COMANCHE PEAK STEAM ELECTRIC STATION

OPERATIONS DEPARTMENT ADMINISTRATION MANUAL

FOR INFORMATION ONLY

SHIFT COMPLEMENT

RESPONSIBILITIES AND AUTHORITIES

PROCEDURE NO. ODA-102

REVISION NO. 5

SAFETY-RELATED

SUBMITTED BY: R B Seidel DATE: 5/16/84
OPERATIONS SUPERINTENDENT

APPROVED BY: [signature] DATE: 6/5/84
MANAGER, PLANT OPERATIONS

1.0 Purpose

This procedure describes the required Operations Department shift manning for various modes of operation of the station and delineates the responsibilities and authorities of the members of the shift.

2.0 Applicability

This procedure is applicable to all members of the Operations Department shift crews. This procedure becomes effective when issued.

3.0 Definitions

3.1 Senior Licensed Operator - An individual having a current USNRC Senior Reactor Operator License on all station units that have a current facility operating license.

3.2 Licensed Operator - An individual having a current USNRC Reactor Operator or Senior Reactor Operator License on all station units that have a current facility operating license.

3.3 Operating - A reactor unit is considered to be operating when it is in operational Mode 1, 2, 3 or 4 as defined by CPSES Technical Specifications.

3.4 Licensed to Operate - A reactor unit is considered to be licensed to operate if it has a current facility operating license and initial fuel loading has begun.

3.5 Controls - Apparatus and mechanisms the manipulation of which directly affect the reactivity or power level of the reactor.

4.0 Instructions

4.1 Authority of Licensed Personnel

4.1.1 The station will be operated by USNRC licensed personnel in accordance with 10CFR50, 10CFR55 and the Technical Specifications, Section 6.

4.1.2 All controls will be manipulated by licensed personnel under the direction of senior licensed personnel. Manipulation of controls by non-licensed personnel is permissible as part of the Replacement Training Program, but must be directly supervised by a licensed individual.

4.1.3 The Reactor Operator, Assistant Shift Supervisor, Shift Supervisor or any other licensed member of the station staff assigned to manipulate or supervise the manipulation of the controls of a unit or units has the responsibility and authority to place the reactor or reactors in a safe condition when he determines that the safety of the reactor(s) is in jeopardy or when operating parameters exceed any Reactor Protection System or Safeguards System setpoints without automatic protection functions occurring.

4.2 Responsibilities of Shift Crew Personnel

4.2.1 General Responsibilities

In addition to the specific duties of shift crew personnel as delineated in Sections 4.2.2, 4.2.3, 4.2.4 and 4.2.5, all shift crew members have the following responsibilities:

4.2.1.1 The responsibility to believe and respond conservatively to instrument indications unless they are proven incorrect.

4.2.1.2 The responsibility to adhere to Technical Specifications.

4.2.1.3 The responsibility to follow written procedures.

4.2.1.4 The responsibility to review routine operating data to assure safe operation.

4.2.2 Shift Supervisor

The Shift Supervisor is responsible to the Operations Supervisor for the operation of the station and the management of operating personnel on an assigned shift consistent with administrative and regulatory requirements. Specific duties of the Shift Supervisor include:

4.2.2.1 Supervision of shift operating personnel to ensure that the station and all associated equipment is operated safely, efficiently, reliably and in accordance with Technical Specifications, approved procedures, regulations and licenses.

4.2.2.2 The responsibility to determine the circumstances, analyze the cause and determine that operations can proceed safely before a reactor is returned to power following a trip or an unplanned or unexplained power reduction and to provide direction for the return to power.

4.2.2.3 Supervision of the preparation of all routine shift documentation and review of routine operating data.

4.2.2.4 Assumption of complete responsibility for the safe operation of the station in the event of an emergency. The Shift Supervisor shall remain in the Control Room during the emergency until properly relieved. The Shift Supervisor shall maintain a broad perspective of operational conditions during the emergency and should not become totally involved in any single operation.

4.2.2.5 The responsibility for the initiation of the Emergency Plan in the event of an emergency situation and for serving as Emergency Coordinator until relieved.

4.2.2.6 The responsibility for the implementation of applicable portions of the Security Plan.

4.2.2.7 Assistance in the review and modification of operating procedures as required.

4.2.2.8 The responsibility to follow radiation protection and control procedures and to manage the radiation exposures of assigned personnel to ensure that they are within administrative and regulatory limits.

4.2.2.9 The responsibility for ensuring that an adequate number of qualified operations personnel are on duty during an assigned shift, consistent with Section 4.3 of this procedure, and for preparing daily shift crew work schedules.

4.2.2.10 Participating in the Requalification Training Program and maintaining a current USNRC Senior Reactor Operator License.

4.2.2.11 Other specific duties as assigned by the Operations Supervisor and as delineated in Station Administrative Procedures STA-601 through STA-607 and Operations Department Administrative Procedures ODA-103 through ODA-105 and ODA-301 through ODA-308.

4.2.3 Assistant Shift Supervisor

The Assistant Shift Supervisor is responsible to the Shift Supervisor for assisting in the operation of the station and the management of operating personnel on an assigned shift. Specific duties of the Assistant Shift Supervisor include:

4.2.3.1 Assumption of the duties of the Shift Supervisor in his absence.

4.2.3.2 Supervision of assigned shift operating personnel to ensure that equipment is operated safely, efficiently, reliably and in accordance with Technical Specifications, approved procedures, regulations and licenses.

