	208.7	3014.4	523.1	7806.4	1050.4	16642.8
460	10.4	145.9	20.9	292.2	52.2	732.9	104.4	1473.9	208.9	2980.9	523.5	7716.5	1051.2	16437.8
465	10.4	144.4	20.9	289.1	52.2	725.0	104.5	1457.9	209.1	2948.1	523.9	7628.6	1052.0	16237.8
470	10.4	142.8	20.9	286.0	52.2	717.2	104.5	1442.2	209.2	2916.1	524.4	7542.7	1052.9	16042.6
475	10.5	141.3	20.9	283.0	52.3	709.6	104.6	1426.9	209.4	2884.7	524.8	7458.7	1053.7	15852.1
480	10.5	139.9	20.9	280.0	52.3	702.2	104.7	1411.8	209.6	2854.0	525.2	7376.6	1054.6	15666.1
485	10.5	138.4	20.9	277.1	52.4	694.9	104.8	1397.1	209.7	2824.0	525.6	7296.3	1055.4	15484.6
490	10.5	137.0	21.0	274.3	52.4	687.8	104.9	1382.7	209.9	2794.6	526.0	7217.7	1056.2	15306.9
495	10.5	135.6	21.0	271.5	52.5	680.8	105.0	1368.6	210.1	2765.7	526.4	7140.7	1057.1	15133.5
500	10.5	134.3	21.0	268.8	52.5	674.0	105.0	1354.8	210.2	2737.5	526.8	7065.4	1057.9	14963.9
510	10.5	131.6	21.0	263.5	52.6	660.7	105.2	1328.0	210.6	2682.7	527.7	6919.5	1059.6	14636.0
520	10.5	129.1	21.1	258.4	52.7	647.9	105.4	1302.2	210.9	2630.1	528.5	6779.5	1061.3	14322.2
530	10.5	126.6	21.1	253.3	52.7	635.6	105.5	1277.4	211.2	2579.5	529.4	6645.0	1063.0	14021.6
540	10.6	124.3	21.1	248.8	52.8	623.8	105.7	1253.5	211.6	2530.9	530.2	6515.8	1064.7	13733.4
550	10.6	122.0	21.2	244.3	52.9	612.4	105.9	1230.5	211.9	2484.0	531.1	6391.5	1066.4	13456.9
560	10.6	119.9	21.2	239.9	53.0	601.4	106.0	1208.3	212.3	2438.8	531.9	6271.8	1068.1	13191.3
570	10.6	117.8	21.2	235.7	53.1	590.8	106.2	1186.9	212.6	2395.2	532.8	6156.6	1069.9	12936.0
580	10.6	115.7	21.3	231.6	53.2	580.6	106.4	1166.3	212.9	2353.2	533.6	6045.5	1071.6	12690.5
590	10.6	113.8	21.3	227.7	53.3	570.7	106.6	1146.3	213.3	2312.6	534.5	5938.4	1073.3	12454.1
600	10.7	111.9	21.3	223.9	53.3	561.2	106.7	1127.1	213.6	2273.4	535.4	5834.9	1075.1	12226.4
610	10.7	110.0	21.4	220.2	53.4	551.9	106.9	1108.4	214.0	2235.5	536.2	5735.1	1076.8	12006.9
620	10.7	108.2	21.4	216.7	53.5	543.0	107.1	1090.4	214.3	2198.9	537.1	5638.6	1078.6	11795.2
630	10.7	106.5	21.4	213.2	53.6	534.3	107.2	1073.0	214.7	2163.4	538.0	5545.3	1080.3	11590.8
640	10.7	104.9	21.5	209.9	53.7	526.0	107.4	1056.1	215.0	2129.1	538.8	5455.0	1082.1	11393.4
650	10.8	103.2	21.5	206.7	53.8	517.8	107.6	1039.7	215.4	2095.8	539.7	5367.6	1083.8	11202.6
660	10.8	101.7	21.5	203.5	53.9	510.0	107.8	1023.8	215.7	2063.5	540.6	5283.0	1085.6	11018.1
670	10.8	100.2	21.6	200.5	53.9	502.3	107.9	1008.4	216.1	2032.3	541.5	5201.0	1087.4	10839.6
680	10.8	98.7	21.6	197.5	54.0	494.9	108.1	993.5	216.4	2001.9	542.4	5121.5	1089.2	10666.8
690	10.8	97.3	21.6	194.7	54.1	487.7	108.3	979.0	216.8	1972.5	543.2	5044.5	1091.0	10499.5

TABLE 7
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PRIMARY SYSTEM TEMP (DEG F) = 547.0 PRESSURE (PSIG) = 2235.0 PRESSURIZER LEVEL (%) = 24.7
MAKEUP WATER TEMP (DEG F) = 70.0 PRESSURE (PSIG) = .1 BORON CONCENTRATION (PPM) = .0
BORIC ACID TEMP (DEG F) = 70.0 PRESSURE (PSIG) = .1 BORON CONCENTRATION (PPM) = 6820.0

GALLONS OF ACID FOR BORATION OR WATER FOR DILUTION

BORON	1 PPM		2 PPM		5 PPM		10 PPM		20 PPM		50 PPM		100 PPM	
PPM	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE
425	9.8	149.8	19.7	300.0	49.2	752.6	98.4	1514.2	197.0	3065.3	493.7	7959.4	991.4	17059.5
430	9.8	148.1	19.7	296.5	49.2	743.8	98.5	1496.4	197.2	3028.8	494.1	7860.9	992.1	16832.3
435	9.9	146.4	19.7	293.1	49.3	735.2	98.6	1479.0	197.3	2993.1	494.5	7764.8	992.9	16611.2
440	9.9	144.7	19.7	289.7	49.3	726.8	98.7	1462.0	197.5	2958.3	494.9	7671.0	993.7	16395.9
445	9.9	143.1	19.7	286.5	49.4	718.6	98.7	1445.3	197.6	2924.3	495.3	7579.4	994.5	16186.1
450	9.9	141.5	19.8	283.3	49.4	710.5	98.8	1429.1	197.8	2891.0	495.7	7490.1	995.3	15981.6
455	9.9	139.9	19.8	280.1	49.4	702.7	98.9	1413.2	198.0	2858.6	496.1	7402.8	996.1	15782.3
460	9.9	138.4	19.8	277.1	49.5	695.0	99.0	1397.7	198.1	2826.8	496.5	7317.5	996.9	15587.8
465	9.9	136.9	19.8	274.1	49.5	687.5	99.1	1382.5	198.3	2795.7	496.8	7234.2	997.6	15398.2
470	9.9	135.4	19.8	271.2	49.5	680.1	99.1	1367.6	198.4	2765.3	497.2	7152.7	998.4	15213.1
475	9.9	134.0	19.8	268.3	49.6	672.9	99.2	1353.1	198.6	2735.6	497.6	7073.1	999.2	15032.4
480	9.9	132.6	19.8	265.5	49.6	665.9	99.3	1338.8	198.7	2706.5	498.0	6995.2	1000.0	14856.0
485	9.9	131.3	19.9	262.8	49.7	659.0	99.4	1324.9	198.9	2678.0	498.4	6919.0	1000.8	14683.8
490	9.9	129.9	19.9	260.1	49.7	652.2	99.4	1311.2	199.1	2650.1	498.8	6844.5	1001.6	14515.4
495	9.9	128.6	19.9	257.5	49.7	645.6	99.5	1297.8	199.2	2622.7	499.2	6771.5	1002.4	14350.9
500	10.0	127.3	19.9	254.9	49.8	639.1	99.6	1284.7	199.4	2596.0	499.6	6700.1	1003.2	14190.2
510	10.0	124.8	19.9	249.9	49.9	626.5	99.8	1259.3	199.7	2544.0	500.4	6561.7	1004.8	13879.2
520	10.0	122.4	20.0	245.1	49.9	614.4	99.9	1234.8	200.0	2494.1	501.2	6428.9	1006.4	13581.6
530	10.0	120.1	20.0	240.4	50.0	602.8	100.1	1211.3	200.3	2446.1	502.0	6301.4	1008.0	13296.6
540	10.0	117.9	20.0	236.0	50.1	591.6	100.2	1188.7	200.6	2400.0	502.3	6178.8	1009.7	13023.3
550	10.0	115.7	20.1	231.7	50.2	580.8	100.4	1166.9	201.0	2355.5	503.6	6061.0	1011.3	12761.1
560	10.0	113.7	20.1	227.5	50.3	570.3	100.6	1145.8	201.3	2312.7	504.4	5947.5	1012.9	12509.2
570	10.1	111.7	20.1	223.5	50.3	560.3	100.7	1125.6	201.6	2271.4	505.2	5838.2	1014.5	12267.1
580	10.1	109.7	20.2	219.7	50.4	550.6	100.9	1106.0	201.9	2231.5	506.0	5732.9	1016.2	12034.3
590	10.1	107.9	20.2	215.9	50.5	541.2	101.0	1087.1	202.3	2193.0	506.9	5631.3	1017.8	11810.1
600	10.1	106.1	20.2	212.3	50.6	532.2	101.2	1068.8	202.6	2155.9	507.7	5533.2	1019.5	11594.2
610	10.1	104.3	20.3	208.8	50.7	523.4	101.4	1051.1	202.9	2119.9	508.5	5438.5	1021.1	11386.0
620	10.1	102.7	20.3	205.5	50.7	514.9	101.5	1034.0	203.2	2085.2	509.3	5347.0	1022.8	11185.2
630	10.2	101.0	20.3	202.2	50.8	506.7	101.7	1017.5	203.6	2051.5	510.1	5258.5	1024.5	10991.4
640	10.2	99.4	20.4	199.0	50.9	498.8	101.9	1001.5	203.9	2019.0	511.0	5172.9	1026.1	10804.2
650	10.2	97.9	20.4	196.0	51.0	491.1	102.0	985.9	204.2	1987.4	511.8	5090.1	1027.8	10623.3
660	10.2	96.4	20.4	193.0	51.1	483.6	102.2	970.9	204.6	1956.8	512.6	5009.8	1029.5	10448.4
670	10.2	95.0	20.5	190.1	51.2	476.3	102.4	956.3	204.9	1927.2	513.5	4932.1	1031.2	10279.1
680	10.2	93.6	20.5	187.3	51.2	469.3	102.5	942.1	205.2	1898.4	514.3	4856.7	1032.9	10115.2
690	10.3	92.2	20.5	184.6	51.3	462.5	102.7	928.4	205.6	1870.5	515.2	4783.6	1034.6	9956.5

TABLE 8
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PRIMARY SYSTEM TEMP (DEG F) =	555.0	PRESSURE (PSIG) =	2235.0	PRESSURIZER LEVEL (%) =	33.8
MAKEUP WATER TEMP (DEG F) =	70.0	PRESSURE (PSIG) =	.1	BORON CONCENTRATION (PPM) =	.0
BORIC ACID TEMP (DEG F) =	70.0	PRESSURE (PSIG) =	.1	BORON CONCENTRATION (PPM) =	6820.0

GALLONS OF ACID FOR BORATION OR WATER FOR DILUTION

BORON	1 PPM		2 PPM		5 PPM		10 PPM		20 PPM		50 PPM		100 PPM	
PPM	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE
425	9.9	150.3	19.7	301.0	49.4	755.1	98.8	1519.2	197.7	3075.4	495.4	7985.8	994.6	17116.1
430	9.9	148.6	19.8	297.5	49.4	746.2	98.8	1501.3	197.8	3038.8	495.8	7887.0	995.4	16888.2
435	9.9	146.8	19.8	294.0	49.4	737.6	98.9	1483.9	198.0	3003.1	496.1	7790.5	996.2	16666.4
440	9.9	145.2	19.8	290.7	49.5	729.2	99.0	1466.8	198.1	2968.1	496.5	7696.4	997.0	16450.3
445	9.9	143.5	19.8	287.4	49.5	720.9	99.1	1450.1	198.3	2934.0	496.9	7604.6	997.8	16239.8
450	9.9	141.9	19.8	284.2	49.6	712.9	99.1	1433.8	198.5	2900.6	497.3	7514.9	998.6	16034.6
455	9.9	140.4	19.8	281.1	49.6	705.0	99.2	1417.9	198.6	2868.0	497.7	7427.3	999.4	15834.6
460	9.9	138.9	19.8	278.0	49.6	697.3	99.3	1402.3	198.8	2836.2	498.1	7341.8	1000.2	15639.6
465	9.9	137.4	19.9	275.0	49.7	689.8	99.4	1387.1	198.9	2805.0	498.5	7258.2	1001.0	15449.3
470	9.9	135.9	19.9	272.1	49.7	682.4	99.5	1372.2	199.1	2774.5	498.9	7176.4	1001.7	15263.6
475	9.9	134.5	19.9	269.2	49.8	675.2	99.5	1357.6	199.2	2744.6	499.3	7096.5	1002.5	15082.3
480	10.0	133.1	19.9	266.4	49.8	668.1	99.6	1343.3	199.4	2715.4	499.7	7018.4	1003.3	14905.3
485	10.0	131.7	19.9	263.6	49.8	661.2	99.7	1329.3	199.6	2686.8	500.1	6942.0	1004.1	14732.5
490	10.0	130.3	19.9	261.0	49.9	654.4	99.8	1315.6	199.7	2658.8	500.5	6867.2	1004.9	14563.6
495	10.0	129.0	20.0	258.3	49.9	647.8	99.9	1302.1	199.9	2631.4	500.9	6794.0	1005.7	14398.6
500	10.0	127.7	20.0	255.7	49.9	641.2	99.9	1289.0	200.0	2604.6	501.3	6722.3	1006.5	14237.2
510	10.0	125.2	20.0	250.7	50.0	628.6	100.1	1263.5	200.3	2552.5	502.1	6583.5	1008.2	13925.3
520	10.0	122.8	20.0	245.9	50.1	616.5	100.3	1238.9	200.7	2502.4	502.9	6450.2	1009.8	13626.7
530	10.0	120.5	20.1	241.2	50.2	604.8	100.4	1215.3	201.0	2454.3	503.7	6322.3	1011.4	13340.7
540	10.0	118.3	20.1	236.7	50.3	593.5	100.6	1192.6	201.3	2407.9	504.5	6199.3	1013.0	13066.5
550	10.1	116.1	20.1	232.4	50.3	582.7	100.7	1170.7	201.6	2363.3	505.3	6081.1	1014.6	12803.4
560	10.1	114.0	20.2	228.3	50.4	572.2	100.9	1149.6	201.9	2320.4	506.1	5967.3	1016.3	12550.7
570	10.1	112.0	20.2	224.3	50.5	562.1	101.1	1129.3	202.3	2278.9	506.9	5857.6	1017.9	12307.9
580	10.1	110.1	20.2	220.4	50.6	552.4	101.2	1109.6	202.6	2238.9	507.7	5751.9	1019.6	12074.2
590	10.1	108.2	20.3	216.6	50.7	543.0	101.4	1090.7	202.9	2200.3	508.5	5650.0	1021.2	11849.3
600	10.1	106.4	20.3	213.0	50.8	533.9	101.5	1072.3	203.2	2163.0	509.4	5551.6	1022.9	11632.7
610	10.2	104.7	20.3	209.5	50.8	525.1	101.7	1054.6	203.6	2127.0	510.2	5456.6	1024.5	11423.8
620	10.2	103.0	20.4	206.1	50.9	516.6	101.9	1037.5	203.9	2092.1	511.0	5364.8	1026.2	11222.4
630	10.2	101.4	20.4	202.9	51.0	508.4	102.0	1020.9	204.2	2058.3	511.8	5276.0	1027.9	11027.9
640	10.2	99.8	20.4	199.7	51.1	500.4	102.2	1004.8	204.6	2025.7	512.7	5190.1	1029.5	10840.1
650	10.2	98.2	20.5	196.6	51.2	492.7	102.4	989.2	204.9	1994.0	513.5	5107.0	1031.2	10658.6
660	10.2	96.7	20.5	193.6	51.2	485.2	102.5	974.1	205.2	1963.3	514.3	5026.5	1032.9	10483.0
670	10.3	95.3	20.5	190.7	51.3	477.9	102.7	959.5	205.6	1933.6	515.2	4948.5	1034.6	10313.2
680	10.3	93.9	20.6	187.9	51.4	470.9	102.9	945.2	205.9	1904.7	516.0	4872.8	1036.3	10148.8
690	10.3	92.5	20.6	185.2	51.5	464.0	103.0	931.4	206.2	1876.7	516.9	4799.5	1038.0	9989.6

TABLE 9
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PRIMARY SYSTEM TEMP (DEG F) = 565.0 PRESSURE (PSIG) = 2235.0 PRESSURIZER LEVEL (%) = 45.1
MAKEUP WATER TEMP (DEG F) = 70.0 PRESSURE (PSIG) = .1 BORON CONCENTRATION (PPM) = .0
BORIC ACID TEMP (DEG F) = 70.0 PRESSURE (PSIG) = .1 BORON CONCENTRATION (PPM) = 6820.0

GALLONS OF ACID FOR BORATION OR WATER FOR DILUTION

BORON	1 PPM		2 PPM		5 PPM		10 PPM		20 PPM		50 PPM		100 PPM	
PPM	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE
425	9.9	150.8	19.8	301.9	49.5	757.4	99.1	1523.8	198.3	3084.8	496.9	8010.2	997.7	17168.3
430	9.9	149.0	19.8	298.4	49.6	748.5	99.1	1505.9	198.4	3048.1	497.3	7911.0	998.5	16939.8
435	9.9	147.3	19.8	294.9	49.6	739.9	99.2	1488.4	198.6	3012.2	497.7	7814.3	999.3	16717.2
440	9.9	145.6	19.8	291.6	49.6	731.4	99.3	1471.3	198.7	2977.2	498.0	7719.9	1000.0	16500.5
445	9.9	144.0	19.9	288.3	49.7	723.1	99.4	1454.6	198.9	2942.9	498.4	7627.8	1000.8	16289.4
450	9.9	142.4	19.9	285.1	49.7	715.1	99.5	1438.2	199.1	2909.5	498.8	7537.9	1001.6	16083.6
455	9.9	140.8	19.9	281.9	49.7	707.2	99.5	1422.2	199.2	2876.8	499.2	7450.0	1002.4	15883.0
460	10.0	139.3	19.9	278.9	49.8	699.4	99.6	1406.6	199.4	2844.8	499.6	7364.2	1003.2	15687.3
465	10.0	137.8	19.9	275.9	49.8	691.9	99.7	1391.3	199.5	2813.5	500.0	7280.3	1004.0	15496.4
470	10.0	136.3	19.9	272.9	49.9	684.5	99.8	1376.4	199.7	2783.0	500.4	7198.4	1004.8	15310.2
475	10.0	134.9	20.0	270.0	49.9	677.2	99.8	1361.7	199.8	2753.0	500.8	7118.2	1005.6	15128.4
480	10.0	133.5	20.0	267.2	49.9	670.1	99.9	1347.4	200.0	2723.7	501.2	7039.8	1006.4	14950.9
485	10.0	132.1	20.0	264.5	50.0	663.2	100.0	1333.3	200.2	2695.0	501.6	6963.2	1007.2	14777.5
490	10.0	130.7	20.0	261.8	50.0	656.4	100.1	1319.6	200.3	2667.0	502.0	6888.1	1008.0	14608.1
495	10.0	129.4	20.0	259.1	50.1	649.7	100.2	1306.1	200.5	2639.5	502.4	6814.7	1008.8	14442.5
500	10.0	128.1	20.0	256.5	50.1	643.2	100.2	1292.9	200.6	2612.5	502.8	6742.8	1009.6	14280.7
510	10.0	125.6	20.1	251.5	50.2	630.5	100.4	1267.3	201.0	2560.3	503.6	6603.6	1011.2	13967.3
520	10.0	123.2	20.1	246.6	50.3	618.3	100.6	1242.7	201.3	2510.0	504.4	6469.9	1012.8	13668.3
530	10.1	120.9	20.1	242.0	50.3	606.6	100.7	1219.0	201.6	2461.8	505.2	6341.6	1014.5	13381.4
540	10.1	118.6	20.2	237.5	50.4	595.3	100.9	1196.3	201.9	2415.3	506.0	6218.3	1016.1	13106.4
550	10.1	116.5	20.2	233.1	50.5	584.5	101.0	1174.3	202.2	2370.6	506.8	6099.6	1017.7	12842.5
560	10.1	114.4	20.2	229.0	50.6	574.0	101.2	1153.1	202.6	2327.5	507.6	5985.5	1019.4	12589.0
570	10.1	112.4	20.3	224.9	50.7	563.9	101.4	1132.7	202.9	2285.9	508.4	5875.5	1021.0	12345.4
580	10.1	110.4	20.3	221.1	50.7	554.1	101.5	1113.0	203.2	2245.8	509.3	5769.5	1022.7	12111.1
590	10.2	108.6	20.3	217.3	50.8	544.7	101.7	1094.0	203.5	2207.0	510.1	5667.2	1024.3	11885.5
600	10.2	106.8	20.4	213.7	50.9	535.6	101.9	1075.6	203.9	2169.6	510.9	5568.5	1026.0	11668.2
610	10.2	105.0	20.4	210.2	51.0	526.7	102.0	1057.8	204.2	2133.5	511.7	5473.2	1027.6	11458.7
620	10.2	103.3	20.4	206.8	51.1	518.2	102.2	1040.6	204.5	2098.5	512.6	5381.1	1029.3	11256.6
630	10.2	101.7	20.5	203.5	51.2	509.9	102.3	1024.0	204.9	2064.6	513.4	5292.1	1031.0	11061.6
640	10.2	100.1	20.5	200.3	51.2	501.9	102.5	1007.9	205.2	2031.8	514.2	5205.9	1032.7	10873.2
650	10.3	98.5	20.5	197.2	51.3	494.2	102.7	992.2	205.5	2000.1	515.1	5122.6	1034.4	10691.1
660	10.3	97.0	20.6	194.2	51.4	486.7	102.8	977.1	205.9	1969.3	515.9	5041.8	1036.1	10515.0
670	10.3	95.6	20.6	191.3	51.5	479.4	103.0	962.4	206.2	1939.5	516.8	4963.6	1037.8	10344.7
680	10.3	94.2	20.6	188.5	51.6	472.3	103.2	948.1	206.5	1910.5	517.6	4887.7	1039.5	10179.8
690	10.3	92.8	20.7	185.8	51.7	465.4	103.3	934.3	206.9	1882.4	518.4	4814.1	1041.2	10020.1

TABLE 10
Page 5 of 8

PRIMARY SYSTEM TEMP (DEG F) = 578.2 PRESSURE (PSIG) = 2235.0 PRESSURIZER LEVEL (%) = 60.0
MAKEUP WATER TEMP (DEG F) = 70.0 PRESSURE (PSIG) = .1 BORON CONCENTRATION (PPM) = .0
BORIC ACID TEMP (DEG F) = 70.0 PRESSURE (PSIG) = .1 BORON CONCENTRATION (PPM) = 6820.0