4.2.3.3 The responsibility to determine the circumstances, analyze the cause and determine that operations can proceed safely before a reactor is returned to power following a trip or an unplanned or unexplained power reduction and to provide direction for the return to power as assigned.

4.2.3.4 Supervision of the preparation of all assigned shift documentation and review of routine operating data.

4.2.3.5 Assistance in the review and modification of operating procedures as required.

4.2.3.6 The responsibility to follow radiation protection and control procedures and to manage the radiation exposures of assigned personnel to ensure that they are within administrative and regulatory limits.

4.2.3.7 The responsibility for assisting in on-shift training of operating personnel.

4.2.3.8 Participating in the Requalification Training Program and maintaining a current USNRC Senior Reactor Operator License.

4.2.3.9 Other specific duties as assigned by the Shift Supervisor and as delineated in Station Administrative Procedures STA-601, STA-602, STA-605 and STA-607 and Operations Department Administrative Procedures ODA-104, ODA-105 and ODA-301 through ODA-306.

4.2.4 Reactor Operator

The Reactor Operator is responsible to the Shift Supervisor or Assistant Shift Supervisor for operations on an assigned unit or units. Specific duties of the Reactor Operator include:

4.2.4.1 The responsibility for safe, efficient and reliable operation of equipment in accordance with Technical Specifications, approved procedures, regulations and licenses.

4.2.4.2 Maintaining all logs and records for the unit or units assigned and reviewing routine operating data.

4.2.4.3 The responsibility for operating equipment from the Control Room and locally and assisting in all phases of operation as assigned.

4.2.4.4 Continuous monitoring of Control Room indications on an assigned unit and adjustment of parameters as necessary.

4.2.4.5 Assisting the Shift Supervisor or Assistant Shift Supervisor in directing and coordinating the operating activities of the Auxiliary Operators.

4.2.4.6 Maintaining necessary communications both within and outside of the plant.

4.2.4.7 Performing the Auxiliary Operator's duties when necessary or when directed by the Shift Supervisor or Assistant Shift Supervisor.

4.2.4.8 Assisting the Shift Supervisor or Assistant Shift Supervisor in tagging and removal of equipment from service and in returning equipment to service when authorized by the Shift Supervisor or Assistant Shift Supervisor.

4.2.4.9 Participating in the Requalification Training Program and maintaining a current USNRC Reactor Operator or Senior Reactor Operator License.

4.2.4.10 Assisting in the training of Auxiliary Operators.

4.2.4.11 Assisting in the preparation, review and modification of operating procedures and other operating documentation.

4.2.4.12 Performing duties required by the Fire Protection Plan and Emergency Plan.

4.2.4.13 Assisting with station housekeeping.

4.2.4.14 Other specific duties as assigned by the Shift Supervisor or Assistant Shift Supervisor and as delineated in Station Administrative Procedures STA-601, STA-605 and STA-607 and Operations Department Administrative Procedures ODA-104 and ODA-301 through ODA-305.

4.2.5 Auxiliary Operator

The Auxiliary Operator is responsible to the Shift Supervisor or Assistant Shift Supervisor for the safe and efficient operation of equipment required to support overall station operation. Specific duties of the Auxiliary Operator include:

4.2.5.1 Proper, safe and efficient care and operation of station auxiliary equipment and systems under the direction of the Shift Supervisor or Assistant Shift Supervisor and the Reactor Operator and in accordance with administrative, regulatory and procedural requirements.

4.2.5.2 Periodic inspection of assigned equipment including completing documentation associated with these inspections and adjusting controls as necessary for proper equipment and system operation.

4.2.5.3 Assisting the Shift Supervisor, Assistant Shift Supervisor or Reactor Operator in tagging and removal of equipment from service and in returning equipment to service when authorized.

4.2.5.4 Maintaining necessary communications with the Control Room.

4.2.5.5 Periodic inspections of controlled access areas including the Containment, Auxiliary Building, Fuel Building and Safeguards Buildings as directed by the Shift Supervisor or Assistant Shift Supervisor.

4.2.5.6 Performance of other duties and assistance in all phases of operation as required and directed by the Shift Supervisor or Assistant Shift Supervisor.

4.2.5.7 Participation in the Replacement Training Program in order to obtain a USNRC Reactor Operator License.

4.2.5.8 Assisting in the preparation, review and modification of operating procedures and other operating documentation.

4.2.5.9 Assisting with station housekeeping.

4.2.5.10 Other specific duties as delineated in Station Administrative Procedures STA-601 and STA-605 and Operations Department Procedures ODA-104, ODA-301, ODA-302 and ODA-304.

4.2.6 Shift Advisor

The Shift Advisor functions at the Assistant Shift Supervisor level and is responsible to the Shift Supervisor for evaluating shift operating activities and providing appropriate recommendations concerning safe operation.

The Shift Advisor is assigned to assist the Shift Supervisor but reports to the Operations Supervisor. He has direct access to plant and corporate management and is responsible for pursuing the resolution of disagreements affecting safe operation through successive management levels.

Specific responsibilities and authorities include:

4.2.6.1 Responsible for assisting in the determination of the circumstances, analyzing the cause and determining that operations can proceed safely before recommending a return to power following a trip or an unplanned or unexplained power reduction.

4.2.6.2 Assisting in the review and modification of operating procedures.

4.2.6.3 Assisting in the preparation and review of shift documentation and operating data.

4.2.6.4 Assisting in on-shift training of operating personnel.

4.2.6.5 Participating in Shift Advisor training, including recurrent training.

4.2.6.6 Other specific duties as assigned by the Shift Supervisor. The duties assigned cannot include those requiring a license.