GALLONS OF ACID FOR BORATION OR WATER FOR DILUTION

BORON	1 PPM		2 PPM		5 PPM		10 PPM		20 PPM		50 PPM		100 PPM	
PPM	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE
425	9.9	151.1	19.8	302.5	49.6	758.9	99.3	1526.8	198.7	3090.9	497.8	8025.9	999.6	17201.9
430	9.9	149.3	19.9	298.9	49.6	750.0	99.3	1508.9	198.8	3054.1	498.2	7926.5	1000.4	16972.9
435	9.9	147.6	19.9	295.5	49.7	741.3	99.4	1491.3	199.0	3018.1	498.6	7829.6	1001.2	16750.0
440	9.9	145.9	19.9	292.1	49.7	732.8	99.5	1474.2	199.1	2983.0	499.0	7735.1	1002.0	16532.8
445	9.9	144.3	19.9	288.8	49.8	724.6	99.6	1457.4	199.3	2948.7	499.4	7642.7	1002.8	16321.3
450	10.0	142.7	19.9	285.6	49.8	716.5	99.6	1441.0	199.5	2915.2	499.8	7552.6	1003.6	16115.1
455	10.0	141.1	19.9	282.5	49.8	708.6	99.7	1425.0	199.6	2882.4	500.2	7464.6	1004.4	15914.1
460	10.0	139.5	19.9	279.4	49.9	700.8	99.8	1409.4	199.8	2850.4	500.6	7378.6	1005.2	15718.0
465	10.0	138.0	20.0	276.4	49.9	693.2	99.9	1394.0	199.9	2819.1	501.0	7294.6	1006.0	15526.8
470	10.0	136.6	20.0	273.4	50.0	685.8	100.0	1379.0	200.1	2788.4	501.4	7212.4	1006.8	15340.2
475	10.0	135.1	20.0	270.6	50.0	678.6	100.0	1364.4	200.2	2758.4	501.8	7132.1	1007.6	15158.0
480	10.0	133.7	20.0	267.7	50.0	671.5	100.1	1350.0	200.4	2729.1	502.2	7053.6	1008.4	14980.1
485	10.0	132.3	20.0	265.0	50.1	664.5	100.2	1335.9	200.6	2700.3	502.6	6976.8	1009.2	14806.4
490	10.0	131.0	20.0	262.3	50.1	657.7	100.3	1322.2	200.7	2672.2	503.0	6901.6	1010.0	14636.7
495	10.0	129.7	20.1	259.6	50.2	651.0	100.4	1308.7	200.9	2644.6	503.4	6828.1	1010.8	14470.8
500	10.0	128.4	20.1	257.0	50.2	644.5	100.4	1295.5	201.0	2617.6	503.8	6756.1	1011.6	14308.7
510	10.1	125.9	20.1	252.0	50.3	631.8	100.6	1269.8	201.4	2565.3	504.6	6616.5	1013.2	13995.1
520	10.1	123.4	20.1	247.1	50.4	619.6	100.8	1245.1	201.7	2515.0	505.4	6482.6	1014.8	13695.1
530	10.1	121.1	20.2	242.4	50.4	607.8	100.9	1221.4	202.0	2466.6	506.2	6354.0	1016.5	13407.6
540	10.1	118.9	20.2	237.9	50.5	596.5	101.1	1198.6	202.3	2420.0	507.0	6230.4	1018.1	13132.1
550	10.1	116.7	20.2	233.6	50.6	585.6	101.2	1176.6	202.6	2375.2	507.8	6111.6	1019.7	12867.6
560	10.1	114.6	20.3	229.4	50.7	575.1	101.4	1155.4	203.0	2332.0	508.6	5997.2	1021.4	12613.7
570	10.1	112.6	20.3	225.4	50.8	565.0	101.6	1135.0	203.3	2290.4	509.4	5887.0	1023.0	12369.6
580	10.2	110.7	20.3	221.5	50.8	555.2	101.7	1115.2	203.6	2250.2	510.3	5780.8	1024.7	12134.8
590	10.2	108.8	20.4	217.7	50.9	545.7	101.9	1096.1	203.9	2211.4	511.1	5678.3	1026.3	11908.8
600	10.2	107.0	20.4	214.1	51.0	536.6	102.1	1077.7	204.3	2173.9	511.9	5579.4	1028.0	11691.0
610	10.2	105.2	20.4	210.6	51.1	527.8	102.2	1059.9	204.6	2137.6	512.7	5484.0	1029.7	11481.1
620	10.2	103.5	20.5	207.2	51.2	519.2	102.4	1042.7	204.9	2102.6	513.6	5391.7	1031.3	11278.7
630	10.2	101.9	20.5	203.9	51.3	510.9	102.5	1026.0	205.3	2068.7	514.4	5302.5	1033.0	11083.2
640	10.3	100.3	20.5	200.7	51.3	502.9	102.7	1009.8	205.6	2035.8	515.2	5216.1	1034.7	10894.5
650	10.3	98.7	20.6	197.6	51.4	495.2	102.9	994.2	205.9	2004.0	516.1	5132.6	1036.4	10712.0
660	10.3	97.2	20.6	194.6	51.5	487.6	103.0	979.0	206.3	1973.2	516.9	5051.7	1038.1	10535.6
670	10.3	95.8	20.6	191.7	51.6	480.3	103.2	964.3	206.6	1943.3	517.8	4973.3	1039.8	10365.0
680	10.3	94.4	20.7	188.9	51.7	473.2	103.4	950.0	206.9	1914.3	518.6	4897.3	1041.5	10199.7
690	10.3	93.0	20.7	186.1	51.8	466.4	103.6	936.1	207.3	1886.1	519.5	4823.6	1043.2	10039.7

TABLE 11
Page 5 of 8

PRIMARY SYSTEM TEMP (DEG F) = 580.0 PRESSURE (PSIG) = 2235.0 PRESSURIZER LEVEL (%) = 62.0
MAKEUP WATER TEMP (DEG F) = 70.0 PRESSURE (PSIG) = .1 BORON CONCENTRATION (PPM) = .0
BORIC ACID TEMP (DEG F) = 70.0 PRESSURE (PSIG) = .1 BORON CONCENTRATION (PPM) = 6820.0

GALLONS OF ACID FOR BORATION OR WATER FOR DILUTION

BORON	1 PPM		2 PPM		5 PPM		10 PPM		20 PPM		50 PPM		100 PPM	
PPM	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE
425	9.9	151.1	19.8	302.5	49.6	758.9	99.3	1526.9	198.7	3091.1	497.9	8026.4	999.7	17203.1
430	9.9	149.3	19.9	299.0	49.7	750.0	99.3	1509.0	198.8	3054.3	498.3	7927.0	1000.5	16974.1
435	9.9	147.6	19.9	295.5	49.7	741.4	99.4	1491.4	199.0	3018.3	498.7	7830.1	1001.3	16751.1
440	9.9	145.9	19.9	292.2	49.7	732.9	99.5	1474.3	199.2	2983.2	499.1	7735.6	1002.1	16533.9
445	10.0	144.3	19.9	288.9	49.8	724.6	99.6	1457.5	199.3	2948.9	499.4	7643.3	1002.9	16322.3
450	10.0	142.7	19.9	285.6	49.8	716.5	99.7	1441.1	199.5	2915.4	499.8	7553.1	1003.7	16116.2
455	10.0	141.1	19.9	282.5	49.8	708.6	99.7	1425.1	199.6	2882.6	500.2	7465.1	1004.5	15915.1
460	10.0	139.6	19.9	279.4	49.9	700.9	99.8	1409.5	199.8	2850.6	500.6	7379.1	1005.2	15719.1
465	10.0	138.1	20.0	276.4	49.9	693.3	99.9	1394.1	199.9	2819.2	501.0	7295.1	1006.0	15527.8
470	10.0	136.6	20.0	273.5	50.0	685.9	100.0	1379.1	200.1	2788.6	501.4	7212.9	1006.8	15341.2
475	10.0	135.1	20.0	270.6	50.0	678.6	100.0	1364.5	200.3	2758.6	501.8	7132.6	1007.6	15159.0
480	10.0	133.7	20.0	267.8	50.0	671.5	100.1	1350.1	200.4	2729.2	502.2	7054.1	1008.4	14981.1
485	10.0	132.4	20.0	265.0	50.1	664.5	100.2	1336.0	200.6	2700.5	502.6	6977.2	1009.2	14807.4
490	10.0	131.0	20.0	262.3	50.1	657.7	100.3	1322.3	200.7	2672.4	503.0	6902.1	1010.0	14637.6
495	10.0	129.7	20.1	259.6	50.2	651.0	100.4	1308.8	200.9	2644.8	503.4	6828.5	1010.9	14471.8
500	10.0	128.4	20.1	257.0	50.2	644.5	100.4	1295.5	201.0	2617.8	503.8	6756.5	1011.7	14309.6
510	10.1	125.9	20.1	252.0	50.3	631.8	100.6	1269.9	201.4	2565.4	504.6	6616.9	1013.3	13996.0
520	10.1	123.4	20.1	247.1	50.4	619.6	100.8	1245.2	201.7	2515.1	505.4	6483.0	1014.9	13696.0
530	10.1	121.1	20.2	242.4	50.4	607.8	100.9	1221.5	202.0	2466.7	506.2	6354.4	1016.5	13408.5
540	10.1	118.9	20.2	237.9	50.5	596.5	101.1	1198.7	202.3	2420.2	507.0	6230.9	1018.2	13132.9
550	10.1	116.7	20.2	233.6	50.6	585.6	101.2	1176.7	202.7	2375.4	507.8	6112.0	1019.8	12868.5
560	10.1	114.6	20.3	229.4	50.7	575.1	101.4	1155.5	203.0	2332.2	508.7	5997.6	1021.4	12614.5
570	10.1	112.6	20.3	225.4	50.8	565.0	101.6	1135.0	203.3	2290.5	509.5	5887.4	1023.1	12370.4
580	10.2	110.7	20.3	221.5	50.8	555.2	101.7	1115.3	203.6	2250.3	510.3	5781.2	1024.7	12135.6
590	10.2	108.8	20.4	217.8	50.9	545.8	101.9	1096.2	204.0	2211.5	511.1	5678.7	1026.4	11909.6
600	10.2	107.0	20.4	214.1	51.0	536.6	102.1	1077.8	204.3	2174.0	511.9	5579.8	1028.1	11691.8
610	10.2	105.2	20.4	210.6	51.1	527.8	102.2	1060.0	204.6	2137.8	512.8	5484.3	1029.7	11481.9
620	10.2	103.5	20.5	207.2	51.2	519.3	102.4	1042.7	204.9	2102.7	513.6	5392.0	1031.4	11279.4
630	10.2	101.9	20.5	203.9	51.3	511.0	102.6	1026.1	205.3	2068.8	514.4	5302.8	1033.1	11084.0
640	10.3	100.3	20.5	200.7	51.3	503.0	102.7	1009.9	205.6	2036.0	515.3	5216.5	1034.8	10895.2
650	10.3	98.7	20.6	197.6	51.4	495.2	102.9	994.2	205.9	2004.1	516.1	5132.9	1036.5	10712.8
660	10.3	97.2	20.6	194.6	51.5	487.7	103.1	979.1	206.3	1973.3	517.0	5052.0	1038.2	10536.3
670	10.3	95.8	20.6	191.7	51.6	480.4	103.2	964.3	206.6	1943.4	517.8	4973.6	1039.9	10365.6
680	10.3	94.4	20.7	188.9	51.7	473.3	103.4	950.1	206.9	1914.4	518.6	4897.6	1041.6	10200.4
690	10.3	93.0	20.7	186.1	51.8	466.4	103.6	936.2	207.3	1886.2	519.5	4823.9	1043.3	10040.4

3/4.4.8 SPECIFIC ACTIVITY

LIMITING CONDITION FOR OPERATION

3.4.8 The specific activity of the primary coolant shall be limited to:

a. Less than or equal to 0.35 microcuries/gram DOSE EQUIVALENT I-131, and | R241

b. Less than or equal to $100/\overline{E}$ microcuries/gram.

APPLICABILITY: MODES 1, 2, 3, 4 and 5

ACTION:

MODES 1, 2 and 3*

a. With the specific activity of the primary coolant greater than 0.35 microcuries/gram DOSE EQUIVALENT I-131 for more than 48 hours during one continuous time interval or exceeding the limit line shown on Figure 3.4-1, be in at least HOT STANDBY with T_{avg} less than 500°F within 6 hours. | R121 | R241

b. With the specific activity of the primary coolant greater than $100/\overline{E}$ microcuries/gram, be in at least HOT STANDBY with T_{avg} less than 500°F within 6 hours. | R121

MODES 1, 2, 3, 4 and 5

a. With the specific activity of the primary coolant greater than 0.35 microcuries/gram DOSE EQUIVALENT I-131 or greater than $100/\overline{E}$ microcuries/gram, perform the sampling and analysis requirements of item 4a of Table 4.4-4 until the specific activity of the primary coolant is restored to within its limits. | R241 | R121

*With T_{avg} greater than or equal 500°F.

4.4.8 The specific activity of the primary coolant shall be determined to be within the limits by performance of the sampling and analysis program of Table 4.4-4.

TABLE 4.4-4

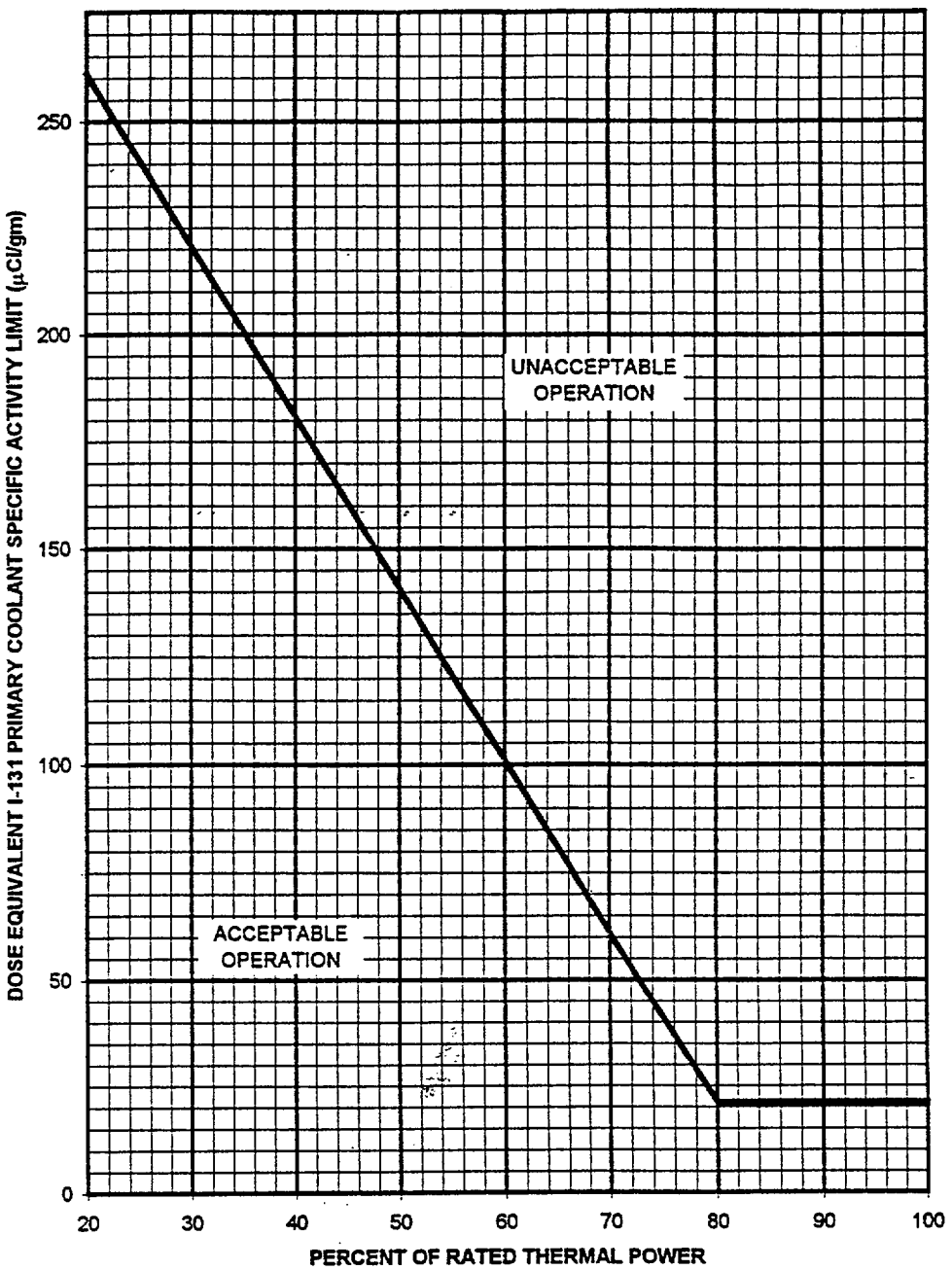
PRIMARY COOLANT SPECIFIC ACTIVITY SAMPLE AND ANALYSIS PROGRAM

TYPE OF MEASUREMENT AND ANALYSIS	SAMPLE AND ANALYSIS FREQUENCY	MODES IN WHICH SAMPLE AND ANALYSIS REQUIRED
1. Gross Activity Determination	At least once per 72 hours	1, 2, 3, 4
2. Isotopic Analysis for DOSE EQUIVALENT I-131 Concentration	1 per 14 days	1
3. Radiochemical for $\bar{E}$ Determination	1 per 6 months*	1
4. Isotopic Analysis for Iodine Including I-131, I-133, and I-135	a) Once per 4 hours, whenever the specific activity exceeds 0.35 μCi/gram DOSE EQUIVALENT I-131 or 100/E μCi/gram, and	$1^{\#}$, $2^{\#}$, $3^{\#}$, $4^{\#}$, $5^{\#}$
	b) One sample between 2 and 6 hours following a THERMAL POWER change exceeding 15 percent of the RATED THERMAL POWER within a one hour period.	1, 2, 3

R241

$^{\#}$Until the specific activity of the primary coolant system is restored within its limits.

*Sample to be taken after a minimum of 2 EFPD and 20 days of POWER OPERATION have elapsed since the reactor was last subcritical for 48 hours or longer.



R241

FIGURE 3.4-1
DOSE EQUIVALENT I-131 Primary Coolant Specific Activity Limit Versus Percent of RATED THERMAL POWER with the Primary Coolant Specific Activity > 0.35 μCi/gram Dose Equivalent I-131

R241

FIGURE A.15

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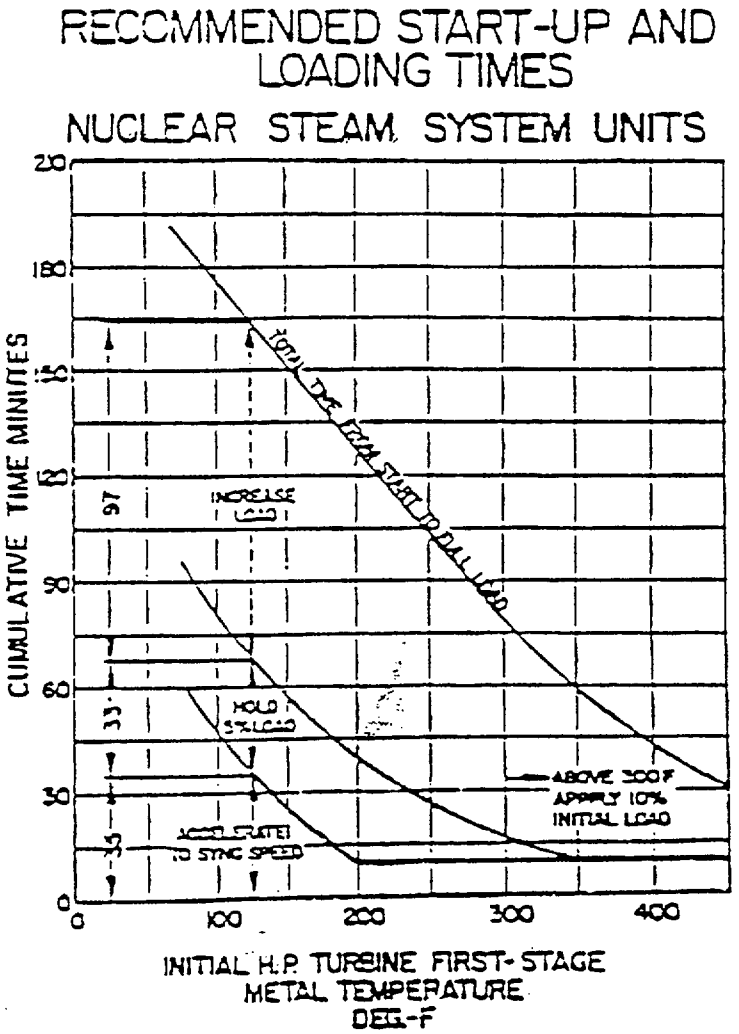

Answer Key

Test Name: RO.TST
Test Date: Friday, July 14, 2000

		Question ID		Type	Pts	Answer(s) 0	1	2	3	4	5	6	7	8	9
1:	1	005 AK2.02	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	2	015 AA2.02	001	MC-SR	1	A	A	A	A	A	A	A	A	A	A
1:	3	W/E09 EK2.2	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	4	024 AA2.02	001	MC-SR	1	B	A	B	C	D	A	B	C	D	A
1:	5	026 AA2.01	001	MC-SR	1	A	A	A	A	A	A	A	A	A	A
1:	6	027 AA1.01	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	7	040 AK2.02	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	8	W/E08 EA1.1	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	9	051 AK3.01	001	MC-SR	1	B	B	B	B	B	B	B	B	B	B
1:	10	055 EK3.02	001	MC-SR	1	A	A	A	A	A	A	A	A	A	A
1:	11	057 AK3.01	002	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	12	062 AA1.05	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	13	067 AK1.01	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	14	069 AK2.03	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	15	074 EK2.05	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	16	076 AA2.02	002	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	17	001 AA2.02	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	18	003 AA2.03	001	MC-SR	1	D	B	C	D	A	B	C	D	A	B
1:	19	007 2.4.6	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	20	008 AA2.13	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	21	009 2.4.16	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	22	W/E04 2.4.4	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	23	W/E03 EK3.1	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	24	W/E11 EA1.1	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	25	W/E02 EK2.2	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	26	022 2.1.20	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	27	025 AK1.01	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	28	032 AK1.01	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	29	037 AK3.03	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	30	038 EA2.13	002	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	31	W/E05 EK2.1	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	32	058 AA2.01	002	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	33	W/E16 EK3.3	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	34	028 AK1.01	001	MC-SR	1	A	A	A	A	A	A	A	A	A	A
1:	35	036 AK3.02	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	36	056 AA1.07	001	MC-SR	1	C	C	C	C	C	C	C	C	C	C
1:	37	001 K6.03	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	38	001 A3.01	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	39	003 K2.01	001	MC-SR	1	D	D	D	D	D	D	D	D	D	D
1:	40	003 K4.04	001	MC-SR	1	B	B	B	B	B	B	B	B	B	B
1:	41	004 K6.01	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	42	004 A4.04	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	43	013 K2.01	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	44	015 K3.03	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	45	017 A4.01	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A

Test Name: RO.TST
Test Date: Friday, July 14, 2000

		Question ID		Type	Pts	Answer(s) 0	1	2	3	4	5	6	7	8	9
1:	46	022 K1.01	001	MC-SR	1	D	D	D	D	D	D	D	D	D	D
1:	47	022 2.2.11	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	48	025 K1.01	001	MC-SR	1	C	C	C	C	C	C	C	C	C	C
1:	49	025 A3.01	001	MC-SR	1	C	C	C	C	C	C	C	C	C	C
1:	50	056 A2.04	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	51	056 2.1.20	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	52	059 K1.04	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	53	059 A4.01	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	54	061 A1.01	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	55	061 A2.03	002	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	56	068 A2.04	001	MC-SR	1	C	C	C	C	C	C	C	C	C	C
1:	57	071 A2.05	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	58	072 A1.01	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	59	072 A4.01	002	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	60	002 A3.01	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	61	006 K4.24	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	62	010 A4.03	001	MC-SR	1	B	B	B	B	B	B	B	B	B	B
1:	63	011 A2.11	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	64	012 K4.09	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	65	014 A1.03	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	66	016 K3.12	001	MC-SR	1	B	B	B	B	B	B	B	B	B	B
1:	67	026 K4.05	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	68	029 A3.01	001	MC-SR	1	A	A	A	A	A	A	A	A	A	A
1:	69	033 K4.05	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	70	035 A2.04	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	71	039 2.1.16	002	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	72	055 K3.01	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	73	062 2.2.13	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	74	063 A4.03	002	MC-SR	1	A	D	A	B	C	D	A	B	C	D
1:	75	064 K3.02	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	76	073 K5.03	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	77	075 A2.01	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	78	079 K1.01	002	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	79	086 K5.03	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	80	007 K4.01	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	81	008 K1.04	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	82	034 K4.02	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	83	041 K3.01	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	84	045 A3.04	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	85	076 A1.02	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	86	078 K2.01	001	MC-SR	1	D or C	A	B	C	A	B	C	A	B	C
1:	87	103 K4.06	001	MC-SR	1	D	D	D	D	D	D	D	D	D	D
1:	88	G2.1.1	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	89	G2.1.25	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	90	G2.1.32	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B

Test Name: RO.TST
Test Date: Friday, July 14, 2000

	Question ID		Type	Pts	Answer(s) 0	1	2	3	4	5	6	7	8	9
1: 91	G2.2.3	002	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1: 92	G2.2.11	003	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1: 93	G2.2.13	002	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1: 94	G2.3.1	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1: 95	G2.3.2	003	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1: 96	G2.3.9	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1: 97	G2.4.2	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1: 98	G2.4.17	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1: 99	G2.4.32	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1: 100	G2.4.47	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B

U.S. Nuclear Regulatory Commission
Site-Specific
Written Examination

Applicant Information	
Name:	Region: II
Date:	Facility/Unit: TVA Sequoyah
License Level: SRO	Reactor Type: W
Start Time:	Finish Time:

Instructions

Use the answer sheets provided to document your answers. Staple this cover sheet on top of the answer sheets. The passing grade requires a final grade of at least 80.00 percent. Examination papers will be collected four hours after the examination starts.

Applicant Certification

All work done on this examination is my own. I have neither given nor received aid.

_____
Applicant's Signature

Results	
Examination Value	_____ Points
Applicant's Score	_____ Points
Applicant's Grade	_____ Percent

1. Given the following plant conditions:

   - Unit 1 at 95% power and is responding to continuous rod withdrawal.
   - AOP-C.01 was entered and the crew transitioned to AOP-C.02.
   - AOP-C.02 directs the control room operator to check for evidence of boration flow.

   Which ONE (1) of the following will provide indications of flow through emergency borate valve (FCV-62-138)?

   -Flow indicated on emergency borate flow indicator, FI-62-137A AND:

   A. -Red light on handswitch for FCV-62-138 on Panel M-6, LIT
      -Flow indicated on emergency borate flow indicator, FI-62-137B

   B. -Red light on handswitch for FCV-62-138 on Panel M-6, LIT
      -NO flow indicated on emergency borate flow indicator, FI-62-137B

   C. -Green light on handswitch for FCV-62-138 on Panel M-6, LIT
      -Flow indicated on emergency borate flow indicator, FI-62-137B

   D. -Green light on handswitch for FCV-62-138 on Panel M-6, LIT
      -NO flow indicated on emergency borate flow indicator, FI-62-137B

2. Given the following plant conditons:

   - Unit 1 is operating at 68% RTP.
   - The control rods are in manual
   - The crew is responding to a "Full Length Rods on Bottom" alarm
   - Control rod M4 RPI indicates zero
   - The reactor did not trip

   Which ONE (1) of the following sets of parameters describes the effect of this malfunction?

A. Delta I for N41 will change from +1% to -2%, QPTR will remain the same, and Delta T for all loops will decrease from 68% to 64% and remain at 64%.

B. Delta I for N41 will change from +1% to -2%, QPTR will remain the same, and Delta T for all loops will not change.

C. Delta I for all NIS channels will not change, QPTR will change from 1.001 to 1.015, and Delta T for all loops will decrease from 68% to 64% and remain at 64%.

D. Delta I for all NIS channels will not change, QPTR will change from 1.001 to 1.015, and Delta T for all loops will decrease from 68% to 64% and return to 68%.

3. Given the following plant conditions:

- Unit 2 is operating at 95% reactor power.
- The crew is recovering from a control rod misalignment.
- Control rod M8 is 15 steps lower than the other rods in control bank D.
- M8 rod has been misaligned for 20 minutes
- Reactor engineering has determined that no restrictions exist on realignment of M8 rod.
- The decision has been made to realign control rod M8 with control bank D.

Which ONE (1) of the following describes the required crew actions in preparation for realignment?

Disconnect the lift coil(s) for:

A. the affected GROUP (except M8) and adjust the affected GROUP step counter to the misaligned rod position.

B. the affected BANK (except M8) and adjust the affected GROUP step counter to the misaligned rod position.

C. control rod M8 and adjust the affected GROUP step counter to the misaligned rod position.

D. control rod M8 and adjust both control BANK D step counters to the misaligned rod position.

4. Given the following plant conditions:

   - Unit 1 is in MODE 4 and stable with RHR in service for shutdown cooling.
   - Both trains of RHR are aligned to all 4 loops.
   - A LOCA occurs.
   - RCS subcooling is 55°F.
   - PZR level is 25% and decreasing.
   - RWST level is 55%.
   - Containment sump level is 8%.

   With regard to RHR, which ONE (1) of the following is correct per AOP-R.02 "Shutdown LOCA"?

   A. Maintain RHR in service and realign RHR suction to the RWST.

   B. Maintain RHR in current alignment, pumps should be stopped only if cavitation occurs.

   C. Immediately stop both RHR pumps until suction can be realigned to RWST.

   D. Immediately realign RHR to the containment sump.

5. Given the following plant conditions:

   - Unit 2 is operating at 100% power when a LOCA outside containment is recognized.
   - The operators initiated safety injection.

   Which ONE (1) of the following best describes the procedure methodology to mitigate this condition?

   A. If the LOCA can not be isolated then transition to E-1.

   B. If the LOCA can not be isolated then transition to the Loss of RHR Sump Recirculation procedure.

   C. When the RWST level is <27%, the operator should transfer ECCS pumps to the containment sump.

   D. When the RWST level is <8%, the operator should transfer ECCS pumps to the containment sump.

6. Given the following plant conditions:

   - Unit #1 has experienced a Reactor Trip and SI.
   - The crew has transitioned to and performed the proper procedures and are currently performing ES-1.1 "SI Termination."
   - The CRO notices that the pressure in #2 Steam Generator is decreasing rapidly out of control and notifies the SRO.

   Which ONE (1) of the following describes the direction the SRO should give the crew?

   A. Close all MSIVs, SG PORVs and isolate Main Feedwater, Auxiliary Feedwater, and S/G blowdown lines.

   B. Transition to E-2, "Faulted Steam Generator Isolation" from the Fold Out Page.

   C. Transition to E-1, "Loss of Reactor or Secondary Coolant" from the Fold Out Page.

   D. Verify all Steam Dumps and Steam Generator PORVs are closed, then close all MSIVs.

7. Given the following plant conditions:

   - Unit 2 is operating at 60% RTP

Which ONE (1) of the following is required following a loss of CCS flow to the RCPs?

A. Trip the reactor and all reactor coolant pumps within two minutes.

B. Reduce CCS loads and increase seal injection flow if power is greater than 10%.

C. To continue operation, restore CCS flow within five minutes to the affected Unit.

D. Trip the reactor and the affected reactor coolant pumps when motor bearing temperature exceeds $180^{o}F$.

8. Given the following plant conditions:

   - A reactor trip has occurred on Unit 1 due to a loss of offsite power.
   - The crew is performing the actions of ES-0.2, "Natural Circulation Cooldown".
   - When adjusting steam dumping rate to control natural circulation, the operators also adjust AFW flow to all S/Gs.

   Which ONE (1) of the following explains why narrow range level is maintained in ALL S/Gs?

   A. To maintain symmetric cooling of the RCS for decay heat removal.

   B. To flood all SGs for subsequent entry into Mode 5.

   C. To prevent SG thermal shock by ensuring all SGs are kept wet prior to establishing auxiliary feedwater flow.

   D. Top of SG tubes on all SGs must be covered for natural circulation to occur.

9. Given the following plant conditions:

- The operating crew is responding to a reactor trip without Safety Injection using appropriate emergency procedures.
- Reactor coolant pumps are running
- Core burnup is 15,000 MWD/MTU

Which ONE (1) of the following describes conditions that require Emergency Boration?

A. Tavg is 544 degrees and decreasing following closure of the steam dump and atmospheric relief valves.

B. Tavg is 537 degrees and continuing to decrease with all rods fully inserted.

C. Control rod C5 RPI is indicating 90 steps withdrawn and control rod M8 RPI is indicating 11 steps withdrawn. All other RPIs indicate zero steps.

D. Control rod H4 RPI is indicating 224 steps withdrawn. All other RPIs indicate zero steps.

10. Given the following plant conditions:

- Unit 2 in MODE 3 for maintenance
- Panel 0-XA-55-27B-D Annunciator A-4, MISC EQUIPM SUPPLY HEADER FLOW LOW, starts alarming
- Panel 0-XA-55-27B-D Annunciator A-6, LETDOWN HX OUTLET FLOW/TEMP ABNORMAL, starts alarming

Which ONE (1) of the following events could cause both alarms to actuate?

A. CCS supply header rupture.

B. Letdown HX tube rupture.

C. Loss of seal injection.

D. Loss of charging flow.

11. Given the following plant conditions:

- Unit 2 was stable at 81% power
- The following Panel XA-55-5C annunciators have just illuminated:
  - Window A-6 TS-68-2M/N RC LOOPS T AVG/AUCT T AVG DEVN HIGH-LOW
  - Window B-6 TS-68-2/A/B REACTOR COOLANT LOOPS DELTA T DEVN HIGH-LOW
  - Window C-6 TS-68-2P/Q REAC COOL LOOPS T REF T AUCT HIGH-LOW

Which ONE (1) of the following plant transients could cause these three annunciators to begin alarming at the same time?

A. Steam line break.

B. Dropped control rod.

C. Continuous rod withdrawal.

D. Turbine runback

12. Unit 1 operators are currently performing FR-S.1 "Nuclear Power Generation/ATWS." The crew is performing step #10 which has them stop any uncontrolled or controlled cooldown.

    Which ONE (1) of the following correctly describes the reason for stopping any cooldown?

    A. To prevent a positive reactivity addition due to a increase in the void content of the reactor coolant system.

    B. To prevent a density decrease in the moderator due to a decrease in reactor coolant temperature.

    C. To prevent a pressure decrease in the moderator due to a decrease in the reactor coolant temperature.

    D. To prevent a positive reactivity addition due to a decrease in reactor coolant temperature.

13. Given the following plant conditions:
    - A LOCA has occurred on Unit 1 and the operating crew has implemented the EOPs.
    - The crew is currently performing E-1, "Loss of Reactor or Secondary Coolant"
    - The STA reports a RED path for FR-P.1, "Pressurized Thermal Shock".

    Which ONE (1) of the following correctly describes the parameter the STA used to make his determination and the reason it was used?

    A. Tcold temperature since it most closely reflects the temperature in the beltline region of the reactor vessel.

    B. Tcold temperature since it most closely reflects the temperature in the core.

    C. Incore thermocouple temperature since it most closely reflects the temperature in the beltline region of the reactor vessel.

    D. Incore thermocouple temperature since it reflects the temperature in the core.

14. Given the following plant conditions:

- Condenser pressure is at 2.6 psia and steadily increasing.
- Turbine load is 75%.

Which ONE (1) of the following would be the FIRST to occur OR be procedurally required?

A. Automatic trip of both Main Feedwater pumps.

B. Loss of Steam dump capability.

C. "Condenser Vacuum Low" annunicator lit, requiring a manual turbine trip.

D. Automatic trip of the main turbine.

15. Given the following plant conditions:

- Units 1 and 2 have experienced a Loss of All AC Power
- ECA-0.0, "Loss of All AC Power" has been implemented
- Step 13 directs the crew to place selected equipment in PULL TO LOCK or OFF

Which ONE (1)of the following describes the reason for placing the equipment in PULL-TO-LOCK or OFF position?

A. To prevent potential overload of the Shutdown Boards when they are re-energized.

B. To prevent ECCS pump starting and thermal shock to RCS penetrations.

C. To prevent ESF pump starts without proper cooling water and auxiliary support equipment available.

D. To prevent RWST inventory depletion.

16. Given the following plant conditions:

- Unit 1 has experienced a loss of 120V AC Vital Instrument Power Board 1-I.
- The operators enter AOP-P.03, "Loss of Unit 1 Vital Instrument Power Board".

Which ONE (1) of the following correctly identifies actions to be taken per AOP-P.03.

A. CHECK to see if the Reactor is Tripped. If not THEN continue with AOP-P.03.

B. CHECK to see if the Reactor is Tripped. If not THEN immediately place 1-FCV-3-103, Main FW Reg Valve, in Manual.

C. ENSURE the reactor is tripped and continue with AOP-P.03.

D. ENSURE the reactor is tripped AND GO TO E-0 WHILE continuing in AOP-P.03

17. Which ONE (1) of the following correctly describes the immediate biological effects to a member of the public after an accidental liquid radwaste release.

A. Somatic

B. Genetic

C. Teratogenic

D. Acute

18. Given the following plant conditions:

- Unit #1 is operating at 100%.
- All systems aligned normal.
- Loss ERCW Supply header 2A occurs due to a rupture in the yard.

Which ONE (1) of the following describes indications the Unit 1 operator would see in the main control room in this event? (Assume no operator actions).

A. Ice condenser chillers trip.

B. Immediate containment pressure increase.

C. General ventilation chillers trip.

D. CCS surge tank level increasing with auto makeup valve closed.

19. Given the following plant conditions:

- Unit 1 is at 100% power.
- Unit 2 is in a refueling outage.
- The shift is fully staffed.

An outage contract worker reports that a Class B fire has just started in the Auxiliary Building.

Which ONE (1) of the following types of fire should the Fire Brigade expect to fight upon arrival at the scene?

A. A fire which involves flammable liquid, oils, or grease.

B. A fire which involves combustible metals.

C. A fire which involves electrical equipment.

D. A fire which involves wood, paper, or cloth.

20. Given the following plant conditions:

- Unit 1 is at 100% RTP when a decision was made to enter AOP-C.04 "Control Room Inaccessibility".
- The Reactor Protection System manual handswitches in the Control Room are operated in an attempt to trip the Reactor per Step #1 of AOP-C.04.

Which ONE (1) of the following describes how the Reactor Trip Breaker's trip coils should respond to operation of the manual Reactor-Trip handswitch?

A. The SSPS undervoltage trip coils and the 125V-DC shunt trip coils both deenergize.

B. The SSPS undervoltage trip coils deenergize, while the 125V-DC shunt trip coils energize.

C. The SSPS undervoltage coils will deenergize and the 125V-DC shunt trip coils are unaffected.

D. The 125V-DC shunt trip coils will energize, while the SSPS undervoltage coils are unaffected.

21. Which ONE (1) of the following conditions represents a loss of primary containment integrity per Technical Specifications 3.6.1.1, Containment Integrity?

A. With the reactor at 100% power, an electrician opens the outer airlock door.

B. With the RCS average coolant temperature 250°F, an inspection of the equipment hatch determines that the hatch is NOT sealed.

C. During an operability test of two normally open, redundant containment isolation valves at 100% power, one of the valves fails to close.

D. During an Integrated Leakage Rate Test in Mode 5, containment leakage exceeds the maximum allowable Technical Specification leakage rate.

22. Given the following plant conditions:

- The operating crew entered procedure FR-C.1, "Inadequate Core Cooling."
- All attempts to establish high pressure Safety Injection flow were unsuccessful.
- RVLIS lower range level is 28% and dropping slowly,
- Core Exit Thermocouples are reading 820 degrees F and slowly increasing.
- Reactor Coolant pumps have been secured.

Which ONE (1) of the following methods would be the NEXT step in mitigating the core cooling challenge?

A. Enter the Severe Accident Management Guidelines (SAMGs).

B. Open available pressurizer PORVs to allow RCS depressurization to the SI accumulator and SI injection pressures.

C. Depressurize all intact steam generators using Steam dumps or ARVs to 125 psig to allow RCS depressurization to the SI accumulator and SI injection pressures.

D. Restart one RCP in an idle loop to provide forced two-phase flow through the core.

23. Given the following plant conditions:

- Unit 1 has operated at 90% RTP for 45 days.
- Chem lab has been sampling RCS for Iodine every 4 hours for the past 20 hrs.
- Last RCS activity sample (1 hour ago) was 1.5 microcuries/gram Dose Equivalent Iodine.
- AOP-R.06 "High RCS Activity" was entered 20 hrs ago.

Which ONE (1) of the following actions describe the expected recommendation from the chem lab?

A. Place one (1) Mixed Bed demineralizer in service at 120 gpm and the Cation Bed in service with 120 gpm.

B. Place one (1) Mixed Bed demineralizer in service at 120 gpm and the cation bed in service at 75 gpm flow.

C. Place both Mixed Bed demineralizers in service at 120 gpm each and the cation bed at 120 gpm.

D. Place both Mixed Bed demineralizers in service at 120 gpm each and the cation bed at 75 gpm.

24. Given the following plant conditions:

- Unit 1 is experiencing a degraded core cooling condition.
- The crew is performing FR-C.2 "Degraded Core Cooling".
- The operator is directed to check RVLIS indication.

Which ONE (1) of the following best describes the purpose of checking RVLIS.

A. To determine the effectiveness of the safety injection in restoring RCS inventory.

B. The determine if a RCP can be started to provide forced flow.

C. To determine the extent of upper head voiding.

D. To determine if a transition to FR-C.1 is required.

25. Given the following plant conditions:

- Unit 1 Reactor tripped from 100% power.
- The crew completed the first 4 steps of E-0 and transitioned to ES-0.1.
- SI occurred and crew transitioned back to E-0.
- US is in E-0 at step 9, "Monitor containment spray not actuated".
- The STA informs the US of a RED PATH on Heat Sink.

Which ONE (1) of the following describes the actions REQUIRED by the US?

A. Transition immediately to FR-H.1, "Response to Loss of Secondary Heat Sink".

B. Continue with E-0 through the event diagnostic steps and enter FR-H.1 when directed to transition to E-1, E-2, or E-3.

C. Direct the OATC to do an independent review all CSF's to determine if any higher priority RED paths exist, then transition to highest priority procedure.

D. Transition to FR-H.1 when directed in E-0 at step 14, "determine if secondary HEAT SINK available".

26. Given the following conditions:

- An automatic reactor trip and safety injection occurred on Unit 2 as a result of decreasing RCS pressure
- Reactor power was stable prior to the reactor trip and dropped following the reactor trip
- Pressurizer pressure dropped prior to and following the SI
- RCS average temperature was stable prior to and following the SI
- Pressurizer level rose prior to and following the SI
- CCP Amp meter indicated decreasing amps and CCP flow meter indicated decreasing flow prior to the SI

Which ONE (1) of the following accidents would result in these conditions?

A. Steamline break

B. Double-ended hot leg break

C. Stuck open pressurizer safety valve

D. 3 inch break on a RCS cold leg

27. A LOCA has occurred and operators have implemented E-0, "Reactor Trip or Safety Injection".

Which ONE (1) of the below statements indicates the basis for tripping ALL RCPs if minimum RCS pressure is lost and SI flow has been established?

A. Prevent damage to RCP impeller due to cavitation and pitting.

B. To further decrease RCS pressure, enhancing ESF systems ability to inject borated liquid into RCS.

C. Prevent damage to the RCP seal packages due to possibility of two-phase flow in RCS.

D. Prevent excessive depletion of RCS inventory through the break leading to severe core uncovery if the RCPs were later tripped.

28. During the performance of ES-1.2, "Post-LOCA Cooldown and Depressurization," it is desirable to have only one RCP running.

    Which ONE (1) of the following describes the reason for having only one RCP in service?

    A. One RCP provides the DELTA-P required to provide letdown. Additional RCPs would add unnecessary heat load.

    B. One RCP is desired for spray and RCS heat transport to the SGs. Additional RCPs would add unnecessary heat load.

    C. One RCP is needed for RCS heat transport to the SGs. Additional RCPs could overload the electrical power supply.

    D. One RCP is desired for spray and RCS mixing. Additional RCPs would strain the plant electrical power supply in the post-LOCA condition.

29. While performing the actions for a Loss RHR Sump Recirculation, a RED path condition is identified for the Containment Status Tree.

    Which ONE (1) of the following reasons describes why the Containment Spray Pumps are operated within the guidelines of ECA-1.1, "Loss of RHR Sump Recirculation" instead of using the guidelines contained in FR-Z.1, "High Containment Pressure."

    A. Ensures that the maximum heat removal system capacity that is available is used to reduce the containment pressure.

    B. ECA-1.1 pump operating criteria is more restrictive, ensuring continuous containment spray system operation to reduce containment pressure.

    C. ECA-1.1 pump operating criteria is less restrictive, permitting reduced containment spray operation to conserve RWST inventory.

    D. Provide a more rapid means of verifying automatic actuation of the containment spray system.

30. Unit 1 control room operators are investigating a possible malfunction of the Reactor Coolant Makeup system based on abnormal indications following an RCS makeup evolution. The RO suspects the controller setting for 1-FC-62-139, Boric Acid Blender Flow Control, may have been set wrong.

    Desired boron concentration is 500 ppm
    BAT boron concentration at 6820 ppm
    Primary water flowrate of 70 gpm
    Primary Water boron concentration of 10 ppm
    (BAT conc - Desired conc)xRequired B.A. flow = (Desired conc - PW conc)xPW flow

    Which ONE (1) of the following would be the most correct setting for 1-FC-62-139?

    A. 2.7

    B. 5.4

    C. 8.7

    D. 11.0

31. Which ONE (1) of the following is an indication of vortexing at the suction of the RHR pump during reduced inventory conditions?

A. Erratic pump amps

B. RHR suction relief lifting

C. RHR flow decrease and stable at the lower value

D. Constant pump discharge pressure

32. With the Pressurizer Pressure Control System selected for PT-68-340, Channel I pressure transmitter fails LOW. The operator swaps the Pressure Control Channel Selector Switch (XS-68-340D) to operable channels per the AOP.

Which ONE (1) of the following correctly describes which is the controlling channel and which channel is selected as the backup channel?

A. Channel II (334) is controlling; channel III (323) is backup.

B. Channel II (334) is controlling; channel IV (322) is backup.

C. Channel III (323) is controlling; channel II (334) is backup.

D. Channel III (323) is controlling; channel IV (322) is backup.

33. Which ONE (1) of the following describes the effects on Source Range Monitor (SRM) output as detector voltage BEGINS to drift from the optimum of 870v?