4.3 Shift Complement

The minimum on-duty shift complement for various modes of single and dual unit operation shall be as shown in Attachment 1 and as follows:

4.3.1 A USNRC Senior licensed Shift Supervisor shall be onsite at all times when at least one unit is loaded with fuel. When the Shift Supervisor is absent from the Control Room during routine operations, he shall be relieved by a qualified and USNRC Senior Licensed member of management. This is normally an Assistant Shift Supervisor. The Shift Supervisor's relief shall assume the Control Room command function as well as the complete responsibility and authority as is normally assigned to the position.

4.3.2 One USNRC Senior Licensed Operator shall be in the Control Room at all times when in Modes 1, 2, 3 or 4.

4.3.3 One USNRC Licensed Operator shall be in the Control Room at all times for each reactor containing fuel.

4.3.4 Two USNRC Licensed Operators should be in the Control Room for each reactor while undergoing a startup, scheduled shutdown or reactor trip recovery.

4.3.5 Two USNRC Senior Licensed Operators shall be onsite at all times with both units loaded with fuel.

4.3.6 In addition to the operators specified in 4.3.1, 4.3.2, 4.3.3. and 4.3.5, an additional USNRC Licensed Operator shall be onsite at all times and available to serve as relief operator for the Control Room if either unit is in Mode 1, 2, 3 or 4.

4.3.7 Shift crew assignments during periods of core alterations shall include a USNRC Senior Licensed Operator to directly supervise the core alterations. This operator may have fuel handling duties but shall not have other concurrent operational duties.

4.3.8 With one unit licensed to operate (mode 5 or 6), each shift crew shall have at least three members including one Shift Supervisor and one USNRC Licensed Operator.

4.3.9 With one unit operating (mode 1, 2, 3 or 4), each shift crew shall have at least six members including one Shift Supervisor, one Assistant Shift Supervisor and two USNRC Licensed Operators.

4.3.10 With two units licensed to operate (both units in mode 5 or 6), each shift crew shall have at least six members including one Shift Supervisor and two USNRC Licensed Operators.

4.3.11 With two units licensed to operate and one or both operating (mode 1, 2, 3 or 4), each shift crew shall have at least eight members, including one Shift Supervisor, one Assistant Shift Supervisor and three USNRC Licensed Operators.

4.3.12 In addition to the personnel specified in 4.3.8, 4.3.9, 4.3.10 and 4.3.11 above and with fuel in the reactor, one Radiation Protection Technician and one Chemistry and Environmental Technician shall be on site at all times.

4.3.13 With one or both units operating (mode 1, 2, 3 or 4), a Shift Technical Advisor shall be on site.

4.3.14 With one or both units operating (modes 1, 2, 3 or 4), a Shift Advisor shall be on site.

4.3.15 A site Fire Brigade of at least 5 members shall be maintained onsite at all times. The Fire Brigade shall not include the Shift Supervisor and the 2 other members of the minimum shift crew necessary for safe shutdown of the unit and any personnel required for other essential functions during a fire emergency.

4.3.16 Except for the Shift Supervisor, the Shift Crew composition may be one less than the minimum requirements for a period of time not to exceed 2 hours in order to accommodate unexpected absence of on-duty shift crew members provided immediate action is taken to restore the Shift Crew composition to within the minimum requirements. This provision does not permit any shift crew position to be unmanned upon shift change due to an oncoming shift crewman being late or absent.

5.0 References

5.1 CPSES Final Safety Analysis Report, Section 13.1

5.2 Procedure ODA-101, "Operations Department Organization and Responsibilities"

5.3 USNRC Standard Review Plan, Section 13.1.2

5.4 USNRC Letter, "Interim Criteria for Shift Staffing, July 31, 1980

5.5 NUREG-0578, 2.2.1.a

6.0 Attachments

6.1 Minimum Shift Crew Composition, Attachment 1

ATTACHMENT 1
PAGE 1 OF 1

MINIMUM SHIFT CREW COMPOSITION

MODE	UNIT LICENSED TO OPERATE	
	UNIT 1	UNIT 1 AND 2
ONE OR BOTH UNITS IN MODE 1, 2, 3, OR 4	1 S. S. 1 Ass't. S. S. 2 R. O. 2 A. O. 1 Shift Advisor 1 S. T. A. 1 R. P. Tech 1 C. E. Tech	1 S. S. 1 Ass't. S. S. 3 R. O. 3 A. O. 1 Shift Advisor 1 S. T. A. 1 R. P. Tech 1 C. E. Tech
TOTAL	10	12
BOTH UNITS IN MODE 5 OR 6	1 S. S. 1 R. O. 1 A. O. 1 R. P. Tech 1 C. E. Tech	1 S. S. 1 Ass't. S. S. 2 R. O. 3 A. O. 1 R. P. Tech 1 C. E. Tech
TOTAL	5	9

POSITION (1)		USNRC LICENSE
SHIFT SUPERVISOR	- S. S.	SRO
ASSISTANT SHIFT SUPERVISOR	- Ass't. S. S.	SRO
REACTOR OPERATOR	- R. O.	RO
AUXILIARY OPERATOR	- A. O.	NONE
SHIFT TECHNICAL ADVISOR	- S. T. A.	NONE
SHIFT ADVISOR		NONE

(1) Any qualified and USNRC Senior Licensed member or management may be used to satisfy the minimum Shift Supervisor or Assistant Shift Supervisor requirement. Any qualified and USNRC Licensed individual may be used to satisfy the Reactor Operator requirement.