The SRM detectors operate in the:

A. proportional region and detector output counts increase as detector voltage drifts high.

B. proportional region and the output counts decrease as detector voltage drifts low.

C. ionization region and the output increases as detector voltage drifts high.

D. ionization region and the output remains constant as detector voltage drifts high.

34. Given the following plant conditions:

- The operating crew has identified a S/G tube leak.
- AOP-R.01 has been implemented.
- Letdown flow = 75 gpm.
- 1 CCP is in service with charging valves FCV 62-93 and 89 full open.
- Charging flow = 160 gpm.
- Pressurizer level is stable at 58%.
- All other parameters are normal

Which ONE (1) of the following best estimates the total primary to secondary leak rate?

A. 55 gpm.

B. 75 gpm.

C. 85 gpm.

D. 150 gpm.

35. During operation at power steam generator tube leakage is detected and estimated at 250 gpm by the reactor operator. The following plant indications existed at that time:

    - RCS pressure – 2200 psig and decreasing
    - SG Pressures – 1000 psig

    The unit is tripped and plant parameters following the trip are:

    - RCS pressure – 1700 psig and decreasing
    - SG Pressures – 1100 psig

    Using the provided equation sheet, determine which ONE (1) of the below describes the leakage following the trip.

    A. one half of the initial leak rate or about 125 gpm.

    B. essentially equal to the initial leak rate or about 250 gpm.

    C. approximately 70% of the initial leak rate or about 175 gpm.

    D. One third of the initial leak rate or about 83 gpm.

36. Procedure FR-H.1, "Loss of Secondary Heat Sink", directs operators to stop all RCPs if actions to restore AFW flow are not successful.

Which ONE (1) of the following is the reason the RCPs are stopped in this situation?

A. Minimize the possibility of a tube rupture when AFW is eventually restored to the steam generators.

B. Conserve reactor coolant inventory by reducing seal leakoff.

C. Obtain increased safety injection flow by decreasing RCS cold leg pressure.

D. Conserve steam generator inventory by reducing RCS heat input.

37. Given the following plant conditions:

- Both units are at 100% power
- All systems are aligned normal

- Window A-5 is "125V DC VITAL BAT BD I ABNORMAL"
- Window A-4 is "125 V DC VITAL CHGR I FAILURE OR VITAL BAT I DISCHARGE"
- Window E-2 is "125V DC VITAL SPARE CHGR 1 FAILURE"

Which ONE (1) of the following sets of conditions would be indicative of a loss of a 125V DC Vital battery charger with the 125V DC battery supplying the board?

A. Annuciator window 1-XA-55-1C A-5 lit and 125V DC Volt meter selected to Batt I and indicating downscale to 75 Volts.

B. Annuciator window 1-XA-55-1C A-4 lit and EI-57-92 (Batt BD I AMPS) is indicating upscale from zero.

C. Annuciator window 1-XA-55-1C A-4 is lit and EI-57-92 (Batt BD I AMPS) is indicating downscale from zero.

D. Annuciator window 1-XA-55-1C E-2 is lit with 125V DC Voltmeter selected to Batt Bd I and indicating 129 Volts.

38. Which ONE (1) of the following is the maximum expected dose at the exclusion boundary that could be received by a person following an inadvertent release from a Waste Gas Decay tank?

A. A total body exposure of 0.2 rem.

B. Not more than the 10 CFR 100 "Reactor Site Criteria" iodine limit over a one hour period.

C. Not more than the 10 CFR 20 "Standards for Protection against Radiation" iodine limit over a two hour period.

D. A total body exposure of 0.5 rem.

39. Given the following plant conditions?
    - "1-RA-90-1C AREA RAD MON INSTR MALFUNC" alarm just came in on 0-XA-55-12A panel

Which ONE (1) of the following describes the three failures/actions that could cause this alarm?

A. -Instrument power failure OR
-MCR module placed in Source Check position OR
-Instrument down scale failure

B. -Instrument power failure OR
-MCR module placed in Source Check position OR
-MCR module placed in Trip Adjust position

C. -Instrument power failure OR
-MCR module placed in Trip Adjust position OR
-Instrument down scale failure

D. -Instrument down scale failure OR
-MCR module placed in Source Check position OR
-MCR module placed in Trip Adjust position

40. Given the following plant conditions:

- Unit 1 is responding to a LOCA
- ES-1.3 was completed and containment recirculation cooling is in progress
- The STA has identified an orange path on containment radiation

Which ONE (1) of the following best describes a high level action in FR-Z.3, High Containment Radiation?

A. VERIFY Containment Ventilation Isolation.

B. VERIFY ABGTS operation.

C. VERIFY Phase A isolation.

D. NOTIFY chem lab to sample the containment sump.

41. Given the following plant conditions:

- The Reactor is at 100% power.
- Pressurizer Level Transmitter 1-LI-68-339 is selected for control.
- All other systems are lined up for normal operation and in automatic.
- The REFERENCE LEG for 1-LI-68-339 is develops a leak.

Which ONE (1) of the following describes the short term (25 to 30 min.) response to this condition?

	1-LI-68-339 level Indication Will	1-LI-68-335 & 320 level Indication Will	VCT level Indication Will
A.	Increase	Decrease	Increase
B.	Decrease	Increase	Increase
C.	Increase	Decrease	Decrease
D.	Decrease	Increase	Decrease

42. Which ONE (1) of the following describes the function of the SFP bridge crane hoist "lower" limit gear operated switch?

A. Stops downward travel before the crane hook enters the water.

B. Stops downward travel before the fuel assembly reaches the bottom of the fuel cell.

C. Automatically changes hoist speed from fast to slow while the fuel assembly is in the fuel cell boundary.

D. Prevents bridge travel when the fuel assembly is within the fuel cell boundary.

43. Given the following plant conditions:

- The plant is at 100% power.
- The ERCW System is in a normal alignment.
- J-A ERCW pump is in service, in Auto, and selected for preferred start (Selector Switch 0-XS-67-225).
- Offsite power is lost to 6.9KV Start Bus 1B.
- 1A-A D/G responds to the event as designed
- Offsite power is now available to Start Bus 1B
- BO relays reset

Which ONE (1) of the following describes the operation of the J-A ERCW pump after the loss of power?

The pump breaker:

A. will trip and immediately reclose, the pump will start when D/G energizes the SD board. The pump can be normally shutdown at any time.

B. stays connected to the bus, the pump will start when the D/G energizes the board. The pump can be normally shutdown ONLY after the SD board is paralleled to offsite power.

C. will trip, the pump will start 15 seconds after the D/G energizes the SD board. The pump can be normally shutdown.

D. will trip, the pump will start 15 seconds after the D/G energizes the SD board. The pump can be shutdown ONLY after Q-A ERCW pump is selected for preferred start (Selector Switch 0-XS-67-225).

44. Given the following plant conditions:

- Unit 1 was operating at 80% power when a reactor trip occurred.
- Reactor trip breaker "A" will not open.
- PT-1-72, Turbine impulse pressure, has failed at 80% (as is)
- The Steam Dump Mode Select Switch is in the Tavg position

Which ONE (1) of the following describes the response of the Steam Dumps and Atmospheric Relief valves to these conditions?

	Atmospheric Relief valves	Steam Dump valves
A.	Opened	Opened
B.	NOT Opened	Opened
C.	Opened	Not Opened
D.	Not Opened	Not Opened

45. Given the following plant conditions:

- Unit 1 is at 30% power
- 1B Start Bus trips out on differential relay actuation

Which ONE (1) of the following describes effect on the plant?

A. 1B-B diesel generator starts and connects to the 1B-B 6.9 kV shutdown board.

B. Control rods insert at 72 steps/minute.

C. CVCS letdown isolates.

D. Reactor trips.

46. Given the following plant conditions:

- Unit 1 is increasing power from 50% to 100% power
- Boron concentration has been reduced from 1070 ppm to 1020 ppm
- Full load boron concentration has been calculated to be 1005 ppm

Which ONE (1) of the following describes the boron concentration differential limit between the RCS and the Pressurizer, and operator actions required to stay below this limit when changing the RCS boron concentration?

The differential limit is less than or equal to:

A. 10 ppm. It is maintained by turning on a PZR backup heater and allowing the PZR sprays to maintain RCS pressure.

B. 50 ppm. It is maintained by turning on a PZR backup heater and allowing the PZR sprays to maintain RCS pressure.

C. 10 ppm. It is maintained by "cracking open" a PZR spray valve and allowing the PZR backup heaters to cycle to maintain RCS pressure.

D. 50 ppm. It is maintained by "cracking open" a PZR spray valve and allowing the PZR backup heaters to cycle to maintain RCS pressure.

47. Given the following plant conditions:

- Unit 1 is performing a startup from Hot Standby to 100% power.
- Reactor power is 25% with RCS boron concentration of 520 ppm.

Which ONE (1) of the following describes the number of gallons of primary water needed to dilute the RCS by 75 ppm?

A. 9968 gallons ±10

B. 9938 gallons ±10

C. 9569 gallons ±10

D. 9272 gallons ±10

48. Which ONE (1) of the following supplies voltage for OPERATION of the SLAVE RELAYS in the SSPS output cabinets?

A. 15V DC from redundant power supplies in the SSPS cabinets.

B. 48V DC from a power distrubution bus in the SSPS cabinets.

C. 120V AC from redundant inverters in the SSPS cabinets.

D. 120V AC Vital Instrument Power from a distribution bus in the SSPS cabinets.

49. Which ONE (1) of the following describes how positive reactivity addition is minimized during a continuous rod withdrawal event?

A. Increasing the Rod Insertion Limit (RIL) as power increases.

B. Adjusting the positive rate reactor trip set point well below Tech Spec allowable values.

C. Maintaining the controlling bank slightly above the RIL to provide immediate negative reactivity.

D. Keeping rods well out of the core and above the rod insertion limit.

50. Given the following plant conditions:

- Unit 1 is conducting refueling operations with core ~~alterations~~ alterations in progress
- Source Range Monitors N-31 and N-32 are reading 10 cps.
- BOTH Intermediate Range Monitors are off scale LOW.
- Power Range Monitor N-41 is OOS with all appropriate BISTABLES TRIPPED.
- Power Range Monitor N-42 = 0%.
- Power Range Monitor N-43 = 0%.
- Power Range Monitor N-44 = 0%.

Which ONE (1) of the following describes the required actions if Power Range Monitor N-44 fails high?

A. Notify IMs to investigate the power range instrument failure and continue with core alterations.

B. Immediately stop all core alterations or positive reactivity changes and determine the boron concentration of the RCS at least once per 12 hours.

C. Ensure NR-45 recorder is selected to the intermediate range channels and continue with core alterations.

D. Immediately stop all core alterations and emergency borate per EA-68-4, "Emergency Boration".

51. Which ONE (1) of the following describes the annunciation "Reactor Coolant Saturation Margin Trouble"?

The annunciator will:

A. alarm if Reactor Coolant System pressure decreases by 40 psig while Reactor power is > 10% of rated thermal power.

B. alarm if RCS pressure decreases to 2205 psig and Reactor power is < 10% of rated thermal power.

C. alarm if RCS saturation margin is < 50 degrees and Reactor power is < 10% of rated thermal power.

D. alarm if RCS saturation margin is < 40 degrees and Reactor power is < 10% of rated thermal power.

52. During outages the CRDM motor power supply may be temporarily realigned to supply receptacle power in the lower containment.

Which ONE (1) of the following describe how this condition is controlled?

With the motor breaker racked out:

A. the motor leads are lifted and re-landed on the receptacle power pack. A TACF is placed on the breaker to identify this temporary condition.

B. the motor leads are lifted and re-landed on the receptacle power pack. A Caution Order is placed on the breaker to identify this temporary condition.

C. a transfer switch is aligned to supply power to the receptacle power pack. A TACF is placed on the breaker to identify this temporary condition.

D. a transfer switch is aligned to supply power to the receptacle power pack. A Caution Order is placed on the breaker to identify this temporary condition.

53. Given the following plant conditions:

- Unit 2 is in Mode 5 for repair of an RCP motor
- Containment purge is in service to the Upper and Lower compartments
- Containment equipment hatch is closed
- Upper and Lower containment personnel airlocks are closed

Which ONE (1) of the following describes the affect on the plant if the Lower Containment Personnel Airlock was breached to carry equipment into containment?

A. Auxiliary Building pressure will increase above the Tech Spec limit due to air flow out of containment.

B. Auxiliary Building Gas Treatment System will automatically start to limit Auxiliary Building pressure increase due to air flow out of containment.

C. The Ice Condenser lower inlet doors may come open due to a pressure imbalance.

D. The Ice Condenser upper deck doors may come open due to a pressure imbalance.

54. Given the following plant conditions:

- LOCA inside containment has occurred
- Containment pressure is 4.8 psid
- Containment sump level is 52%
- ECCS is operating in the Recirculation Mode
- Both containment spray pumps are in service

Which ONE (1) of the following describes the design features that prevent debris from plugging containment spray nozzles?

A. Water entering the sump must flow over an elevated curb and containment spray pump discharge strainers located in the 690' pipe chase.

B. Containment spray pump discharge strainers located in the 690' pipe chase and screens covering the two 14 " drain holes in the refueling cavity (upper to lower containment drains).

C. Screens covering the two 14 " drain holes in the refueling cavity (upper to lower containment drains) and a sloping grated screen over the sump opening.

D. Water entering the sump must flow over an elevated curb and a sloping grated screen over the sump opening.

55. Given the following plant conditions:
    - Unit 2 is starting up from cold shutdown conditions
    - Condensate and feedwater systems are shutdown

Which ONE (1) of the following describes the Caution in 2-SO-2/3-1 and basis for throttling the pump discharge valve prior to starting the first Hotwell pump?

The discharge valve is turned 25 turns from the fully:

A. open position to prevent damage to piping and hangers.

B. open position to prevent pump runout.

C. closed position to prevent damage to piping and hangers.

D. closed position to prevent pump runout.

56. Given the following plant conditions:

- Unit 1 is operating at 100%
- All control systems are normal in automatic.

Which ONE (1) of the following describes the plant response to a trip of Main Feed Pump turbine 1A?

A. The plant runs back to 80% load, the running Main Feedwater Pump accelerates to the high speed stop, Hotwell Pump 1A trips due to closing of Main Feedwater Pump 1A condenser isolation valves and Steam Generator levels control at 33%.

B. The plant runs back to 75% load, the running Main Feedwater Pump accelerates to the high speed stop, Hotwell Pump 1A trips due to closing of Main Feedwater Pump 1A condenser isolation valves, and Steam Generator levels control at 44%.

C. The plant runs back to 75% load, the running Main Feedwater Pump accelerates to the high speed stop, the Main Feed Pump 1A condenser isolation valves close, and Steam Generator levels control at 44%.

D. The plant runs back to 80% load, the running Main Feedwater Pump accelerates to the high speed stop, the Main Feed Pump 1A condenser isolation valves close, and Steam Generator levels control at 33%.

57. Which ONE (1) of the following describes the operation of the Unit 2 TDAFW LCVs following automatic actuation of the AFW system?

A. These valves go to the full open position and remain there until the S/G level reaches 33% Narrow Range, then the valves throttle to maintain 33% until operator action is taken.

B. These valves are controlled by a level controller that automatically positions the valves to maintain S/G level at 33% Narrow Range.

C. These normally open valves remain fully open until operator action is taken.

D. These normally closed valves go to the full open position and remain there until operator action is taken.

58. Given the following plant conditions:

- Unit 1 is operating at 100% RTP
- During a modification the 125 V DC breaker supplying power to the TDAFW pump Trip and Throttle valve was broken causing the breaker to open.
- The breaker cannot be reclosed and maintenance estimates it will take 2 hours to replace the broken breaker.

Which ONE (1) of the following describes the effects on the TDAFW while repairs are in progress?

The pump will not auto start for an accident condition AND:

A. Control power will be automatically restored by auto transfer to the alternate supply.

B. Control power can be manually restored by manual transfer to the alternate supply by transfer switch located on 125 V DC Battery board # 1.

C. Control power can be manually restored by manual transfer to the alternate supply by transfer switch located on a panel just outside the TDAFW pump room.

D. Control power can be manually restored by manual transfer to the alternate supply by the Nor/Alt selector switch located in the Auxiliary Control Room (ACR).

59. Which ONE (1) of the following describes the relationship between the Vital Battery # 1 and Vital Battery charger # 1?

Information:
EI-57-92 is the main control room amp meter for 125V DC Vital Battery # 1.

A. Negative 20 amps indicated on EI-57-92 indicates amp flow into the battery from the charger.

B. Negative 20 amps indicated on EI-57-92 indicates amp flow out of the battery to the 125V DC Vital Battery Board # 1.

C. Positive 20 amps indicated on EI-57-92 indicates amp flow into the battery from the charger.

D. Direction of amp flow cannot be determined using EI-57-92 because amp flow is independent of direction.

60. Given the following plant conditions:

- Waste condensate tank A release is in progress.
- Waste condensate tank A activity is within technical specification limits.
- Trip setpoint for radiation monitor RM-90-122 was adjusted based on tank samples.
- During the release RM-90-122 setpoint is exceeded, however the alarm (0-RA-90-122A WDS LIQ EFF MON HIGH RAD) did not work and Radiation Control Valve RCV-77-43 failed to close.

Which ONE (1) of the following describes the effect of RCV-77-43 failing to automatically terminate this release?

A. The release WILL be terminated by the radwaste operator who continously monitors RM-90-122 during liquid radwaste releases.

B. The release WILL be terminated by the control room operator who continously monitors RM-90-122 during liquid radwaste releases.

C. 10CFR20 limits WILL NOT be exceeded for the nearest potable water or surface water supply in an unrestricted area.

D. 10CFR20 limits WILL be exceeded for the nearest potable water or surface water supply in an unrestricted area.

61. Given the following plant conditions:

- A gas decay tank release is in progress.
- 0-XA-55-12B, "0-RA-90-118A WDS GAS EFF MON INSTR MALFUNC" alarm just came in on 0-XA-55-12B.

Which ONE (1) of the following describes the effects of loss of power to 0-RM-90-118?

A. 0-RCV-90-119 will close, the ABGTS fan will stop, and 0-FIC-90-119 must be set to zero, at local panel 0-L-2, prior to reopening 0-RCV-90-119.

B. 0-RCV-90-119 must be manually closed, at local panel 0-L-2, to terminate the release, the ABGTS fan will stop, and 0-FIC-90-119 must be set to zero prior to reopening 0-RCV-90-119.

C. 0-RCV-90-119 will close, the ABGTS fan will remain running, and 0-FIC-90-119 must be set to zero, at local panel 0-L-2, prior to reopening 0-RCV-90-119.

D. 0-RCV-90-119 must be manually closed, at local panel 0-L-2, to terminate the release, the ABGTS fan will remain running, and 0-FIC-90-119 automatically resets to zero so 0-RCV-90-119 can be reopened.

62. Given the following plant conditions:

- Unit 1 is operating at 100% RTP
- While transporting a container of radioactive liquid, a spill occurrs in the Auxiliary Building near the Unit 1 CCS heat exchanger
- The spill was reported to the operating crew by Radcon
- Area Radiation Monitor 1-RM-90-6 is trending up but has not yet alarmed

Which ONE (1) of the following describes the best method for the operating crew to determine the alarm setpoint for 1-RM-90-6 ?

A. Use 0-SO-90-5, Area Radiation Monitors

B. Use Tech Spec section 3/4.3.3.3.1 Radiation Monitoring Instrumentation

C. Use Annunciator Response Manual 0-AR-M12-A

D. Call instrument maintenance personnel and have them look in the setpoint and scaling document.

63. Which ONE (1) of the following combinations represents the RCS leak detection systems that are required to be OPERABLE during Mode 3 operations?

1. Upper containment atmosphere gaseous radioactivity monitor
2. Vessel flange leakoff temperature monitor
3. Containment purge air radioactivity monitor
4. Containment pocket sump level monitor
5. Lower containment atmosphere gaseous radioactivity monitor
6. Lower containment atmosphere particulate radioactivity monitor

A. 1, 2 & 5

B. 1, 3 & 4

C. 2, 3 & 6

D. 4, 5 & 6

64. Given the following plant conditions:

- Unit 2 was operating at 100% power
- A large break LOCA occurred
- Automatic reactor trip and Safety Injection occurred

Which ONE (1) of the following conditions would indicate an ECCS system misalignment during the injection phase?

A. The Charging Pump Injection Tank discharge valves FCV-63-25 and FCV-63-26 are OPEN.

B. Charging line isolation valves FCV-62-90 and FCV-62-91 are CLOSED.

C. The Volume Control Tank outlet valves are CLOSED.

D. Charging pump mini-flow valves are CLOSED.

65. Given the following plant conditions:

- All controls are in automatic
- PT-68-322, PZR pressure transmitter, had previously failed and all actions of AOP-I.04 are complete
- Pressure control is selected for PT-68-340 & 334
- PT-68-340 fails high
- The PZR Pressure Control System operates as designed after this failure

Which ONE (1) of the following describes the response of the PZR PORVs for this event? (Assume NO operator action.)

A. PCV-68-340 opens, then closes at 2315 psig actual PZR pressure, decreasing.

B. PCV-68-340 opens, then does not close at 2315 psig actual PZR pressure, decreasing.

C. PCV-68-340 and PCV-68-334 open, then close at 2315 psig actual PZR pressure, decreasing.

D. PCV-68-340 and PCV-68-334 open, then do not close at 2315 psig actual PZR pressure, decreasing.

66. Given the following plant conditions:

- The plant is operating at 10% power during a startup
- S/G level control is in automatic on bypass regulating valves
- A significant leak develops in the reference leg for LT-3-174, S/G level input to FCV-3-35A for #1 S/G
- The condensing pot is unable to keep up with the leak.

Which ONE (1) of the following describes the response of the plant (assuming no operator action)?

A. The turbine will trip on S/G Hi-Hi level.

B. The reactor will trip on S/G Lo-Lo level.

C. The #1 S/G level will increase but MFP speed will decrease to prevent going above the S/G Hi-Hi trip setpoint.

D. The #1 S/G level will decrease but MFP speed will increase to prevent going below the S/G Lo-Lo trip setpoint.

67. Given the following plant conditions:

- Unit 1 is responding to a LOCA using E-1 procedure
- RCS dose equivalent Iodine-131 activity is 290 micro curies per gram

Which ONE (1) of the following describes a method or design feature used to reduce the iodine-131 concentration in the containment atmosphere AND reduce the potential for inadvertent release of Iodine from the containment?

A. When containment iodine exceeds Tech Spec limits, E-1 directs the venting of the containment to reduce the concentration to within limits

B. When containment iodine exceeds Tech Spec limits, E-1 directs the purging of the containment to reduce the concentration to within limits.

C. Containment spray water from the RWST will remove elemental iodine from the containment atmosphere.

D. A sodium tetraborate additive in the ice will remove elemental iodine from the containment atmosphere.

68. Given the following plant conditions:

- Unit 2 has operated at 100% power for the last 120 days
- A large LOCA occurred with resultant RX trip and SI
- Containment hydrogen concentration is increasing

Which ONE (1) of the following describes the method of containment hydrogen removal?

A. The hydrogen is burned by electrically heating the air mixture to a ignition temperature.

B. Hydrogen Recombiners should be placed in service after hydrogen analyzers have been operating for 30 minutes OR Hydrogen analyzer reading has been verified by chem lab results.

C. Hydrogen Recombiner operation is acceptable less than 6% hydrogen concentration; TSC approval must be obtained to operate above 6%.