Attachment 4

TRA-299

Shift Advisor Training and Qualifications

EXAM KEY

COURSE NAME

SHIFT ADVISOR TRAINING
WEEK 2

Date

MAY 18, 1984

TOTAL POINTS 32.75

SUBMITTED BY : S. T. Carneyhan DATE : 17 May 84
APPROVED BY : Phillip H. Tackett DATE : 5/17/84

NOT-105-1 Form C Rev. 0

1 RPS (1.5) 1 Q. Briefly describe the operation of the Reactor Protection System by tracing the path of components for a reactor trip signal.

2 RPS 1 A. From the sensor to the bistables, to the input cabinets and input relays to the solid state logic cabinets, to the UV coils on the reactor trip breakers.

5* RPS (3) 3 Q. Describe the functions provided by the following permissives/interlocks.

a. P-4 Reactor Trip
b. P-7 At Power
c. P-12 Low-low Tavg
d. C-9 Condenser interlock
e. C-5 Low Power interlock
f. C-8 Turbine T~ip

6 RPS 3 A.

	NAME	FUNCTION
P-4	Reactor Trip	1. Trips Main turbine 2. Trips FRV W/Lo Tavg 3. Prevents reactuation of SI after a manual reset
P-7	At Power	Automatically unblocks PZR low press., PZR hi level, all flow trips.
P-12	Low-Low Tavg	Interlocks steam dump below setpoint. Cooldown valves may be bypassed.
C-5	Low power interlock	Stops outward rod motion in auto only.

C-8	Turbine trip			Arming of steam dump after turbine trip-Train "A". Train "B" shifts steam dump valves from output of LOL to the T.T. Controller.
C-9	Condenser interlock			Condenser available for steam dump.

1	ERG (1)	1	Q.	What types of procedures make up the Emergency Response Guidelines?
2	ERG	1	A.	1. Emergency Operating Procedures (EOP) 2. Emergency Operating Sub-Procedures (EOS) 3. Emergency Contingency Actions (ECA) 4. Functional Restoration Guide-lines (FRG's) (.25 each)
3	ERG (.5)	2	Q.	What is the purpose of the Functional Restoration Guidelines?
4	ERG	2	A.	The FRG's are procedures designed to maintain the plant in a safe condition without regard to initiating events.

7	ERG (.5)	4	Q.	If a Critical Safety Function Status Tree contains a "Red" path, do you: (circle correct answer) a. Finish the step you are on and then take actions defined by the CSFST. b. Immediately take actions as determined by the CSFST. c. Complete the procedure you are in and then take actions defined by the CSFST.
8	ERG	4	A.	b. Immediately take actions as determined by the CSFST.
31	SOP (1.5)	16	Q.	How many RCP's may be started at one time? What are the starting duty limitations on the RCP's?
32	SOP	16	A.	1 RCP at a time. (.25) Maximum of 3 starts in a 2-hour period with at least 30 minutes rest between starts or attempted starts. (.75) A fourth start should first allow a 1-hour rest period. (.5)

5	ABN (.75)	3	Q.	List three operator actions which are performed following verification of the failure of the #1 seal in a RCP. (ABN-101A)
6	ABN	3	A.	Any three for full credit (.25 pts each) 1) Reduce reactor power to less than 45% within 30 minutes. 2) Within 5 minutes of discovery and verification of the failed seal, close the #1 seal leakoff isolation valve for the affected RCP. 3) After reaching 45% reactor power, secure the affected RCP. 4) Place the Unit in Hot Standby within one hour after stopping the affected RCP. 5) Consult CPSES Tech Specs Section 3/4.4.1 for any applicable LCO's.
7	ABN (1)	4	Q.	List 4 conditions that could result in a gross failed fuel monitor "alert" alarm. (ABN-102A)
8	ABN	4	A.	1) Gross Failed Fuel Monitor Malfunction 2) Depleted resin in Letdown ion exchanger 3) Crud burst causing activity 4) Actual failed fuel (0.25 pts. each)