D. Containment Purge fans must be operated first to reduce containment hydrogen concentrations to less than 4% before operating the Hydrogen Recombiners.

69. Given the following plant conditions:

- Unit 1 is in Mode 4.
- A containment purge is in progress in preparation for refueling.
- During a maintenance activity, RM-90-130 was placed and held in the source check postion WITHOUT placing HS-90-136A1 in the RM-90-130 position.

Which ONE (1) of the following describes the response of the containment purge system to these conditions?

A. Only Train A containment purge isolation valves isolate.

B. Only Train B containment purge isolation valves isolate.

C. Neither Train A or B containment purge isolation valves isolate.

D. Both Train A and B containment purge isolation valves isolate.

70. Given the following plant conditions:

- Unit 1 is in a refueling outage
- Core unloading is in progress

Which ONE (1) of the following describes the movement of a fuel assembly from the reactor core to the Rx side upender?

A. The manipulator crane bridge travels South (right) until out of the core region. Then the trolley travels East(forward) to the cavity wall. Then the bridge travels South (right) to the upender.

B. The manipulator crane trolley travels South (right) until out of the core region. Then the bridge travels East (forward) to the cavity wall. Then the trolley travels South(right) to the upender.

C. The manipulator crane trolley moves East (forward) to cavity wall. Then the bridge travels South (right) to the upender.

D. The manipulator crane bridge travels South (right) until it aligns with the upender. Then the trolley travels East (forward) to the upender.

71. Given the following plant conditions:

- Unit 1 is operating at 50% power
- The # 1 SG controlling pressure transmitter fails HIGH

Which ONE (1) of the following describe the INITIAL feedwater flow response AND the correct operator action?

A. The feedwater flow would decrease due to the failure of the steam pressure input to the steam flow signal AND the operator should place the # 1 SG LCV in Man and restore feedflow to match steam flow.

B. The feedwater flow would increase due to the failure of the steam pressure input to the steam flow signal AND the operator should place the # 1 SG LCV in Man and restore feedflow to match steam flow.

C. The feedwater flow would decrease due to the failure of the steam pressure input to the steam flow signal AND the operator should leave the # 1 SG LCV in Auto because SG level is the dominant control signal and will restore feedflow to match steam flow.

D. The feedwater flow would increase due to the failure of the steam pressure input to the steam flow signal AND the operator should leave the # 1 SG LCV in Auto because SG level is the dominant control signal and will restore feedflow to match steam flow.

72. Given the following plant conditions:

- Unit 1 is operating at 100% power.
- The turbine building AUO is working with maintenance in the 2C MSR doghouse.
- The 2C MSR doghouse is designated as an area sensitive to portable radio operation.

Which ONE (1) of the following describes a correct method of communication between the Main Control Room operator and the Turbine building AUO in the MSR doghouse?

A. A radio with a white antenna may be used for two way communication ONLY if it is >1 meter from sensitive equipment.

B. A radio with a black antenna may be used for two way communication ONLY if it is >1 meter from sensitive equipment.

C. A radio with a black antenna may be used for receiving ONLY.

D. A radio with a white antenna may be used for transmission ONLY.

73. Which ONE (1) of the following statements correctly describe the requirement(s) for safety grounds when used on plant equipment, in conjunction with a clearance?

A. Prior to being issued a clearance, the person responsible for the work MUST ensure all safety grounds have been placed and numbered ground discs attached as required.

B. After a clearance released, the person responsible for the work MUST ensure all safety grounds have been removed and numbered ground discs returned to their storage cabinet.

C. Operations personnel picking up a clearance on the 6.9 KV Unit Board are REQUIRED to open the compartment doors and verify removal of three phase ground wires.

D. Following the issue of a clearance requiring three-phase grounds, a ground disc on the ground side of each phase is required except where a single device provides a 3-phase ground.

74. Given the following plant conditions:

- Unit 1 was operating at 100% power.
- A Loss of Offsite Power occurred.
- All four diesel generators started and connected to their shutdown boards.
- 1A-A diesel generator automatic voltage regulator FAILS to respond as loads are sequenced on to the 1A-A shutdown board.

Which ONE (1) of the following describes the effects of this failure on ESF equipment powered from the 1A-A shutdown board?

A. Voltage adjustments WILL be made by the operator after selecting manual voltage control; no significant effect on ESF equipment.

B. The degraded voltage relays WILL NOT load shed ESF equipment because they are removed from service following an emergency start.

C. When voltage drops to degraded voltage relays setpoint, ESF equipment WILL load shed.

D. Shutdown board voltage WILL NOT drop to degraded voltage setpoint as long as DG load is maintained <4000 KW.

75. Given the following information:
    - Work is to be performed in a high radiation area.
    - Dose rate in the work area as 1.2 R/hr.
    - Worker's maximum dose is 200 mRem.

Which ONE (1) of the following describes the maximum work time for the workers without exceeding the their maximum dose?

A. 100 minutes

B. 10 minutes

C. 6 minutes

D. 1.67 minutes

76. Given the following plant conditions:

- Both units were operating at 100% power.
- A failure of Chickamaugea Dam locks causes river level at the plant to decrease to the 667' elevation.

Which ONE (1) of the following components will be lost and require procedural guidance to restore the feature?

Loss of cooling water :

A. to the auxiliary control air compressors.

B. to the ice condenser chiller packages.

C. control building electrical board room air conditioner units.

D. 480V Shutdown Board room 1A-A and 2A-A air conditioner units.

77. Given the following plant conditions:

- Air receiver #1 pressure is 96 psi and steady
- Air receiver #2 pressure is 99 psi and steady
- Service air receiver pressure is 78 psi and decreasing

Which ONE (1) of the following describes the cause of decreasing service air receiver pressure?

A. Loss of compressors A & B sequencer power.

B. Stuck open blowdown valve on air dryer A tower # 1.

C. Pressure control valve 0-PCV-33-4 failed open.

D. Loss of power to pressure control valve 0-PCV-33-4.

78. Given the following plant conditions:

- High pressure fire protection water spray was used to extinguish a fire in the turbine building.
- During fire fighting activities, a large volume of water was sprayed directly on a 480V limitorque motor operated valve (MOV).

Which ONE (1) of the following is correct regarding water damage to this MOV from this water spray?

A. No damage. Limitorque motors and valve position limit switches are in sealed water tight housings to prevent water from contacting electrical components.

B. No damage. Water may enter the housing that surround the motor and limit switches, however, electrical components are designed to operate submerged in water.

C. Potential damage. Valve position limit switches are in sealed water tight housings to prevent water from contacting electrical components, however, limit torque motors are not sealed and spray water contacting the motor windings could cause a short and damage the motor.

D. Potential damage. Limitorque motors are sealed to prevent water from contacting the motor, however, valve position limit switches are located outside the sealed housing and shorted out limit switches could cause inadvertent component operation.

79. Which ONE (1) of the following describes the system isolation / component actuations that will occur upon MANUAL actuation of 2-HS-30-68A and 2-HS-30-68B, Phase B Actuation handswitches?

A. Main Steam Isolation Valves will close.

B. Emergency Gas Treatment Fans will start.

C. CVCS Excess Letdown out of containment will close.

D. Containment Spray Pump 2A-A Room Cooler will start.

80. Which ONE (1) of the following describes the method used to cool the Pressurizer Relief Tank (PRT)?

A. Spray from Primary Water into the top of the PRT and drain to the Reactor Coolant Drain Tank (RCDT) pump suction line.

B. Spray from Primary Water into the bottom of the PRT and drain directly to the Reactor Coolant Drain Tank (RCDT).

C. Spray from CVCS charging line into the top of the PRT and drain to the Reactor Coolant Drain Tank (RCDT) pump suction line.

D. Spray from CVCS charging line into the bottom of the PRT and drain directly to the Reactor Coolant Drain Tank (RCDT).

81. Given the following plant conditions:

- Unit 1 is operating at 100% power.
- CCS surge tank level was increasing but is now stable.
- "1-RA-90-123A CCS LIQ EFF MON HIGH RAD" Alarm is LIT.
- Surge tank vent valve is closed.

Which ONE (1) of the following describes the control board indications that are consistent with the above conditions?

The thermal barrier containment isolation inlet and outlet valves:

A. to the affected RCP close (the non-affected RCPs isolation valves remain open), and the thermal barrier booster pumps trip.

B. to the affected RCP close (the non-affected RCPs isolation valves remain open), the inlet and outlet CCS valves to the RCP oil coolers close, and the thermal barrier booster pumps continue to run with miniflow valves open.

C. to all 4 RCPs close, the inlet and outlet CCS valves to the RCP oil coolers remain open, and the thermal barrier booster pumps trip.

D. to all 4 RCPs close, the inlet and outlet CCS valves to the RCP oil coolers are not affected, and the thermal barrier booster pumps continue to run with miniflow valves open.

82. Given the following plant conditions and information:

- Unit 1 was operating at 100% power
- A Safety Injection just occurred on Unit 1

For information:
- 0-FCV-67-152 is the CCS HX 0B1 and 0B2 outlet valve
- 1-FCV-67-146 is the CCS HX 1A1 and 1A2 outlet valve

Which ONE (1) of the following describes the operation of the ERCW outlet valves from the CCS heat exchangers as a result of the SI signal?

A. 0-FCV-67-152 automatically goes to the full open position.
1-FCV-67-146 automatically goes to the full open position.

B. 0-FCV-67-152 automatically goes to the 35% position.
1-FCV-67-146 automatically goes to the 35% position.

C. 0-FCV-67-152 automatically goes to the 35% position.
1-FCV-67-146 remains in it's current position.

D. 0-FCV-67-152 remains in it's current position.
1-FCV-67-146 automatically goes to the 35% position.

83. Given the following plant conditions:

- Both units were operating at 100% power.
- A loss of offsite power occurred.
- Both units automatically shutdown.
- All four DG started and energized their respective shutdown boards.

Which ONE (1) of the following describes the required actions to restore the air system service prior to restoration of offsite power?

A. No action is necessary, air compressors A, B, C, and D will be sequenced back on by the Blackout Sequencer.

B. Air compressors A, B, C, and D can be reset and started locally at any time.

C. Air compressors A and B can be reset and started locally at any time.

D. Air compressors A and B can be reset and started locally after the Blackout Relays are reset.

84. Given the following plant conditions:
    - Unit 1 is in Mode 4.
    - Shift turnover is in progress.
    - Unit 2 is at 100% and the on coming staffing will meet Tech Specs.
    - You are the oncoming SM.
    - One of your Unit 1 operators has called and will be one hour late.
    - The operators in the offgoing crew have all worked 16 hours.

    One licensed Senior Reactor Operator, and One certified (non-licensed) UO are present for the oncoming Unit 1 crew.

    Which ONE (1) of the following is the necessary course of action for staffing Unit 1 in accordance with Technical Specifications (TS)?

    A. No action required because only two ROs are required in the Control Room for these conditions.

    B. No action required because three RO's are required for Mode 4 but TS allow the crew to be short one RO for up to two hours to account for unexpected absences.

    C. Have the Plant Manager authorize performance of BOP duties by a certified UO (non-licensed) until the late licensed RO arrives.

    D. Obtain Plant Manager authorization to hold one RO over from the offgoing crew because three RO's are required for these conditions.

85. Unit 1 is steady at 100% RTP. One RPS PressurizerLevel channel has just failed high and been declared inoperable. All other channels are operable.

Which ONE (1) of the following Technical Specification actions apply in this event?

A. Place the failed channel in TRIP within 1 hour.

B. Place the failed channel in TRIP within 6 hours.

C. Be in at least Hot Standby within 1 hour.

D. Be in at least Hot Standby within the next 6 hours.

86. Which ONE (1) of the following describe an INCORRECT use of the Safety Parameters Display System (SPDS)?

A. The SPDS may be used during normal plant operations for trending or displaying plant data.

B. The SPDS may be used during accident conditions as an operator aid for evaluating the status of the plant.

C. The SPDS may be used during plant heatup or cooldown as an aid for monitoring vessel fracture toughness requirements.

D. The SPDS may be used during an accident to verify that a Critical Safety Function restoration instruction is required to be used.

87. When restarting the unit after a trip, a NOTE in 0-GO-2 gives specific guidance about when the operations staff is to declare mode 2.

Which ONE (1) of the following is the correct time to declare MODE 2 per this procedure?

The unit enters mode 2 administratively when:

A. the control banks are first withdrawn.

B. the shutdown banks are first withdrawn.

C. the Keff is > .99 and RCS Temperature is > 350°F with Reactor Power less than 5%.

D. reactor power is greater than or equal to 1% and RCS Temperature is > 540°F.

88. Which ONE (1) of the following describes the three Steady State Activity/Chemistry Limits for the RCS in MODE 1?

A. Dose Equivalent 1-131 - 1.0 *u*ci/gm
Chloride and Fluoride - 0.15 ppm
Dissolved Oxygen - 0.10 ppm

B. Dose Equivalent 1-131 - 1.0, *u*ci/gm
Chloride and Fluoride - 0.15 ppm
Dissolved Oxygen - 1.0 ppm

C. Dose Equivalent 1-131 - .35 *u*ci/gm
Chloride and Fluoride - 1.5 ppm
Dissolved Oxygen - 1.0 ppm

D. Dose Equivalent 1-131 - .35 *u*ci/gm
Chloride and Fluoride - 0.15 ppm
Dissolved Oxygen - 0.10 ppm

89. Given the following plant conditions:
    - A plant change request form is in the approval process.
    - The proposed modification will alter nuclear safety related structures, systems, and components.

    Which ONE (1) of the following describes who must approve the change prior to implementation?

    A. Maintenance and MODs Manager

    B. Site Vice President

    C. Plant Manager

    D. Engineering and Support Manager

90. Given the following plant conditions:

- A special test of plant equipment has been proposed/
- You have been asked to determine if an Unresolved Saftey Question (USQ) might be caused by this special test

Which ONE (1) of the following describes three circumstances that would indicate a USQ exist?

A. -Increased probability of an accident previously evaluated in the SAR
OR
-Increased consequences of an accident previously evaluated in the SAR
OR
-Reduced safety margin as defined in the basis of any Tech Spec

B. -Increased probability of an accident previously evaluated in the SAR.
OR
-Increased consequences of an accident previously evaluated in the SAR.
OR
-Increased probability of failure of non-safety related equipment needed for full load operation.

C. -Increased consequences of an accident previously evaluated in the SAR.
OR
-Reduced safety margin as defined in the basis of any Tech Spec.
OR
-Increased probability of an injury to plant personnel.

D. -Increased consequences of an accident previously evaluated in the SAR
OR.
-Increased probability of an injury to plant personnel.
OR
-Increased probability of failure of non-safety related equipment needed for full load operation.

91. Given the following plant conditions:

- Unit is shutdown for refueling.
- Containment Spray (CS) Pump 1B-B is out of service and tagged for maintenance.
- CS pump 1B-B discharge valve,1-FCV-72-39, was discovered to be leaking through and had to be hand-tightened 1.5 turns using the handwheel.
- A valve wrench (cheater) was NOT used on the discharge valve handwheel.

Which ONE (1) of the following is required because the valve was manually tightened?

A. The valve remains OPERABLE because a valve wrench (cheater) was not required to manually seat the valve.

B. The valve must be declared INOPERABLE until the valve is stroked open then closed using the motor.

C. The valve is to be declared and remain INOPERABLE until the handwheel can be rotated 1.5 turns in the open direction after maintenance is complete.

D. The valve is to be declared and remain INOPERABLE until Systems Engineering develops an action plan to restore operability.

92. Given the following plant conditions:

- Unit 1 is in Mode 3. Unit 2 is in Mode 1.
- 1A-A CCP is in service for normal charging
- 1B-B CCP is in standby.
- Both trains of RHR are aligned normal.
- 1B-B DG is inoperable and tagged for a 1 hour repair.
- Maintenance has requested 1-FCV-74-35 (1B RHR crosstie valve) be closed so minor maintenance can be performed.

Which ONE (1) of the following would be the correct response to this maintenance request?

A. Allow the work since Tech Specs allows 72 hours for this maintenance.

B. Allow the work since 1B-B RHR is inop due to the DG being inoperable.

C. Do NOT allow the work since the 1B-B DG is inoperable.

D. Do NOT allow the work since both trains of RHR would be inoperable.

93. Due to conditions causing Control Room Inaccessibility, the main control room has been abandoned and all checklists are complete. Hot Standby conditions are being maintained from the Auxiliary Control Room when 2B-B 6.9-kV S/D Bd. experiences a loss of voltage.

Which ONE (1) of the following is the expected response by the operating staff for this condition?

A. Check Diesel Generators running and all auto-connected to the 6.9-kV S/D Boards.

B. Ensure Diesel Generators running and dispatch personnel to manually close the 2B-B 6.9-kV S/D Board Emergency Feeder Bkr. Verify 2B-B D/G connected to 2B-B 6.9-kV S/D Bd.

C. Verify Diesel Generators running and dispatch personnel to manually close all 6.9-kV S/D Bd. Emergency Feeder Breakers. Verify all D/Gs connected to the 6.9-kV S/D Boards.

D. Verify D/Gs running and 2B-B D/G auto-connected to the 2B-B 6.9-kV S/D Board.

94. Given the following plant conditions:

- A General Emergency has been declared on Unit 1 due to a LOCA in the El. 653 pipe chase
- An offsite release is in progress due to this leak
- A worker isolating the leak suffered a heart attack
- An emergency responder has volunteered to go in to remove the injured worker
- The volunteer has a current year-to-date exposure of 3 rem

Which ONE of the following describes the MAXIMUM dose the emergency responder could be allowed to receive for this activity?

A. 10 rem TEDE

B. 7 rem TEDE

C. 25 rem TEDE

D. 22 rem TEDE

95. Given the following plant conditions:

An AUO is required to perform a valve checklist in the 690 pipe chase. The following conditions exist:

- area dose rate = 20 mrem/hr
- some airborne radioactivity present
- working with respirator = 1 hr to complete
- working without respirator = 1/2 hr to complete
- working without respirator = 1.3 DAC hrs internal exposure
- 1 DAC-hr = 2.5 mrem

Which ONE (1) of the following is correct concerning this situation?

A. The AUO should complete the work WITH a respirator in order to receive the smaller TEDE.

B. The AUO should complete the work WITHOUT a respirator in order to receive the smaller TEDE.

C. The TEDE would be the same WITH or WITHOUT a respirator.

D. The AUO should require another person to enter the area to assist with the checklist and NEITHER would wear a respirator.

96. Given the following plant conditions:

- Unit 2 is operating at 100% RTP
- Chemistry reports RCS specific activity has increased 100 / E-bar microcuries/gm
- The SM directs the crew to shut down the reactor to HOT STANDBY with T-avg <500 degrees within the next 6 hours.

Which ONE (1) of the following is the reason for reducing T-avg below 500 degrees F?

A. Prevent additional fuel cladding oxidation and pellet-cladding interaction.

B. Prevent the release of activity if a Steam Generator Tube Rupture occurs.

C. Enhance the ability of the mixed-bed demineralizers to remove ionic fission products.

D. Minimize the deposition of particulate fission and activation products on surfaces within the core.

97. Given the following plant conditions:

- Unit 2 is experiencing a degraded core cooling condition and the crew is progressing thru FR-C.2.
- FR-C.2 directs the operator stop all RCPs.
- After stopping all RCPs, the STA identifies a red condition for Core Cooling.

Which ONE (1) of the following best describes the RED condition on Core Cooling.

A. The operators should restart one RCP and continue in FR-C.2.

B. The operators should restart all RCPs and continue in FR-C.2.

C. The red condition was caused when the RCPs were removed from service, a previous step exempts transition to FR-C.1.

D. The red condition was caused when the RCPs were removed from service and the crew should transition to FR-C.1.

98. Given conditions of a Control Room Inaccessibility, which ONE (1) of the following is correct concerning Unit 1 OATC duties after leaving the main control room?

A. If offsite power is lost during this emergency, closes running Diesel Generators breaker to energize the 6.9-KV Shutdown Boards.

B. Calculates from unit boration tables the amount of boron required to achieve adequate shutdown margin for cold shutdown.

C. Distribute all Checklist and Appendix A.

D. Places all transfer switches on Auxiliary Control Room panels 1-L-11A and 1-L-11B in the AUX position according to Checklist.

99. Given the following plant conditions:

- Unit 1 is operating at 95% RTP
- Unit 2 is in Mode 6 with core alterations in progress
- At 0435 hours the OATC notices all Unit 2 annunciators windows change to dark condition
- The US is able to return Channel B annunciators to operable condition at 0500 hours

The SM stops all Core Alterations at 0440.

Which ONE (1) response below describes the required REP classification for the given conditions.

A. No Emergency Action Level (EAL) exceeded

B. Notification Of Unusual Event

C. Alert

D. Site Area Emergency

100. Given the following plant conditions:

- Unit 2 is operating at 100% RTP
- Condenser Vacuum Pump air exhaust monitor high Radiation alarm come in
- PZR level chart recorder indicates a slight decrease in level trend, followed by a return to normal
- RCS leak calculation shows RCS leakage has increased by 9 gpm
- The affected SG has been identified

Which ONE (1) of the following describes the NEXT operation required by the crew?

A. Commence plant shutdown and be in HOT STANDBY within 10 hours.

B. Shut the MSIV on the affected S/G and commence plant shutdown.

C. Isolate blowdown from the affected S/G to prevent contamination and continue power operation.

D. Increase S/G blowdown from the affected S/G to remove any radioactivity accumulation and continue power operations.

3/4.4.8 SPECIFIC ACTIVITY

LIMITING CONDITION FOR OPERATION

3.4.8 The specific activity of the primary coolant shall be limited to:

a. Less than or equal to 0.35 microcuries/gram DOSE EQUIVALENT I-131, and | R241

b. Less than or equal to $100/\overline{E}$ microcuries/gram.

APPLICABILITY: MODES 1, 2, 3, 4 and 5

ACTION:

MODES 1, 2 and 3*

a. With the specific activity of the primary coolant greater than 0.35 microcuries/gram DOSE EQUIVALENT I-131 for more than 48 hours during one continuous time interval or exceeding the limit line shown on Figure 3.4-1, be in at least HOT STANDBY with T_{avg} less than 500°F within 6 hours. | R121 | R241

b. With the specific activity of the primary coolant greater than $100/\overline{E}$ microcuries/gram, be in at least HOT STANDBY with T_{avg} less than 500°F within 6 hours. | R121

MODES 1, 2, 3, 4 and 5

a. With the specific activity of the primary coolant greater than 0.35 microcuries/gram DOSE EQUIVALENT I-131 or greater than $100/\overline{E}$ microcuries/gram, perform the sampling and analysis requirements of item 4a of Table 4.4-4 until the specific activity of the primary coolant is restored to within its limits. | R241

| R121

*With T_{avg} greater than or equal 500°F.

SURVEILLANCE REQUIREMENTS

4.4.8 The specific activity of the primary coolant shall be determined to be within the limits by performance of the sampling and analysis program of Table 4.4-4.

TABLE 4.4-4

PRIMARY COOLANT SPECIFIC ACTIVITY SAMPLE AND ANALYSIS PROGRAM

TYPE OF MEASUREMENT AND ANALYSIS	SAMPLE AND ANALYSIS FREQUENCY	MODES IN WHICH SAMPLE AND ANALYSIS REQUIRED
1. Gross Activity Determination	At least once per 72 hours	1, 2, 3, 4
2. Isotopic Analysis for DOSE EQUIVALENT I-131 Concentration	1 per 14 days	1
3. Radiochemical for $\bar{E}$ Determination	1 per 6 months*	1
4. Isotopic Analysis for Iodine Including I-131, I-133, and I-135	a) Once per 4 hours, whenever the specific activity exceeds 0.35 μCi/gram DOSE EQUIVALENT I-131 or 100/E μCi/gram, and	1#, 2#, 3#, 4#, 5#
	b) One sample between 2 and 6 hours following a THERMAL POWER change exceeding 15 percent of the RATED THERMAL POWER within a one hour period.	1, 2, 3

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#Until the specific activity of the primary coolant system is restored within its limits.

*Sample to be taken after a minimum of 2 EFPD and 20 days of POWER OPERATION have elapsed since the reactor was last subcritical for 48 hours or longer.

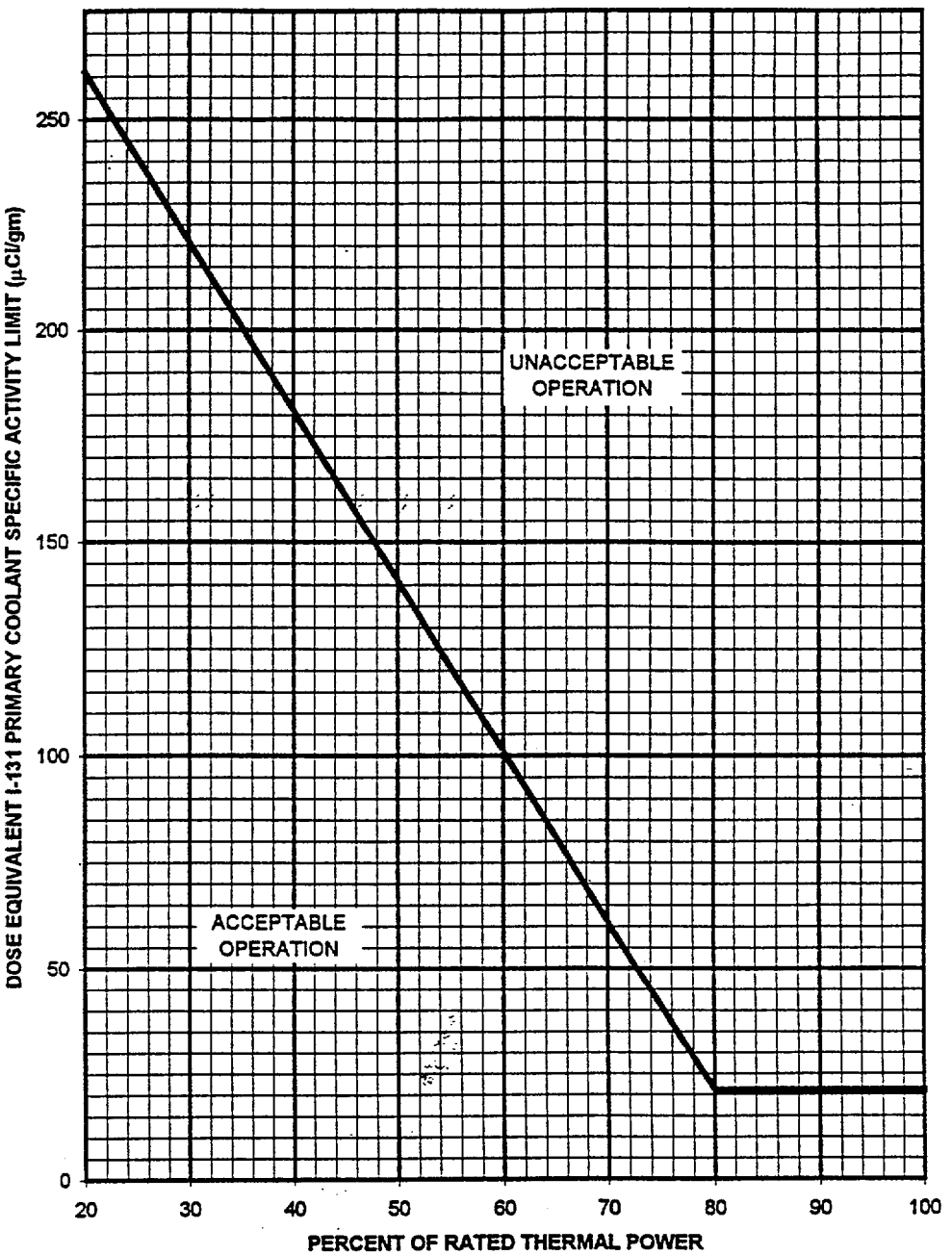

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FIGURE 3.4-1
DOSE EQUIVALENT I-131 Primary Coolant Specific Activity Limit Versus Percent of RATED THERMAL POWER with the Primary Coolant Specific Activity > 0.35 µCi/gram Dose Equivalent I-131

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2.1 Loss of Instrumentation

	Mode	Initiating / Condition
GENERAL EMERGENCY		*Refer to "Fission Product Barrier Matrix" (Section 1) and "Radiological Effluents" (Section7) and Continue in This Column.*
SITE AREA EMERGENCY	1, 2, 3, 4	**On either unit an inability to monitor a SIGNIFICANT TRANSIENT in progress *(1 and 2 and 3 and 4):***
	1,	1.Loss of > 75% of MCR annunciators and the annunciator printer or > 75% of safety system indications.
	2,	2. Loss of Plant Computer.
	3,	3. Inability to directly monitor any of the following CSFs: Subcriticality, PTS, Core Cooling, Containment, Heat Sink, Inventory
	4	4. **SIGNIFICANT TRANSIENT** in progress.
ALERT	1, 2, 3, 4	**On either unit an UNPLANNED loss of >75% MCR annunciators and annunciator printer or > 75% of safety system indications for > 15 minutes with a SIGNIFICANT TRANSIENT in progress or plant computer unavailable. *(1 and 2 and 3):***
	1,	1. **UNPLANNED** loss of >75% MCR annunciators and the annunciator printer for >15 minutes or > 75% of safety system indications for > 15 minutes.
	2,	2. SM/SED judgment that increased surveillance is required (> shift compliment) to safely operate the unit.
	3,	3. (a or b)
	4	a. **SIGNIFICANT TRANSIENT** in progress. OR b. Loss of plant computer.
UNUSUAL EVENT	1, 2, 3, 4	**On either unit an UNPLANNED loss > 75% MCR annunciators and annunciator printer or > 75% of safety system indications for > 15 minutes and plant computer available. *(1 and 2 and 3):***
	1,	1. **UNPLANNED** loss of >75% of MCR annunciators and the annunciator printer for > 15 minutes or > 75% of safety system indicators for > 15 minutes.
	2,	2. SM/SED judgment that increased surveillance is required (> shift compliment) to safely operate the unit.
	3,	3. The plant computer is capable of displaying requested data.
	4	

2.2 Loss of Communication

Mode	Initiating / Condition
	Not Applicable.
	Not Applicable.
	Not Applicable.
ALL	**A. UNPLANNED loss of all in-plant communication capability *(1 and 2 and 3):***
	1. **UNPLANNED** loss of EPABX phones.
	2. **UNPLANNED** loss of all sound powered phones.
	3. **UNPLANNED** loss of all radios.
	OR
	B. UNPLANNED loss of all offsite communication capability *(1 and 2 and 3 and 4 and 5):*
	1. **UNPLANNED** loss of all EPABX phones
	2. **UNPLANNED** loss of all radio frequencies
	3. **UNPLANNED** loss of all OPX (Microwave)system
	4. **UNPLANNED** loss of all 1-FB-Bell lines
	5. **UNPLANNED** loss of all FTS 2000 (NRC) system

3/4.3 INSTRUMENTATION

3/4.3.1 REACTOR TRIP SYSTEM INSTRUMENTATION

LIMITING CONDITION FOR OPERATION

3.3.1.1 As a minimum, the reactor trip system instrumentation channels and interlocks of Table 3.3-1 shall be OPERABLE. R194

APPLICABILITY: As shown in Table 3.3-1.

ACTION:

As shown in Table 3.3-1.

SURVEILLANCE REQUIREMENTS

4.3.1.1.1 Each reactor trip system instrumentation channel and interlock shall be demonstrated OPERABLE by the performance of the CHANNEL CHECK, CHANNEL CALIBRATION and CHANNEL FUNCTIONAL TEST operations for the MODES and at the frequencies shown in Table 4.3-1. R16

4.3.1.1.2 The logic for the interlocks shall be demonstrated OPERABLE prior to each reactor startup unless performed during the preceeding 92 days. The total interlock function shall be demonstrated OPERABLE at least once per 18 months during CHANNEL CALIBRATION testing of each channel affected by interlock operation.

4.3.1.1.3 The REACTOR TRIP SYSTEM RESPONSE TIME of each reactor trip function shall be verified to be within its limit at least once per 18 months. Neutron detectors are exempt from response time testing. Each verification shall include at least one train such that both trains are verified at least once per 36 months and one channel per function such that all channels are verified at least once every N times 18 months where N is the total number of redundant channels in a specific reactor trip function as shown in the "Total No. of Channels" column of Table 3.3.1. R255

TABLE 3.3-1

REACTOR TRIP SYSTEM INSTRUMENTATION

FUNCTIONAL UNIT	TOTAL NO. OF CHANNELS	CHANNELS TO TRIP	MINIMUM CHANNELS OPERABLE	APPLICABLE MODES	ACTION
1. Manual Reactor Trip	2	1	2	1, 2, and *	1
2. Power Range, Neutron Flux	4	2	3	1, 2	2#
3. Power Range, Neutron Flux High Positive Rate	4	2	3	1, 2	2#
4. Power Range, Neutron Flux, High Negative Rate	4	2	3	1, 2	2#
5. Intermediate Range, Neutron Flux	2	1	2	1, 2, and *	3
6. Source Range, Neutron Flux					
A. Startup	2	1	2	2##, and *	4
B. Shutdown	2	0	1	3, 4 and 5	5
7. Overtemperature Delta T Four Loop Operation	4	2	3	1, 2	6#
8. Overpower Delta T Four Loop Operation	4	2	3	1, 2	6#
9. Pressurizer Pressure-Low	4	2	3	1, 2	6#
10. Pressurizer Pressure--High	4	2	3	1, 2	6#
11. Pressurizer Water Level--High	3	2	2	1, 2	6#

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TABLE 3.3-1 (Continued)

REACTOR TRIP SYSTEM INSTRUMENTATION

FUNCTIONAL UNIT	TOTAL NO. OF CHANNELS	CHANNELS TO TRIP	MINIMUM CHANNELS OPERABLE	APPLICABLE MODES	ACTION	
12. Loss of Flow - Single Loop (Above P-8)	3/loop	2/loop in any operating loop	2/loop in each operating loop	1	6#	
13. Loss of Flow - Two Loops (Above P-7 and below P-8)	3/loop	2/loop in two operating loops	2/loop each operating loop	1	6#	
14. Main Steam Generator Water Level--Low-Low						
A. Steam Generator Water Level -- Low-Low (Adverse)	3/Stm. Gen.	2/Stm. Gen. in any operating Stm. Gen.	2/ Stm. Gen. in each operating Stm. Gen.	1,2	9#	
B. Steam Generator Water Level -- Low-Low (EAM)	3/Stm. Gen.	2/Stm. Gen. in any operating Stm. Gen.	2/Stm. Gen. in each operating Stm. Gen.	1,2	9#	R145
C. RCS Loop ΔT	4(1/loop)	2	3	1,2	10#	
D. Containment Pressure (EAM)	4	2	3	1,2	11#	
15. Deleted						
16. Undervoltage-Reactor Coolant Pumps	4-1/bus	2	3	1	6#	
17. Underfrequency-Reactor Coolant Pumps	4-1/bus	2	3	1	6#	
18. Turbine Trip						
A. Low Fluid Oil Pressure	3	2	2	1	6#	
B. Turbine Stop Valve Closure	4	4	4	1	6#	R145

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TABLE 3.3-1 (Continued)

REACTOR TRIP SYSTEM INSTRUMENTATION

FUNCTIONAL UNIT	TOTAL NO. OF CHANNELS	CHANNELS TO TRIP	MINIMUM CHANNELS OPERABLE	APPLICABLE MODES	ACTION
19. Safety Injection Input from ESF	2	1	2	1, 2	12
20. Reactor Trip Breakers					
A. Startup and Power Operation	2	1	2	1, 2	12, 15
B. Shutdown	2	1	2	3*, 4* and 5*	16
21. Automatic Trip Logic					
A. Startup and Power Operation	2	1	2	1, 2	12
B. Shutdown	2	1	2	3*, 4* and 5*	16
22. Reactor Trip System Interlocks					
A. Intermediate Range Neutron Flux P-6	2	1	2	2, and*	8a
B. Power Range Neutron Flux - P-7	4	2	3	1	8b
C. Power Range Neutron Flux - P-8	4	2	3	1	8c
D. Power Range Neutron Flux - P-10	4	2	3	1, 2	8d
E. Turbine Impulse Chamber Pressure - P-13	2	1	2	1	8b
F. Power Range Neutron Flux - P-9	4	2	3	1	8e
G. Reactor Trip - P-4	2	1	2	1, 2, and*	14

R60

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TABLE 3.3-1 (Continued)
TABLE NOTATION

*With the reactor trip system breakers in the closed position and the control rod drive system capable of rod withdrawal, and fuel in the reactor vessel. R217

#The provisions of Specification 3.0.4 are not applicable.

##Source Range outputs may be disabled above the P-6 (Block of Source Range Reactor Trip) setpoint. R140

ACTION STATEMENTS

ACTION 1 - With the number of OPERABLE channels one less than required by the Minimum Channels OPERABLE requirement, restore the inoperable channel to OPERABLE status within 48 hours or be in HOT STANDBY within the next 6 hours and/or open the reactor trip breakers.

ACTION 2 - With the number of OPERABLE channels one less than the Total Number of Channels, STARTUP and POWER OPERATION may proceed provided the following conditions are satisfied:

a. The inoperable channel is placed in the tripped condition within 6 hours. R51

b. The Minimum Channels OPERABLE requirement is met; however, the inoperable channel may be bypassed for up to 4 hours for surveillance testing of other channels per Specification 4.3.1.1.1. R51 R145

c. The QUADRANT POWER TILT RATIO is monitored in accordance with Technical Specification 3.2.4. R139

TABLE 3.3-1 (Continued)

ACTION 3 - With the number of channels OPERABLE one less than required by the Minimum Channels OPERABLE requirement and with the THERMAL POWER level:

a. Below the P-6 (Block of Source Range Reactor Trip) setpoint, restore the inoperable channel to OPERABLE status prior to increasing THERMAL POWER above the P-6 Setpoint.

b. Above the P-6 (Block of Source Range Reactor Trip) setpoint, but below 5% of RATED THERMAL POWER, restore the inoperable channel to OPERABLE status prior to increasing THERMAL POWER above 5% of RATED THERMAL POWER.

c. Above 5% of RATED THERMAL POWER, POWER OPERATION may continue.

d. Above 10% of RATED THERMAL POWER, the provisions of Specification 3.0.3 are not applicable.

ACTION 4 - With the number of channels OPERABLE one less than required by the Minimum Channels OPERABLE requirement and with the THERMAL POWER level:

a. Below the P-6 (Block of Source Range Reactor Trip) setpoint, restore the inoperable channel to OPERABLE status prior to increasing THERMAL POWER above the P-6 Setpoint.

b. Above the P-6 (Block of Source Range Reactor Trip) setpoint, operation may continue.

ACTION 5 - With the number of channels OPERABLE one less than required by the Minimum Channels OPERABLE requirement, verify compliance with the SHUTDOWN MARGIN requirements of Specification 3.1.1.1 or 3.1.1.2, as applicable, within 1 hour and at least once per 12 hours thereafter.

ACTION 6 - With the number of OPERABLE channels one less than the Total Number of Channels, STARTUP and/or POWER OPERATION may proceed provided the following conditions are satisfied:

a. The inoperable channel is placed in the tripped condition within 6 hours. R51

b. The Minimum Channels OPERABLE requirement is met; however, the inoperable channel may be bypassed for up to 4 hours for surveillance testing of other channels per Specification 4.3.1.1.1. R51

ACTION 7 - Deleted. R145

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TABLE 3.3-1 (Continued)

ACTION 8 - With less than the Minimum Number of Channels OPERABLE, declare the interlock inoperable and verify that all affected channels of the functions listed below are OPERABLE or apply the appropriate ACTION statement(s) for these functions. Functions to be evaluated are:

a. Source Range Reactor Trip

b. Reactor Trip

Low Reactor Coolant Loop Flow (2 loops)
Undervoltage
Underfrequency
Pressurizer Low Pressure
Pressurizer High Level

c. Reactor Trip

Low Reactor Coolant Loop Flow (1 loop)

d. Reactor Trip

Intermediate Range
Low Power Range
Source Range

e. Reactor Trip

Turbine Trip

ACTION 9 - With the number of OPERABLE channels one less than the Total Number of Channels, STARTUP and/or POWER OPERATION may proceed provided the following conditions are satisfied:

R145

a. The inoperable channel is placed in the tripped condition within 6 hours.

b. For the affected protection set, the Trip Time Delay for one affected steam generator (T_S) is adjusted to match the Trip Time Delay for multiple affected steam generators (T_M) within 4 hours.

c. The Minumum Channels OPERABLE requirement is met; however, the inoperable channel may be bypassed for up to 4 hours for surveillance testing of other channels per Specification 4.3.1.1.1.

ACTION 10 - With the number of OPERABLE channels one less than the Total Number of Channels, STARTUP and/or POWER OPERATION may proceed provided that within 6 hours, for the affected protection set, the Trip Time Delays (T_S and T_M) threshold power level for zero seconds time delay is adjusted to 0 % RTP.

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TABLE 3.3-1 (Continued)

ACTION 11 - With the number of OPERABLE channels one less than the Total Number of Channels, STARTUP and/or POWER OPERATION may proceed provided that within 6 hours, for the affected protection set, the Steam Generator Water Level - Low-Low (EAM) channels trip setpoint is adjusted to the same value as Steam Generator Water Level - Low-Low (Adverse). R145

ACTION 12 - With the number of OPERABLE channels one less than required by the Minimum Channels OPERABLE requirement, be in at least HOT STANDBY within 6 hours; however, one channel may be bypassed for up to 2 hours for surveillance testing per Specification 4.3.1.1.1 provided the other channel is OPERABLE. R217

ACTION 13 - Deleted

ACTION 14 - With the number of channels OPERABLE one less than required by the Minimum Channels OPERABLE requirement, be in at least HOT STANDBY within 6 hours.

ACTION 15 - With one of the diverse trip features (undervoltage or shunt trip attachment) inoperable, restore it to operable status within 48 hours or declare the breaker inoperable and apply ACTION 12. The breaker shall not be bypassed while one of the diverse trip features is inoperable except for up to 4 hours for performing maintenance to restore the breaker to OPERABLE status.

ACTION 16 - With the number of OPERABLE channels one less than the minimum channels operable requirement, restore the inoperable channel to operable status within 48 hours or open the reactor trip breakers within the next hour.

TABLE 5
Page 5 of 8

PRIMARY SYSTEM TEMP (DEG F) = 400.0 PRESSURE (PSIG) = 2235.0 PRESSURIZER LEVEL (%) = 24.7
MAKEUP WATER TEMP (DEG F) = 70.0 PRESSURE (PSIG) = .1 BORON CONCENTRATION (PPM) = .0
BORIC ACID TEMP (DEG F) = 70.0 PRESSURE (PSIG) = .1 BORON CONCENTRATION (PPM) = 6820.0

GALLONS OF ACID FOR BORATION OR WATER FOR DILUTION

BORON	1 PPM		2 PPM		5 PPM		10 PPM		20 PPM		50 PPM		100 PPM	
PPM	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE
425	11.3	171.3	22.5	343.1	56.3	860.7	112.6	1731.8	225.3	3505.8	564.7	9103.3	1133.8	19511.1
430	11.3	169.3	22.5	339.1	56.3	850.7	112.7	1711.4	225.5	3464.0	565.1	8990.6	1134.7	19251.4
435	11.3	167.4	22.5	335.2	56.4	840.8	112.8	1691.5	225.7	3423.3	565.6	8880.7	1135.6	18998.5
440	11.3	165.5	22.6	331.3	56.4	831.2	112.8	1672.1	225.9	3383.5	566.0	8773.4	1136.5	18752.2
445	11.3	163.6	22.6	327.6	56.4	821.8	112.9	1653.1	226.0	3344.5	566.5	8668.7	1137.4	18512.2
450	11.3	161.8	22.6	324.0	56.5	812.6	113.0	1634.5	226.2	3306.5	566.9	8566.5	1138.3	18278.4
455	11.3	160.0	22.6	320.4	56.5	803.7	113.1	1616.3	226.4	3269.4	567.4	8466.7	1139.2	18050.6
460	11.3	158.3	22.6	316.9	56.6	794.9	113.2	1598.5	226.6	3233.0	567.8	8369.1	1140.1	17828.0
465	11.3	156.6	22.6	313.5	56.6	786.3	113.3	1581.2	226.8	3197.5	568.2	8273.8	1141.0	17611.1
470	11.3	154.9	22.7	310.2	56.7	777.9	113.4	1564.2	226.9	3162.7	568.7	8180.6	1141.9	17399.6
475	11.3	153.3	22.7	306.9	56.7	769.6	113.5	1547.5	227.1	3128.7	569.1	8089.6	1142.8	17192.8
480	11.3	151.7	22.7	303.7	56.8	761.6	113.6	1531.2	227.3	3095.4	569.6	8000.5	1143.7	16991.1
485	11.4	150.1	22.7	300.5	56.8	753.7	113.6	1515.3	227.5	3062.8	570.0	7913.4	1144.7	16794.0
490	11.4	148.6	22.7	297.5	56.8	746.0	113.7	1499.7	227.7	3030.9	570.5	7828.1	1145.6	16601.5
495	11.4	147.1	22.8	294.5	56.9	738.4	113.8	1484.4	227.8	2999.6	571.0	7744.7	1146.5	16413.4
500	11.4	145.6	22.8	291.5	56.9	731.0	113.9	1469.4	228.0	2969.0	571.4	7663.0	1147.4	16229.5
510	11.4	142.7	22.8	285.8	57.0	716.6	114.1	1440.3	228.4	2909.6	572.3	7504.7	1149.2	15873.8
520	11.4	140.0	22.8	280.3	57.1	702.7	114.3	1412.3	228.7	2852.6	573.2	7352.8	1151.1	15533.5
530	11.4	137.4	22.9	275.0	57.2	689.4	114.5	1385.4	229.1	2797.7	574.1	7207.0	1152.9	15207.5
540	11.5	134.8	22.9	269.9	57.3	676.6	114.6	1359.5	229.5	2744.9	575.1	7066.8	1154.8	14894.9
550	11.5	132.4	23.0	265.0	57.4	664.2	114.8	1334.6	229.8	2694.1	576.0	6932.0	1156.6	14595.0
560	11.5	130.0	23.0	260.2	57.5	652.3	115.0	1310.5	230.2	2645.1	576.9	6802.3	1158.5	14307.0
570	11.5	127.7	23.0	255.6	57.6	640.8	115.2	1287.3	230.6	2597.8	577.8	6677.3	1160.3	14030.1
580	11.5	125.5	23.1	251.2	57.7	629.7	115.4	1264.9	230.9	2552.2	578.8	6556.8	1162.2	13763.8
590	11.5	123.4	23.1	247.0	57.8	619.0	115.6	1243.3	231.3	2508.2	579.7	6440.6	1164.1	13507.4
600	11.6	121.3	23.1	242.8	57.9	608.6	115.8	1222.4	231.7	2465.7	580.6	6328.4	1166.0	13260.4
610	11.6	119.3	23.2	238.9	57.9	598.6	115.9	1202.2	232.1	2424.6	581.6	6220.1	1167.9	13022.4
620	11.6	117.4	23.2	235.0	58.0	588.9	116.1	1182.6	232.4	2384.8	582.5	6115.5	1169.8	12792.7
630	11.6	115.5	23.2	231.3	58.1	579.5	116.3	1163.7	232.8	2346.4	583.5	6014.3	1171.7	12571.0
640	11.6	113.7	23.3	227.6	58.2	570.4	116.5	1145.4	233.2	2309.1	584.4	5916.4	1173.6	12356.9
650	11.7	112.0	23.3	224.1	58.3	561.6	116.7	1127.6	233.6	2273.0	585.4	5821.6	1175.5	12150.0
660	11.7	110.3	23.4	220.7	58.4	553.1	116.9	1110.4	234.0	2238.1	586.3	5729.8	1177.4	11949.9
670	11.7	108.6	23.4	217.4	58.5	544.8	117.1	1093.7	234.3	2204.1	587.3	5640.9	1179.4	11756.4
680	11.7	107.0	23.4	214.2	58.6	536.8	117.3	1077.5	234.7	2171.2	588.2	5554.7	1181.3	11568.9
690	11.7	105.5	23.5	211.1	58.7	529.0	117.5	1061.8	235.1	2139.3	589.2	5471.1	1183.2	11387.4