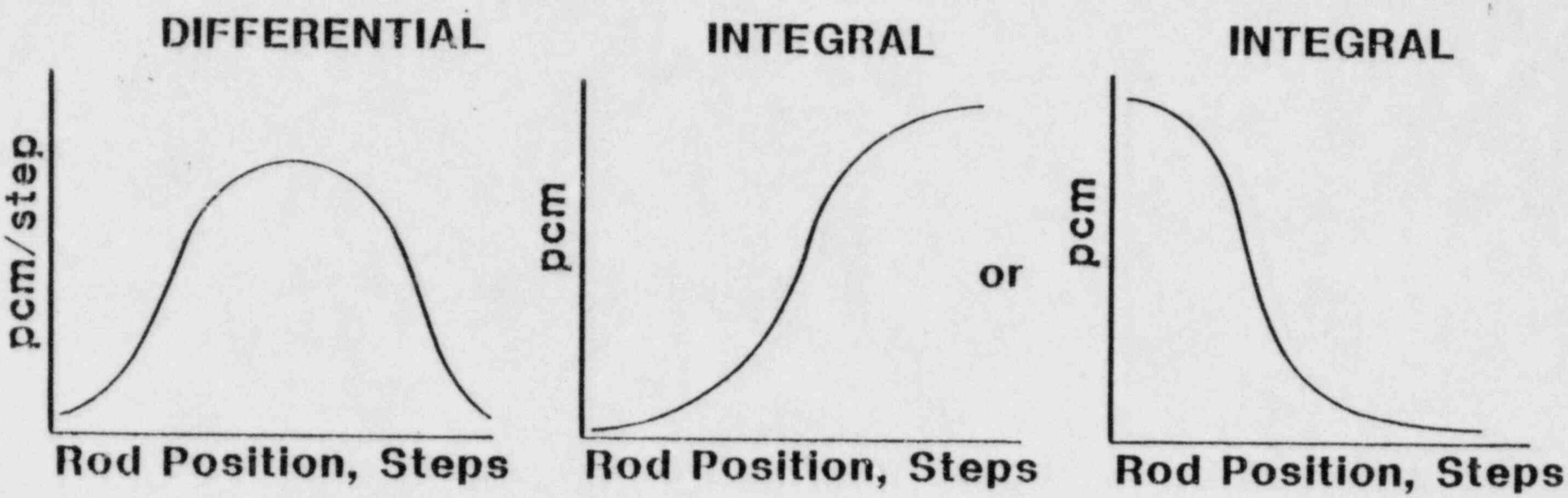
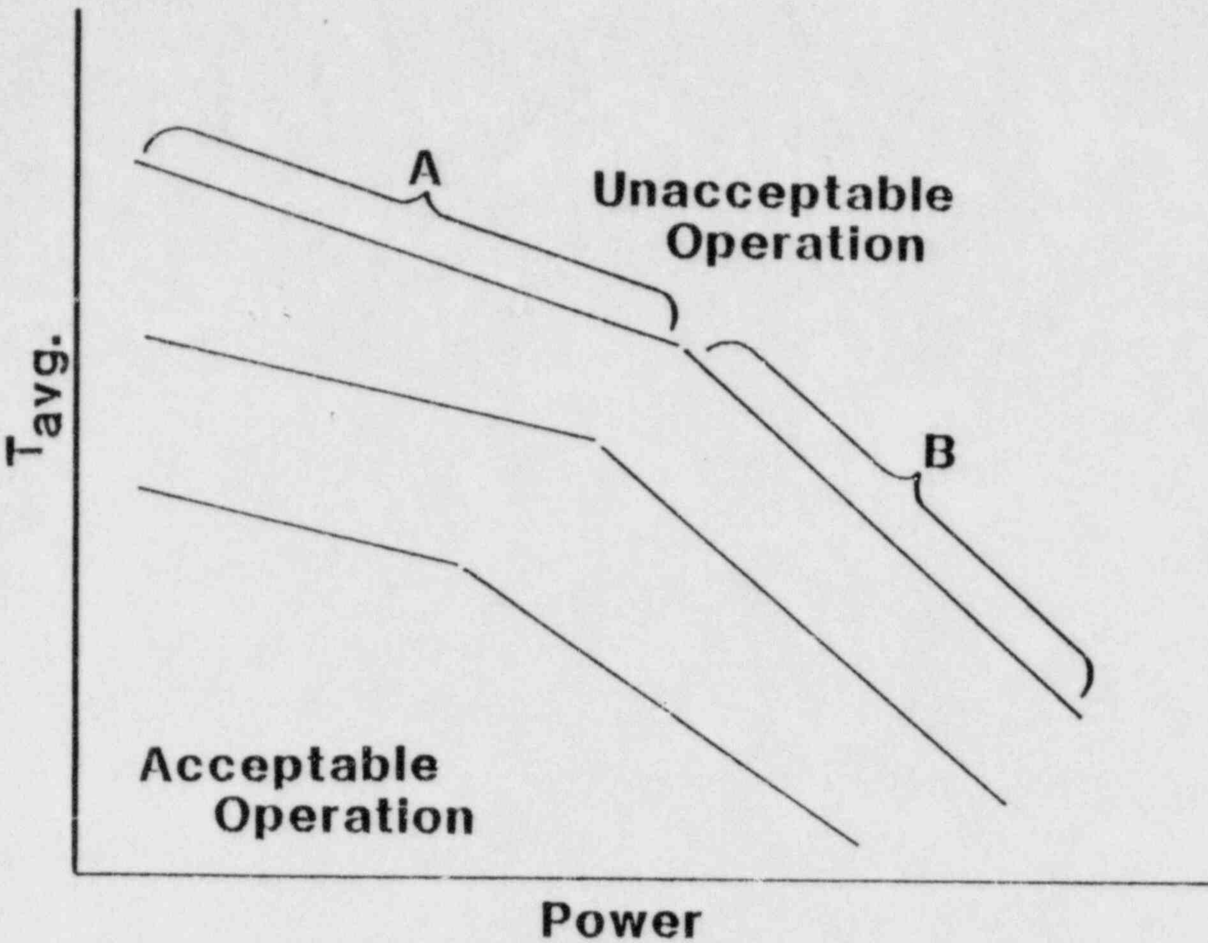

DIFFERENTIAL
pcm/step
Rod Position, Steps
INTEGRAL
pcm
Rod Position, Steps
or
INTEGRAL
pcm
Rod Position, Steps

FIGURE TDB-1



A portion - protection against saturation conditions in the hot leg

B portion - protection against DNB conditions

FIGURE TDB-2

1	TDB (1)	1	Q.	Draw an integral and differential rod worth curve and explain the reasons for the observed shape. (Label each axis with correct units - actual numerical values are not required.)
2	TDB	1	A.	The reactivity of any absorber at any position within the core is proportional to flux squared - since the axial flux is a cosine shape the axial worth is proportional to (cosine)^2 and since the worth is related to the flux at the tip of the rod the axial differential worth will be (cosine)^2 or as shown above - the integral of this function will be a sigmoid as shown in Fig. TDB-1.
3	TDB (1)	2	Q.	Draw a family of curves similar to the CPSES safety limit curves and explain the rationale for each portion of the curve. (Label each axis with correct units - actual numerical values are not required.)
4	TDB	2	A.	