TABLE 6
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PRIMARY SYSTEM TEMP (DEG F) = 500.0 PRESSURE (PSIG) = 2235.0 PRESSURIZER LEVEL (%) = 24.7
MAKEUP WATER TEMP (DEG F) = 70.0 PRESSURE (PSIG) = .1 BORON CONCENTRATION (PPM) = .0
BORIC ACID TEMP (DEG F) = 70.0 PRESSURE (PSIG) = .1 BORON CONCENTRATION (PPM) = 6820.0

GALLONS OF ACID FOR BORATION OR WATER FOR DILUTION

BORON	1 PPM		2 PPM		5 PPM		10 PPM		20 PPM		50 PPM		100 PPM	
PPM	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE
425	10.4	158.0	20.7	316.3	51.9	793.6	103.8	1596.7	207.8	3232.4	520.6	8393.4	1045.4	17989.7
430	10.4	156.1	20.8	312.6	51.9	784.3	103.9	1577.9	207.9	3193.9	521.1	8289.5	1046.2	17750.2
435	10.4	154.3	20.8	309.0	52.0	775.3	104.0	1559.6	208.1	3156.3	521.5	8188.2	1047.1	17517.0
440	10.4	152.6	20.8	305.5	52.0	766.4	104.0	1541.7	208.3	3119.6	521.9	8089.3	1047.9	17289.9
445	10.4	150.9	20.8	302.1	52.0	757.7	104.1	1526.1	208.4	3083.7	522.3	7992.7	1048.7	17068.7
450	10.4	149.2	20.8	298.7	52.1	749.3	104.2	1507.0	208.6	3048.7	522.7	7898.5	1049.5	16853.0
455	10.4	147.5	20.8	295.4	52.1	741.0	104.3	1490.3	208.7	3014.4	523.1	7806.4	1050.4	16642.8
460	10.4	145.9	20.9	292.2	52.2	732.9	104.4	1473.9	208.9	2980.9	523.5	7716.5	1051.2	16437.8
465	10.4	144.4	20.9	289.1	52.2	725.0	104.5	1457.9	209.1	2948.1	523.9	7628.6	1052.0	16237.8
470	10.4	142.8	20.9	286.0	52.2	717.2	104.5	1442.2	209.2	2916.1	524.4	7542.7	1052.9	16042.6
475	10.5	141.3	20.9	283.0	52.3	709.6	104.6	1426.9	209.4	2884.7	524.8	7458.7	1053.7	15852.1
480	10.5	139.9	20.9	280.0	52.3	702.2	104.7	1411.8	209.6	2854.0	525.2	7376.6	1054.6	15666.1
485	10.5	138.4	20.9	277.1	52.4	694.9	104.8	1397.1	209.7	2824.0	525.6	7296.3	1055.4	15484.4
490	10.5	137.0	21.0	274.3	52.4	687.8	104.9	1382.7	209.9	2794.6	526.0	7217.7	1056.2	15306.9
495	10.5	135.6	21.0	271.5	52.5	680.8	105.0	1368.6	210.1	2765.7	526.4	7140.7	1057.1	15133.5
500	10.5	134.3	21.0	268.8	52.5	674.0	105.0	1354.8	210.2	2737.5	526.8	7065.4	1057.9	14963.9
510	10.5	131.6	21.0	263.5	52.6	660.7	105.2	1328.0	210.6	2682.7	527.7	6919.5	1059.6	14636.0
520	10.5	129.1	21.1	258.4	52.7	647.9	105.4	1302.2	210.9	2630.1	528.5	6779.5	1061.3	14322.2
530	10.5	126.6	21.1	253.5	52.7	635.6	105.5	1277.4	211.2	2579.5	529.4	6645.0	1063.0	14021.6
540	10.6	124.3	21.1	248.8	52.8	623.8	105.7	1253.5	211.6	2530.9	530.2	6515.8	1064.7	13733.4
550	10.6	122.0	21.2	244.3	52.9	612.4	105.9	1230.5	211.9	2484.0	531.1	6391.5	1066.4	13456.9
560	10.6	119.9	21.2	239.9	53.0	601.4	106.0	1208.3	212.3	2438.8	531.9	6271.8	1068.1	13191.3
570	10.6	117.8	21.2	235.7	53.1	590.8	106.2	1186.9	212.6	2395.2	532.8	6156.6	1069.9	12936.0
580	10.6	115.7	21.3	231.6	53.2	580.6	106.4	1166.3	212.9	2353.2	533.6	6045.5	1071.6	12690.5
590	10.6	113.8	21.3	227.7	53.3	570.7	106.6	1146.3	213.3	2312.6	534.5	5938.4	1073.3	12454.1
600	10.7	111.9	21.3	223.9	53.3	561.2	106.7	1127.1	213.6	2273.4	535.4	5834.9	1075.1	12226.4
610	10.7	110.0	21.4	220.2	53.4	551.9	106.9	1108.4	214.0	2235.5	536.2	5735.1	1076.8	12006.9
620	10.7	108.2	21.4	216.7	53.5	543.0	107.1	1090.4	214.3	2198.9	537.1	5638.6	1078.6	11795.2
630	10.7	106.5	21.4	213.2	53.6	534.3	107.2	1073.0	214.7	2163.4	538.0	5545.3	1080.3	11590.8
640	10.7	104.9	21.5	209.9	53.7	526.0	107.4	1056.1	215.0	2129.1	538.8	5455.0	1082.1	11393.4
650	10.8	103.2	21.5	206.7	53.8	517.8	107.6	1039.7	215.4	2095.8	539.7	5367.6	1083.8	11202.6
660	10.8	101.7	21.5	203.5	53.9	510.0	107.8	1023.8	215.7	2063.5	540.6	5283.0	1085.6	11018.1
670	10.8	100.2	21.6	200.5	53.9	502.3	107.9	1008.4	216.1	2032.3	541.5	5201.0	1087.4	10839.6
680	10.8	98.7	21.6	197.5	54.0	494.9	108.1	993.5	216.4	2001.9	542.4	5121.5	1089.2	10666.8
690	10.8	97.3	21.6	194.7	54.1	487.7	108.3	979.0	216.8	1972.5	543.2	5044.5	1091.0	10499.5

TABLE 7
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PRIMARY SYSTEM TEMP (DEG F) = 547.0 PRESSURE (PSIG) = 2235.0 PRESSURIZER LEVEL (%) = 24.7
MAKEUP WATER TEMP (DEG F) = 70.0 PRESSURE (PSIG) = .1 BORON CONCENTRATION (PPM) = .0
BORIC ACID TEMP (DEG F) = 70.0 PRESSURE (PSIG) = .1 BORON CONCENTRATION (PPM) = 6820.0

GALLONS OF ACID FOR BORATION OR WATER FOR DILUTION

BORON	1 PPM		2 PPM		5 PPM		10 PPM		20 PPM		50 PPM		100 PPM	
PPM	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE
425	9.8	149.8	19.7	300.0	49.2	752.6	98.4	1514.2	197.0	3065.3	493.7	7959.4	991.4	17059.5
430	9.8	148.1	19.7	296.5	49.2	743.8	98.5	1496.4	197.2	3028.8	494.1	7860.9	992.1	16832.3
435	9.9	146.4	19.7	293.1	49.3	735.2	98.6	1479.0	197.3	2993.1	494.5	7764.8	992.9	16611.2
440	9.9	144.7	19.7	289.7	49.3	726.8	98.7	1462.0	197.5	2958.3	494.9	7671.0	993.7	16395.9
445	9.9	143.1	19.7	286.5	49.4	718.6	98.7	1445.3	197.6	2924.3	495.3	7579.4	994.5	16186.1
450	9.9	141.5	19.8	283.3	49.4	710.5	98.8	1429.1	197.8	2891.0	495.7	7490.1	995.3	15981.6
455	9.9	139.9	19.8	280.1	49.4	702.7	98.9	1413.2	198.0	2858.6	496.1	7402.8	996.1	15782.3
460	9.9	138.4	19.8	277.1	49.5	695.0	99.0	1397.7	198.1	2826.8	496.5	7317.5	996.9	15587.8
465	9.9	136.9	19.8	274.1	49.5	687.5	99.1	1382.5	198.3	2795.7	496.8	7234.2	997.6	15398.2
470	9.9	135.4	19.8	271.2	49.5	680.1	99.1	1367.6	198.4	2765.3	497.2	7152.7	998.4	15213.1
475	9.9	134.0	19.8	268.3	49.6	672.9	99.2	1353.1	198.6	2735.6	497.6	7073.1	999.2	15032.4
480	9.9	132.6	19.8	265.5	49.6	665.9	99.3	1338.8	198.7	2706.5	498.0	6995.2	1000.0	14856.0
485	9.9	131.3	19.9	262.8	49.7	659.0	99.4	1324.9	198.9	2678.0	498.4	6919.0	1000.8	14683.8
490	9.9	129.9	19.9	260.1	49.7	652.2	99.4	1311.2	199.1	2650.1	498.8	6844.5	1001.6	14515.4
495	9.9	128.6	19.9	257.5	49.7	645.6	99.5	1297.8	199.2	2622.7	499.2	6771.5	1002.4	14350.9
500	10.0	127.3	19.9	254.9	49.8	639.1	99.6	1284.7	199.4	2596.0	499.6	6700.1	1003.2	14190.2
510	10.0	124.8	19.9	249.9	49.9	626.5	99.8	1259.3	199.7	2544.0	500.4	6561.7	1004.8	13879.2
520	10.0	122.4	20.0	245.1	49.9	614.4	99.9	1234.8	200.0	2494.1	501.2	6428.9	1006.4	13581.6
530	10.0	120.1	20.0	240.4	50.0	602.8	100.1	1211.3	200.3	2446.1	502.0	6301.4	1008.0	13296.6
540	10.0	117.9	20.0	236.0	50.1	591.6	100.2	1188.7	200.6	2400.0	502.3	6178.8	1009.7	13023.3
550	10.0	115.7	20.1	231.7	50.2	580.8	100.4	1166.9	201.0	2355.5	503.6	6061.0	1011.3	12761.1
560	10.0	113.7	20.1	227.5	50.3	570.3	100.6	1145.8	201.3	2312.7	504.4	5947.5	1012.9	12509.2
570	10.1	111.7	20.1	223.5	50.3	560.3	100.7	1125.6	201.6	2271.4	505.2	5838.2	1014.5	12267.1
580	10.1	109.7	20.2	219.7	50.4	550.6	100.9	1106.0	201.9	2231.5	506.0	5732.9	1016.2	12034.3
590	10.1	107.9	20.2	215.9	50.5	541.2	101.0	1087.1	202.3	2193.0	506.9	5631.3	1017.8	11810.1
600	10.1	106.1	20.2	212.3	50.6	532.2	101.2	1068.8	202.6	2155.9	507.7	5533.2	1019.5	11594.2
610	10.1	104.3	20.3	208.8	50.7	523.4	101.4	1051.1	202.9	2119.9	508.5	5438.5	1021.1	11386.0
620	10.1	102.7	20.3	205.5	50.7	514.9	101.5	1034.0	203.2	2085.2	509.3	5347.0	1022.8	11185.2
630	10.2	101.0	20.3	202.2	50.8	506.7	101.7	1017.5	203.6	2051.5	510.1	5258.5	1024.5	10991.4
640	10.2	99.4	20.4	199.0	50.9	498.8	101.9	1001.5	203.9	2019.0	511.0	5172.9	1026.1	10804.2
650	10.2	97.9	20.4	196.0	51.0	491.1	102.0	985.9	204.2	1987.4	511.8	5090.1	1027.8	10623.3
660	10.2	96.4	20.4	193.0	51.1	483.6	102.2	970.9	204.6	1956.8	512.6	5009.8	1029.5	10448.4
670	10.2	95.0	20.5	190.1	51.2	476.3	102.4	956.3	204.9	1927.2	513.5	4932.1	1031.2	10279.1
680	10.2	93.6	20.5	187.3	51.2	469.3	102.5	942.1	205.2	1898.4	514.3	4856.7	1032.9	10115.2
690	10.3	92.2	20.5	184.6	51.3	462.5	102.7	928.4	205.6	1870.5	515.2	4783.6	1034.6	9956.5

TABLE 8
Page 5 of 8

PRIMARY SYSTEM TEMP (DEG F) = 555.0 PRESSURE (PSIG) = 2235.0 PRESSURIZER LEVEL (%) = 33.8
MAKEUP WATER TEMP (DEG F) = 70.0 PRESSURE (PSIG) = .1 BORON CONCENTRATION (PPM) = .0
BORIC ACID TEMP (DEG F) = 70.0 PRESSURE (PSIG) = .1 BORON CONCENTRATION (PPM) = 6820.0

GALLONS OF ACID FOR BORATION OR WATER FOR DILUTION

BORON	1 PPM		2 PPM		5 PPM		10 PPM		20 PPM		50 PPM		100 PPM	
PPM	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE
425	9.9	150.3	19.7	301.0	49.4	755.1	98.8	1519.2	197.7	3075.4	495.4	7985.8	994.6	17116.1
430	9.9	148.6	19.8	297.5	49.4	746.2	98.8	1501.3	197.8	3038.8	495.8	7887.0	995.4	16888.2
435	9.9	146.8	19.8	294.0	49.4	737.6	98.9	1483.9	198.0	3003.1	496.1	7790.5	996.2	16666.4
440	9.9	145.2	19.8	290.7	49.5	729.2	99.0	1466.8	198.1	2968.1	496.5	7696.4	997.0	16450.3
445	9.9	143.5	19.8	287.4	49.5	720.9	99.1	1450.1	198.3	2934.0	496.9	7604.6	997.8	16239.8
450	9.9	141.9	19.8	284.2	49.6	712.9	99.1	1433.8	198.5	2900.6	497.3	7514.9	998.6	16034.6
455	9.9	140.4	19.8	281.1	49.6	705.0	99.2	1417.9	198.6	2868.0	497.7	7427.3	999.4	15834.6
460	9.9	138.9	19.8	278.0	49.6	697.3	99.3	1402.3	198.8	2836.2	498.1	7341.8	1000.2	15639.6
465	9.9	137.4	19.9	275.0	49.7	689.8	99.4	1387.1	198.9	2805.0	498.5	7258.2	1001.0	15449.3
470	9.9	135.9	19.9	272.1	49.7	682.4	99.5	1372.2	199.1	2774.5	498.9	7176.4	1001.7	15263.6
475	9.9	134.5	19.9	269.2	49.8	675.2	99.5	1357.6	199.2	2744.6	499.3	7096.5	1002.5	15082.3
480	10.0	133.1	19.9	266.4	49.8	668.1	99.6	1343.3	199.4	2715.4	499.7	7018.4	1003.3	14905.3
485	10.0	131.7	19.9	263.6	49.8	661.2	99.7	1329.3	199.6	2686.8	500.1	6942.0	1004.1	14732.5
490	10.0	130.3	19.9	261.0	49.9	654.4	99.8	1315.6	199.7	2658.8	500.5	6867.2	1004.9	14563.6
495	10.0	129.0	20.0	258.3	49.9	647.8	99.9	1302.1	199.9	2631.4	500.9	6794.0	1005.7	14398.6
500	10.0	127.7	20.0	255.7	49.9	641.2	99.9	1289.0	200.0	2604.6	501.3	6722.3	1006.5	14237.2
510	10.0	125.2	20.0	250.7	50.0	628.6	100.1	1263.5	200.3	2552.5	502.1	6583.5	1008.2	13925.3
520	10.0	122.8	20.0	245.9	50.1	616.5	100.3	1238.9	200.7	2502.4	502.9	6450.2	1009.8	13626.7
530	10.0	120.5	20.1	241.2	50.2	604.8	100.4	1215.3	201.0	2454.3	503.7	6322.3	1011.4	13340.7
540	10.0	118.3	20.1	236.7	50.3	593.5	100.6	1192.6	201.3	2407.9	504.5	6199.3	1013.0	13066.5
550	10.1	116.1	20.1	232.4	50.3	582.7	100.7	1170.7	201.6	2363.3	505.3	6081.1	1014.6	12803.4
560	10.1	114.0	20.2	228.3	50.4	572.2	100.9	1149.6	201.9	2320.4	506.1	5967.3	1016.3	12550.7
570	10.1	112.0	20.2	224.3	50.5	562.1	101.1	1129.3	202.3	2278.9	506.9	5857.6	1017.9	12307.9
580	10.1	110.1	20.2	220.4	50.6	552.4	101.2	1109.6	202.6	2238.9	507.7	5751.9	1019.6	12074.2
590	10.1	108.2	20.3	216.6	50.7	543.0	101.4	1090.7	202.9	2200.3	508.5	5650.0	1021.2	11849.3
600	10.1	106.4	20.3	213.0	50.8	533.9	101.5	1072.3	203.2	2163.0	509.4	5551.6	1022.9	11632.7
610	10.2	104.7	20.3	209.5	50.8	525.1	101.7	1054.6	203.6	2127.0	510.2	5456.6	1024.5	11423.8
620	10.2	103.0	20.4	206.1	50.9	516.6	101.9	1037.5	203.9	2092.1	511.0	5364.8	1026.2	11222.4
630	10.2	101.4	20.4	202.9	51.0	508.4	102.0	1020.9	204.2	2058.3	511.8	5276.0	1027.9	11027.9
640	10.2	99.8	20.4	199.7	51.1	500.4	102.2	1004.8	204.6	2025.7	512.7	5190.1	1029.5	10840.1
650	10.2	98.2	20.5	196.6	51.2	492.7	102.4	989.2	204.9	1994.0	513.5	5107.0	1031.2	10658.6
660	10.2	96.7	20.5	193.6	51.2	485.2	102.5	974.1	205.2	1963.3	514.3	5026.5	1032.9	10483.0
670	10.3	95.3	20.5	190.7	51.3	477.9	102.7	959.5	205.6	1933.6	515.2	4948.5	1034.6	10313.2
680	10.3	93.9	20.6	187.9	51.4	470.9	102.9	945.2	205.9	1904.7	516.0	4872.8	1036.3	10148.8
690	10.3	92.5	20.6	185.2	51.5	464.0	103.0	931.4	206.2	1876.7	516.9	4799.5	1038.0	9989.6

TABLE 9
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PRIMARY SYSTEM TEMP (DEG F) = 565.0 PRESSURE (PSIG) = 2235.0 PRESSURIZER LEVEL (%) = 43.1
MAKEUP WATER TEMP (DEG F) = 70.0 PRESSURE (PSIG) = .1 BORON CONCENTRATION (PPM) = .0
BORIC ACID TEMP (DEG F) = 70.0 PRESSURE (PSIG) = .1 BORON CONCENTRATION (PPM) = 6820.0

GALLONS OF ACID FOR BORATION OR WATER FOR DILUTION

BORON	1 PPM		2 PPM		5 PPM		10 PPM		20 PPM		50 PPM		100 PPM	
PPM	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE
425	9.9	150.8	19.8	301.9	49.5	757.4	99.1	1523.8	198.3	3084.8	496.9	8010.2	997.7	17168.3
430	9.9	149.0	19.8	298.4	49.6	748.5	99.1	1505.9	198.4	3048.1	497.3	7911.0	998.5	16939.8
435	9.9	147.3	19.8	294.9	49.6	739.9	99.2	1488.4	198.6	3012.2	497.7	7814.3	999.3	16717.2
440	9.9	145.6	19.8	291.6	49.6	731.4	99.3	1471.3	198.7	2977.2	498.0	7719.9	1000.0	16500.5
443	9.9	144.0	19.9	288.3	49.7	723.1	99.4	1454.6	198.9	2942.9	498.4	7627.8	1000.8	16289.4
450	9.9	142.4	19.9	285.1	49.7	715.1	99.5	1438.2	199.1	2909.5	498.8	7537.9	1001.6	16083.6
455	9.9	140.8	19.9	281.9	49.7	707.2	99.5	1422.2	199.2	2876.8	499.2	7450.0	1002.4	15883.0
460	10.0	139.3	19.9	278.9	49.8	699.4	99.6	1406.6	199.4	2844.8	499.6	7364.2	1003.2	15687.3
465	10.0	137.8	19.9	275.9	49.8	691.9	99.7	1391.3	199.5	2813.5	500.0	7280.3	1004.0	15496.4
470	10.0	136.3	19.9	272.9	49.9	684.5	99.8	1376.4	199.7	2783.0	500.4	7198.4	1004.8	15310.2
475	10.0	134.9	20.0	270.0	49.9	677.2	99.8	1361.7	199.8	2753.0	500.8	7118.2	1005.6	15128.4
480	10.0	133.5	20.0	267.2	49.9	670.1	99.9	1347.4	200.0	2723.7	501.2	7039.8	1006.4	14950.9
485	10.0	132.1	20.0	264.5	50.0	663.2	100.0	1333.3	200.2	2695.0	501.6	6963.2	1007.2	14777.5
490	10.0	130.7	20.0	261.8	50.0	656.4	100.1	1319.6	200.3	2667.0	502.0	6888.1	1008.0	14608.1
495	10.0	129.4	20.0	259.1	50.1	649.7	100.2	1306.1	200.5	2639.5	502.4	6814.7	1008.8	14442.5
500	10.0	128.1	20.0	256.5	50.1	643.2	100.2	1292.9	200.6	2612.5	502.8	6742.8	1009.6	14280.7
510	10.0	125.6	20.1	251.5	50.2	630.5	100.4	1267.3	201.0	2560.3	503.6	6603.6	1011.2	13967.3
520	10.0	123.2	20.1	246.6	50.3	618.3	100.6	1242.7	201.3	2510.0	504.4	6469.9	1012.8	13668.3
530	10.1	120.9	20.1	242.0	50.3	606.6	100.7	1219.0	201.6	2461.8	505.2	6341.6	1014.5	13381.4
540	10.1	118.6	20.2	237.5	50.4	595.3	100.9	1196.3	201.9	2415.3	506.0	6218.3	1016.1	13106.4
550	10.1	116.5	20.2	233.1	50.5	584.5	101.0	1174.3	202.2	2370.6	506.8	6099.6	1017.7	12842.5
560	10.1	114.4	20.2	229.0	50.6	574.0	101.2	1153.1	202.6	2327.5	507.6	5985.5	1019.4	12589.0
570	10.1	112.4	20.3	224.9	50.7	563.9	101.4	1132.7	202.9	2285.9	508.4	5875.5	1021.0	12345.4
580	10.1	110.4	20.3	221.1	50.7	554.1	101.5	1113.0	203.2	2245.8	509.3	5769.5	1022.7	12111.1
590	10.2	108.6	20.3	217.3	50.8	544.7	101.7	1094.0	203.5	2207.0	510.1	5667.2	1024.3	11885.5
600	10.2	106.8	20.4	213.7	50.9	535.6	101.9	1075.6	203.9	2169.6	510.9	5568.5	1026.0	11668.2
610	10.2	105.0	20.4	210.2	51.0	526.7	102.0	1057.8	204.2	2133.5	511.7	5473.2	1027.6	11458.7
620	10.2	103.3	20.4	206.8	51.1	518.2	102.2	1040.6	204.5	2098.5	512.6	5381.1	1029.3	11256.6
630	10.2	101.7	20.5	203.5	51.2	509.9	102.3	1024.0	204.9	2064.6	513.4	5292.1	1031.0	11061.6
640	10.2	100.1	20.5	200.3	51.2	501.9	102.5	1007.9	205.2	2031.8	514.2	5205.9	1032.7	10873.2
650	10.3	98.5	20.5	197.2	51.3	494.2	102.7	992.2	205.5	2000.1	515.1	5122.6	1034.4	10691.1
660	10.3	97.0	20.6	194.2	51.4	486.7	102.8	977.1	205.9	1969.3	515.9	5041.8	1036.1	10515.0
670	10.3	95.6	20.6	191.3	51.5	479.4	103.0	962.4	206.2	1939.5	516.8	4963.6	1037.8	10344.7
680	10.3	94.2	20.6	188.5	51.6	472.3	103.2	948.1	206.5	1910.5	517.6	4887.7	1039.5	10179.8
690	10.3	92.8	20.7	185.8	51.7	465.4	103.3	934.3	206.9	1882.4	518.4	4814.1	1041.2	10020.1