5	TDB (1.5)	3	Q.	Figures 3.2 and 3.3 (Heatup and Cooldown curves) in the Tech. Data Book show a parameter "RT_{NDT}" - briefly explain what is meant by this term; also which is more limiting heatup or cooldown and why?
6	TDB	3	A.	RT_{NDT} - reference temperature for the transition from ductile to brittle fracture. Cooldown is more limiting since the tensile forces on the inside surface of the vessel are all additive (i.e., no counteracting compressive forces) and the total tensile force comes closest to reaching the maximum allowable design stress where a failure may occur.
3	TAA (3)	2	Q.	Provide the bases for the Rod Insertion Limits as specified by the CPSES Technical Specifications?
4	TAA	2	A	1. Ensure adequate shutdown margin. (1) 2. Promote more even power distribution. (1) 3. Minimize effects of ejected rod accident. (1)

5	TAA (4)	3	Q.	What conditions must be maintained by operators to ensure that the hot channel factors limits are not exceeded?
6	TAA	3	A.	1. Delta Flux limits are observed as prescribed by Axial Flux Difference Target Band. (1) 2. Rod Insertion Limits are observed. (1) 3. Observe proper bank sequencing with overlap. (1) 4. Maintain rods in a bank within ± 12 steps of each other. (1)
19	TS (1)	10	Q.	Define "shutdown margin."
20	TS	10	A.	The instantaneous amount of reactivity by which the reactor is subcritical (or would be subcritical) if all rod clusters were inserted except the cluster of highest reactivity worth.
57	TS (.5)	29	Q.	CIRCLE THE CORRECT ANSWER(S). <u>Per Technical Specification Bases</u>, the limits on heat flux hot channel factor, RCS flowrate, and nuclear enthalpy rise hot channel factor ensure that: 1. The design limits on peak local power density and minimum DNBR are not exceeded. 2. A coolable core geometry is maintained.

				3. The DNB parameters are not exceeded.
				4. In the event of a LOCA the peak clad temperature will not exceed the 2200°F ECCS acceptance criteria limit.
				5. All the above.
				6. None of the above.
58	TS	29	A.	1. The design limits on peak local power density and minimum DNBR are not exceeded.
				4. In the event of a LOCA the peak clad temperature will not exceed the 2200°F ECCS acceptance criteria limit.
73	TS (1)	37	Q.	At the Comanche Peak Steam Electric Station, no credit was taken for the Source Range and Intermediate Range Rx Trip in the Final Safety Analysis Report for a startup accident event. Explain why.
74	TS	37	A.	The Source and Intermediate Range trip circuits can be manually bypassed by operators by utilizing the Level Trip Bypass switches on the front of the instrument drawers. Since the Rx Trips can be physically bypassed, they were not used in the FSAR.

75 TS (4) 38 Q. a. Define the following

1. DNBR (1)
2. Hot Channel Factor (F) (1)
3. Critical Heat Flux (1)

b. What Rx protection signal is designed specifically to prevent DNB for all combinations of pressure, power, coolant temperature and axial power distribution? (1)

76 TS 38 A. a.

1. DNBR is defined as the ratio of the heat flux that would cause DNB at a particular core location to the local heat flux at that same core location.

2. Hot Channel Factor (F) is a peak (maximum) to average ratio of something, e.g. for local power density:

$$F = \frac{\text{Peak kw/ft}}{\text{Average kw/ft}}$$

3. Critical Heat Flux is the heat flux (Q) necessary to depart from the nucleate boiling region, or the heat flux needed at DNB.

b. OTN-16 trip.

77 TS (3) 39 Q. According to Technical Specifications, what requirements are necessary for a high radiation area in which the intensity of radiation is greater than 100 mrem/hr but less than 1000 mrem/hr?

78 TS 39 A. (.5 pts. each)

1. Area shall be barricaded
2. Conspicuously posted as a high radiation area
3. Entrance controlled by requiring issuance of RWP
4. Individuals entering shall be provided with, or accompanied by one or more of the following:
   - (a) A radiation monitoring device which continuously indicates dose rate, <u>or</u>
   - (b) A radiation monitoring device which continuously integrates the dose rate and alarms when a preset limit is reached, <u>or</u>
   - (c) A HP individual (qualified) <u>with</u> a dose rate monitoring device who is responsible for positive control over the activities in the area.

79 TS (3) 40 Q. What is/are

a. Axial Flux Difference (1)
b. Quadrant Power Tilt Ratio (1)
c. Subcooling Margin (1)

80 TS 40 A. a. Axial Flux Difference is the difference in power (expressed in %) between the upper and lower halves of the core, e.g. $P_{TOP} - P_{BOTTOM} = \Delta Flux$. Measured by excore detectors in each of four quadrants of the core.

b. Quadrant Power Tilt Ratio is the ratio of the maximum calibrated upper detector output to the average of the upper detector outputs or the maximum calibrated lower detector output to the average of the lower detector outputs; whichever ratio is greater. (1)

c. Subcooling margins is T_{SAT} - $T_{operating}$ or the margin between the hottest fluid temperature in a system and the saturation temperature for the system pressure, e.g. Pzr Temp at saturation = 653°F and T_{Hot} at full power ≅ 620°F. Subcooling margin ≅ 33°F. (1)

EXAM KEY

COURSE NAME

SHIFT ADVISOR TRAINING

WEEK 4

Date

JUNE 1, 1984

TOTAL POINTS ~~51.5~~ 44.5

SUBMITTED BY : [signature] DATE : 5/30/84

APPROVED BY : Phillip H. Tackett DATE : 5/31/84

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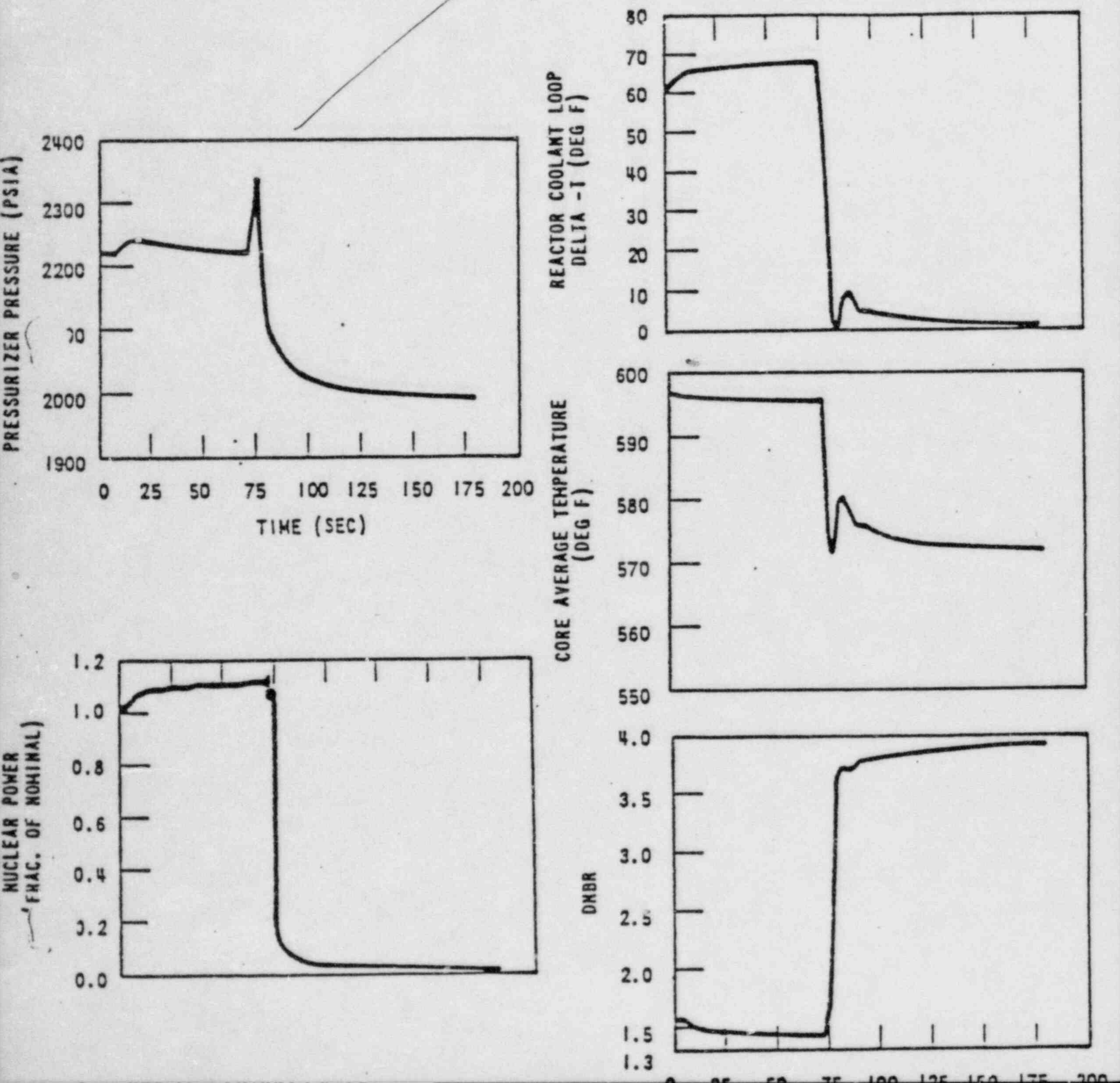
1	CG (1)	1	Q.	What concentration of hydrogen is considered an explosive concentration in air?
2	CG	1	A.	$\geq$ 4%
3	CG (1.5)	2	Q.	List three (3) sources of hydrogen production in containment following a LOCA.
4	CG	2	A.	1. Hydrogen present in the reactor coolant released on depressurization. (.5) 2. Zirconium/water reaction in the core. (.5) 3. Radiolysis of water in the core and containment sump. (.5) 4. Aluminum and zinc corrosion of plant materials. (.5)
37	EPP (.5)	19	Q.	State the purpose for Protection Action Guides.
38	EPP	19	A.	To provide guidelines to the Emergency Coordinator for evaluating post-emergency conditions and for making recommendations to offiste agencies concerning protective measures that could be implemented to insure minimum doses of radiation to the public following offsite releases of radioactive nuclides.