TABLE 10
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PRIMARY SYSTEM TEMP (DEG F) = 578.2 PRESSURE (PSIG) = 2235.0 PRESSURIZER LEVEL (%) = 60.0
MAKEUP WATER TEMP (DEG F) = 70.0 PRESSURE (PSIG) = .1 BORON CONCENTRATION (PPM) = .0
BORIC ACID TEMP (DEG F) = 70.0 PRESSURE (PSIG) = .1 BORON CONCENTRATION (PPM) = 6820.0

GALLONS OF ACID FOR BORATION OR WATER FOR DILUTION

BORON	1 PPM		2 PPM		5 PPM		10 PPM		20 PPM		50 PPM		100 PPM	
PPM	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE
425	9.9	151.1	19.8	302.5	49.6	758.9	99.3	1526.8	198.7	3090.9	497.8	8025.9	999.6	17201.9
430	9.9	149.3	19.9	298.9	49.6	750.0	99.3	1508.9	198.8	3054.1	498.2	7926.5	1000.4	16972.9
435	9.9	147.6	19.9	295.5	49.7	741.3	99.4	1491.3	199.0	3018.1	498.6	7829.6	1001.2	16750.0
440	9.9	145.9	19.9	292.1	49.7	732.8	99.5	1474.2	199.1	2983.0	499.0	7735.1	1002.0	16532.8
445	9.9	144.3	19.9	288.8	49.8	724.6	99.6	1457.4	199.3	2948.7	499.4	7642.7	1002.8	16321.3
450	10.0	142.7	19.9	285.6	49.8	716.5	99.6	1441.0	199.5	2915.2	499.8	7552.6	1003.6	16115.1
455	10.0	141.1	19.9	282.5	49.8	708.6	99.7	1425.0	199.6	2882.4	500.2	7464.6	1004.4	15914.1
460	10.0	139.5	19.9	279.4	49.9	700.8	99.8	1409.4	199.8	2850.4	500.6	7378.6	1005.2	15718.0
465	10.0	138.0	20.0	276.4	49.9	693.2	99.9	1394.0	199.9	2819.1	501.0	7294.6	1006.0	15526.8
470	10.0	136.6	20.0	273.4	50.0	685.8	100.0	1379.0	200.1	2788.4	501.4	7212.4	1006.8	15340.2
475	10.0	135.1	20.0	270.6	50.0	678.6	100.0	1364.4	200.2	2758.4	501.8	7132.1	1007.6	15158.0
480	10.0	133.7	20.0	267.7	50.0	671.5	100.1	1350.0	200.4	2729.1	502.2	7053.6	1008.4	14980.1
485	10.0	132.3	20.0	265.0	50.1	664.5	100.2	1335.9	200.6	2700.3	502.6	6976.8	1009.2	14806.4
490	10.0	131.0	20.0	262.3	50.1	657.7	100.3	1322.2	200.7	2672.2	503.0	6901.6	1010.0	14636.7
495	10.0	129.7	20.1	259.6	50.2	651.0	100.4	1308.7	200.9	2644.6	503.4	6828.1	1010.8	14470.8
500	10.0	128.4	20.1	257.0	50.2	644.5	100.4	1295.5	201.0	2617.6	503.8	6756.1	1011.6	14308.7
510	10.1	125.9	20.1	252.0	50.3	631.8	100.6	1269.8	201.4	2565.3	504.6	6616.5	1013.2	13995.1
520	10.1	123.4	20.1	247.1	50.4	619.6	100.8	1245.1	201.7	2515.0	505.4	6482.6	1014.8	13695.1
530	10.1	121.1	20.2	242.4	50.4	607.8	100.9	1221.4	202.0	2466.6	506.2	6354.0	1016.5	13407.6
540	10.1	118.9	20.2	237.9	50.5	596.5	101.1	1198.6	202.3	2420.0	507.0	6230.4	1018.1	13132.1
550	10.1	116.7	20.2	233.6	50.6	585.6	101.2	1176.6	202.6	2375.2	507.8	6111.6	1019.7	12867.6
560	10.1	114.6	20.3	229.4	50.7	575.1	101.4	1155.4	203.0	2332.0	508.6	5997.2	1021.4	12613.7
570	10.1	112.6	20.3	225.4	50.8	565.0	101.6	1135.0	203.3	2290.4	509.4	5887.0	1023.0	12369.6
580	10.2	110.7	20.3	221.5	50.8	555.2	101.7	1115.2	203.6	2250.2	510.3	5780.8	1024.7	12134.8
590	10.2	108.8	20.4	217.7	50.9	545.7	101.9	1096.1	203.9	2211.4	511.1	5678.3	1026.3	11908.8
600	10.2	107.0	20.4	214.1	51.0	536.6	102.1	1077.7	204.3	2173.9	511.9	5579.4	1028.0	11691.0
610	10.2	105.2	20.4	210.6	51.1	527.8	102.2	1059.9	204.6	2137.6	512.7	5484.0	1029.7	11481.1
620	10.2	103.5	20.5	207.2	51.2	519.2	102.4	1042.7	204.9	2102.6	513.6	5391.7	1031.3	11278.7
630	10.2	101.9	20.5	203.9	51.3	510.9	102.5	1026.0	205.3	2068.7	514.4	5302.5	1033.0	11083.2
640	10.3	100.3	20.5	200.7	51.3	502.9	102.7	1009.8	205.6	2035.8	515.2	5216.1	1034.7	10894.5
650	10.3	98.7	20.6	197.6	51.4	495.2	102.9	994.2	205.9	2004.0	516.1	5132.6	1036.4	10712.0
660	10.3	97.2	20.6	194.6	51.5	487.6	103.0	979.0	206.3	1973.2	516.9	5051.7	1038.1	10535.6
670	10.3	95.8	20.6	191.7	51.6	480.3	103.2	964.3	206.6	1943.3	517.8	4973.3	1039.8	10365.0
680	10.3	94.4	20.7	188.9	51.7	473.2	103.4	950.0	206.9	1914.3	518.6	4897.3	1041.5	10199.7
690	10.3	93.0	20.7	186.1	51.8	466.4	103.6	936.1	207.3	1886.1	519.5	4823.6	1043.2	10039.7

TABLE 11
Page 5 of 8

PRIMARY SYSTEM TEMP (DEG F) = 580.0 PRESSURE (PSIG) = 2235.0 PRESSURIZER LEVEL (%) = 62.0
MAKEUP WATER TEMP (DEG F) = 70.0 PRESSURE (PSIG) = .1 BORON CONCENTRATION (PPM) = .0
BORIC ACID TEMP (DEG F) = 70.0 PRESSURE (PSIG) = .1 BORON CONCENTRATION (PPM) = 6320.0

GALLONS OF ACID FOR BORATION OR WATER FOR DILUTION

BORON	1 PPM		2 PPM		5 PPM		10 PPM		20 PPM		50 PPM		100 PPM	
PPM	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE	BORATE	DILUTE
425	9.9	151.1	19.8	302.5	49.6	758.9	99.3	1526.9	198.7	3091.1	497.9	8026.4	999.7	17203.1
430	9.9	149.3	19.9	299.0	49.7	750.0	99.3	1509.0	198.8	3054.3	498.3	7927.0	1000.5	16974.1
435	9.9	147.6	19.9	295.5	49.7	741.4	99.4	1491.4	199.0	3018.3	498.7	7830.1	1001.3	16751.1
440	9.9	145.9	19.9	292.2	49.7	732.9	99.5	1474.3	199.2	2983.2	499.1	7735.6	1002.1	16533.9
445	10.0	144.3	19.9	288.9	49.8	724.6	99.6	1457.5	199.3	2948.9	499.4	7643.3	1002.9	16322.3
450	10.0	142.7	19.9	285.6	49.8	716.5	99.7	1441.1	199.5	2915.4	499.8	7553.1	1003.7	16116.2
455	10.0	141.1	19.9	282.5	49.8	708.6	99.7	1425.1	199.6	2882.6	500.2	7465.1	1004.5	15915.1
460	10.0	139.6	19.9	279.4	49.9	700.9	99.8	1409.5	199.8	2850.6	500.6	7379.1	1005.2	15719.1
465	10.0	138.1	20.0	276.4	49.9	693.3	99.9	1394.1	199.9	2819.2	501.0	7295.1	1006.0	15527.8
470	10.0	136.6	20.0	273.5	50.0	685.9	100.0	1379.1	200.1	2788.6	501.4	7212.9	1006.8	15341.2
475	10.0	135.1	20.0	270.6	50.0	678.6	100.0	1364.5	200.3	2758.6	501.8	7132.6	1007.6	15159.0
480	10.0	133.7	20.0	267.8	50.0	671.5	100.1	1350.1	200.4	2729.2	502.2	7054.1	1008.4	14981.1
485	10.0	132.4	20.0	265.0	50.1	664.5	100.2	1336.0	200.6	2700.5	502.6	6977.2	1009.2	14807.4
490	10.0	131.0	20.0	262.3	50.1	657.7	100.3	1322.3	200.7	2672.4	503.0	6902.1	1010.0	14637.6
495	10.0	129.7	20.1	259.6	50.2	651.0	100.4	1308.8	200.9	2644.8	503.4	6828.5	1010.9	14471.8
500	10.0	128.4	20.1	257.0	50.2	644.5	100.4	1295.5	201.0	2617.8	503.8	6756.5	1011.7	14309.6
510	10.1	125.9	20.1	252.0	50.3	631.8	100.6	1269.9	201.4	2565.4	504.6	6616.9	1013.3	13996.0
520	10.1	123.4	20.1	247.1	50.4	619.6	100.8	1245.2	201.7	2515.1	505.4	6483.0	1014.9	13696.0
530	10.1	121.1	20.2	242.4	50.4	607.8	100.9	1221.5	202.0	2466.7	506.2	6354.4	1016.5	13408.5
540	10.1	118.9	20.2	237.9	50.5	596.5	101.1	1198.7	202.3	2420.2	507.0	6230.9	1018.2	13132.9
550	10.1	116.7	20.2	233.6	50.6	585.6	101.2	1176.7	202.7	2375.4	507.8	6112.0	1019.8	12868.5
560	10.1	114.6	20.3	229.4	50.7	575.1	101.4	1155.5	203.0	2332.2	508.7	5997.6	1021.4	12614.5
570	10.1	112.6	20.3	225.4	50.8	565.0	101.6	1135.0	203.3	2290.5	509.5	5887.4	1023.1	12370.4
580	10.2	110.7	20.3	221.5	50.8	555.2	101.7	1115.3	203.6	2250.3	510.3	5781.2	1024.7	12135.6
590	10.2	108.8	20.4	217.8	50.9	545.8	101.9	1096.2	204.0	2211.5	511.1	5678.7	1026.4	11909.6
600	10.2	107.0	20.4	214.1	51.0	536.6	102.1	1077.8	204.3	2174.0	511.9	5579.8	1028.1	11691.8
610	10.2	105.2	20.4	210.6	51.1	527.8	102.2	1060.0	204.6	2137.8	512.8	5484.3	1029.7	11481.9
620	10.2	103.5	20.5	207.2	51.2	519.3	102.4	1042.7	204.9	2102.7	513.6	5392.0	1031.4	11279.4
630	10.2	101.9	20.5	203.9	51.3	511.0	102.6	1026.1	205.3	2068.8	514.4	5302.8	1033.1	11084.0
640	10.3	100.3	20.5	200.7	51.3	503.0	102.7	1009.9	205.6	2036.0	515.3	5216.5	1034.8	10895.2
650	10.3	98.7	20.6	197.6	51.4	495.2	102.9	994.2	205.9	2004.1	516.1	5132.9	1036.5	10712.8
660	10.3	97.2	20.6	194.6	51.5	487.7	103.1	979.1	206.3	1973.3	517.0	5052.0	1038.2	10536.3
670	10.3	95.8	20.6	191.7	51.6	480.4	103.2	964.3	206.6	1943.4	517.8	4973.6	1039.9	10365.6
680	10.3	94.4	20.7	188.9	51.7	473.3	103.4	950.1	206.9	1914.4	518.6	4897.6	1041.6	10200.4
690	10.3	93.0	20.7	186.1	51.8	466.4	103.6	936.2	207.3	1886.2	519.5	4823.9	1043.3	10040.4

THERMODYNAMICS, HEAT TRANSFER, FLUID FLOW

Basic Formulae and Conversions

April 16, 1992

(Continued, page 5)

FLUID FLOW:

$$\frac{\dot{V}_2}{\dot{V}_1} = \frac{N_2}{N_1}$$

$$\frac{H_2}{H_1} = \left(\frac{N_2}{N_1}\right)^2$$

$$\frac{P_2}{P_1} = \left(\frac{N_2}{N_1}\right)^3$$

N = Speed of the pump

$\dot{V}$ = Flowrate

H = Head

P = Power Required

$$h = f\frac{L\bar{v}^2}{D2g} = K\frac{\bar{v}^2}{2g}$$

Net Positive Suction Head:

$NPSH = P_{suc} - P_{sat}$

$= (P_{cover\ gas} + P_{static} - h_L) - P_{sat}$ where P_{suc} = parameters in ( )

CONVERSION FACTORS:

TEMPERATURE:

$°F = \frac{9}{5}\,°C + 32$ $\qquad$ $°R = °F + 460$

$°C = \frac{5}{9}(°F-32)$ $\qquad$ $°K = °C + 273$

EQUATIONS

$\dot{Q} = \dot{m} c_p \Delta T$

$\dot{Q} = \dot{m} \Delta h$

$\dot{Q} = UA\Delta T$

$\dot{Q} \propto \dot{m}^3_{\text{Nat Circ}}$

$\Delta T \propto \dot{m}^2_{\text{Nat Circ}}$

$K_{eff} = 1 / (1 - \rho)$

$\rho = (K_{eff} - 1) / K_{eff}$

$SUR = 26.06 / \tau$

$$\tau = \frac{\bar{\beta} - \rho}{\bar{\lambda}_{eff} * \rho}$$

$$\rho = \frac{\ell^*}{\tau} + \frac{\bar{\beta}}{1 + \lambda_{eff}\tau}$$

$\ell^* = 1 \times 10^{-4}$ seconds

$\lambda_{eff} = 0.1$ seconds^{-1}

$\beta_{eff} = \beta_i$

$P = P_0 \, 10^{SUR(t)}$

$P = P_0 \, e^{(t/\tau)}$

$A = A_0 \, e^{-\lambda t}$

$CR_{S/D} = S / (1 - K_{eff})$

$CR_1 (1 - K_{eff1}) = CR_2 (1 - K_{eff2})$

$1/M = CR_1 / CR_X$

$DRW \propto \phi^2_{tip} / \phi^2_{avg}$

$F = PA$

$\dot{m} = \rho A \bar{v}$

$\dot{W}_{pump} = \dot{m} \Delta P v$

$E = IR$

Eff. = Net Work Out / Energy In

$$v(P_2 - P_1) + \frac{\bar{v}_2^2 - \bar{v}_1^2}{2g_c} + \frac{g(z_2 - z_1)}{g_c} = 0$$

CONVERSIONS

1 MW	=	3.41×10^6 Btu/hr
1 hp	=	2.54×10^3 Btu/hr
1 Btu	=	778 ft-lbf
°C	=	(5/9) (°F - 32)
°F	=	(9/5) (°C) + 32
°R	=	°F + 460
°K	=	°C + 273

1 Curie	=	3.7×10^{10} dps
1 kg	=	2.21 lbm
1 gal $_{water}$	=	8.35 lbm
1 ft^3 $_{water}$	=	7.48 gal.

$\rho H_2O = 62.4$ lbm / ft^3 = 1 gm / cm^3 @ STP

1 EFPH = 1.6 MWD / MTU

$g_c = 32.2$ lbm-ft / lbf-sec^2

Thursday, August 17, 2000 @ 01:54 PM

Answer Key

VERSION USED

Test Name: SRO.TST
Test Date: Friday, July 14, 2000

		Question ID		Type	Pts	Answer(s) 0	1	2	3	4	5	6	7	8	9
1:	1	001 AA2.02	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	2	003 AA2.03	001	MC-SR	1	D	B	C	D	A	B	C	D	A	B
1:	3	005 AK2.02	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	4	011 2.1.7	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	5	W/E04 2.4.4	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	6	W/E02 EK2.2	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	7	015 AA2.02	001	MC-SR	1	A	A	A	A	A	A	A	A	A	A
1:	8	W/E09 EK2.2	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	9	024 AA2.02	001	MC-SR	1	B	A	B	C	D	A	B	C	D	A
1:	10	026 AA2.01	001	MC-SR	1	A	A	A	A	A	A	A	A	A	A
1:	11	040 AK2.02	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	12	029 EK1.05	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	13	W/E08 EA1.1	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	14	051 AK3.01	001	MC-SR	1	B	B	B	B	B	B	B	B	B	B
1:	15	055 EK3.02	001	MC-SR	1	A	A	A	A	A	A	A	A	A	A
1:	16	057 AK3.01	002	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	17	059 AK1.02	002	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	18	062 AA1.05	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	19	067 AK1.01	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	20	068 AA1.14	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	21	069 AK2.03	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	22	074 EK2.05	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	23	076 AA2.02	002	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	24	W/E06 EA1.1	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	25	007 2.4.6	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	26	008 AA2.13	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	27	009 2.4.16	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	28	W/E03 EK3.1	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	29	W/E11 EA1.1	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	30	022 2.1.20	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	31	025 AK1.01	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	32	027 AA1.01	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	33	032 AK1.01	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	34	037 AK3.03	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	35	038 EA2.13	002	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	36	W/E05 EK2.1	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	37	058 AA2.01	002	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	38	060 2.3.1	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	39	061 AK2.01	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	40	W/E16 EK3.3	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	41	028 AK1.01	001	MC-SR	1	A	A	A	A	A	A	A	A	A	A
1:	42	036 AK3.02	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	43	056 AA1.07	001	MC-SR	1	C	C	C	C	C	C	C	C	C	C
1:	44	001 K6.03	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	45	003 K2.01	001	MC-SR	1	D	D	D	D	D	D	D	D	D	D

Test Name: SRO.TST
Test Date: Friday, July 14, 2000

		Question ID		Type	Pts	Answer(s) 0	1	2	3	4	5	6	7	8	9
1:	46	004 K6.01	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	47	004 A4.04	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	48	013 K2.01	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	49	014 A1.03	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	50	015 K3.03	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	51	017 A4.01	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	52	022 2.2.11	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	53	025 K1.01	001	MC-SR	1	C	C	C	C	C	C	C	C	C	C
1:	54	026 K4.05	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	55	056 2.1.20	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	56	059 A4.01	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	57	061 A1.01	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	58	061 A2.03	002	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	59	063 A4.03	002	MC-SR	1	A	D	A	B	C	D	A	B	C	D
1:	60	068 A2.04	001	MC-SR	1	C	C	C	C	C	C	C	C	C	C
1:	61	071 A2.05	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	62	072 A4.01	002	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	63	002 A3.01	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	64	006 K4.24	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	65	010 A4.03	001	MC-SR	1	B	B	B	B	B	B	B	B	B	B
1:	66	016 K3.12	001	MC-SR	1	B	B	B	B	B	B	B	B	B	B
1:	67	027 2.3.10	001	MC-SR	1	C or D	D	D	D	D	D	D	D	D	D
1:	68	028 A2.02	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	69	029 A3.01	001	MC-SR	1	A	A	A	A	A	A	A	A	A	A
1:	70	034 K4.02	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	71	035 A2.04	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	72	039 2.1.16	002	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	73	062 2.2.13	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	74	064 K3.02	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	75	073 K5.03	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	76	075 A2.01	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	77	079 K1.01	002	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	78	086 K5.03	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	79	103 K4.06	001	MC-SR	1	D	D	D	D	D	D	D	D	D	D
1:	80	007 K4.01	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	81	008 K1.04	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	82	076 A1.02	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	83	078 K2.01	001	MC-SR	1	D or C	A	B	C	A	B	C	A	B	C
1:	84	G2.1.4	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	85	G2.1.12	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	86	G2.1.19	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	87	G2.1.22	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B
1:	88	G2.1.34	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	89	G2.2.5	001	MC-SR	1	C	D	A	B	C	D	A	B	C	D
1:	90	G2.2.8	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B

Test Name: SRO.TST
Test Date: Friday, July 14, 2000

		Question ID		Type	Pts	Answer(s) 0	1	2	3	4	5	6	7	8	9
1:	91	G2.2.23	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	92	G2.2.24	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	93	G2.3.3	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	94	G2.3.4	002	MC-SR	1	C	C	C	C	C	C	C	C	C	C
1:	95	G2.3.10	003	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	96	G2.4.7	001	MC-SR	1	B	C	D	A	B	C	D	A	B	C
1:	97	G2.4.22	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	98	G2.4.34	001	MC-SR	1	D	A	B	C	D	A	B	C	D	A
1:	99	G2.4.41	001	MC-SR	1	A	A	A	A	A	A	A	A	A	A
1:	100	G2.4.47	001	MC-SR	1	A	B	C	D	A	B	C	D	A	B