39	EPP (1)	20	Q.	Define: a. Plume Exposure Emergency Planning Zone b. Ingestion Exposure Emergency Planning Zone
40	EPP	20	A.	a. The Plume Exposure EPZ is a zone 10 miles in radius from plant centerline. Used in determining protection measure to protect public from excessive doses received from plume passage. (.5) b. The Ingestion Exposure EPZ extends to a radius 50 miles from plant boundaries. Used in determining protection measures to limit ingestion of radioactive nuclides from food supplies and to limit public exposure from ground level contamination. (.5)
3	RM (1)	2	Q.	What type radiation detectors are used in Process and Area Monitors?
4	RM	2	A.	Process → Scintillation GM Tube Area → G-M Tube (Low Range) → Ionization Chamber (High Range)

7	RM (1)	4	Q.	How do we monitor for fission-product activity in the RCS by the Radiation Monitoring System?
8	RM	4	A.	Use of failed fuel monitors
9	TAA (5) 3	5	Q.	a. ~~Other than the major LOCA, which events at the CPSES are most limiting with respect to DNBR. (2 pts.)~~ Remove not by objectives b. Define DNBR. (1 pt.) c. What parameters are monitored to ensure that DNBR is maintained greater than a value of 1.30? (2 pts.)
10	TAA	5	A.	a. ~~Rod ejection accident; continuous single rod withdrawal accident and RCP locked rotor or shaft break accident. (2)~~ [illegible] b. $DNBR = \frac{\text{heat flux to cause DNB at some pt. in the core}}{\text{actual heat flux at that point in core}}$ c. DNBR > 1.3 Temperature (.5), Pressure (.5), Power (.5), Flow (.5)

27 *	TAA (5)	14	Q.	Draw graphs of nuclear power, pressurizer pressure, Tavg, Loop ΔT and DNBR for the ten minute period following an increase in feedwater flow accident.
28	TAA	14	A.	

Remove ΔT not By Objectives



21	TAA (3)	11	Q.	State three (3) methods of decay heat removal following a turbine trip. (Assume the steam dumps are not operable.)
22	TAA	11	A.	a. Pressurizer reliefs and safeties b. Steam generator reliefs and safeties c. Auxiliary feedwater flow to S/G's
27*	TAA (5)	14	Q.	Draw graphs of nuclear power, pressurizer pressure, Tavg, Loop ΔT and DNBR for the ten minute period following an increase in feedwater flow accident.
28	TAA	14	A.	
29	TAA (3)	15	Q.	Compare the differences in severity of a large steam line rupture with forced Reactor Coolant flow versus initiation of the accident accompanied with loss of off-site power.
30	TAA	15	A.	Large steam line rupture cooldown event is faster acting on core when the pumps are running since there is faster coupling of cold water to the core from the S/G. with no pumping power, the S/G cooldown that results is not seen as soon by the core because of the reduced flow. Therefore, maintaining pump power is a more severe transient.

37 TAA (3) 19 Q. The CPSES reactor is operating at 100% power with all control systems in automatic when an inadvertent dilution event occurs. Assuming BOL conditions and the dilution continues indefinitely, explain what will happen to plant conditions over the first 15 minutes. If a reactor protection signal is generated, what will cause it to occur?

38 TAA 19 A. As dilution begins, positive reactivity will be added to the core, causing reactor power to increase. As reactor power rises above steam demand, T hot and, subsequently, T cold will increase causing Tavg to increase. When Tavg increases to 1.5°F greater than Tref, rods will step inward to maintain Tavg with Tref. Rods will probably move inward intermittently as dilution continues until the rod insertion limit low and low low alarm points are reached and passed. Delta flux will start to be pushed negative which will force operation outside the target band and also cause a penalty f (Δ flux) to the OTN-16 trip setpoint, reducing the setpoint. As OTN-16 trip setpoint is reduced toward the actual N-16 in two of four loops turbine runback/rod stop will occur (3% difference) and quite probably a reactor trip will follow. Dilution will continue until stopped by operator or system action.

69* TAA (3) 35 Q. The CPSES Reactor is operating at 100% power with rods in manual when a 50% load rejection occurs. Assuming no reactor trip and proper steam dump operation, describe the plant conditions once they have stabilized. Include in your discussion the transient effects on power, temperature, pressure and S/G level.

70 TAA 35 A. Answers will vary based on assumptions for values of αT and Doppler power coefficient. Assume BOL values: αT - 5pcm/°F; Doppler power coeff - 10 pcm/% power

Ideal case: With rods in manual, the steam dumps will accommodate 40% of the load rejection. When load is lost, Tavg will increase adding - ρ to the core, causing power to decrease which adds + ρ due to Doppler which balances the reactivity.

With a 5°F deadband on the load rejection controller before actuation, Tavg will use from 588°F (full power program) to 593°F to actuate dumps. Meanwhile Tref will be reduced to 572.5°F as a function of turbine steam pressure.

The 5°F increase in Tavg will reduce power about 2.5% to 97.5% power. Steam dump p p open actuation will account for 40% of steam demand, so the remaining 10% will be lost due to Tavg increase. 10% is -100 pcm which would result in a 20°F increase in Tavg.

a. Tavg would approximate 613°F.

b. Nuclear power would approximate 87.5%.

c. Steam dumps would be wide open dumping 40% steam demand.

				d.	Turbine load would approximate 50%.
				e.	S/G levels would shrink but are assumed to return to normal.
				f.	Pressure would exercise but return to normal (sprays).
39	TAA (2)	20	Q.	a.	What is a reactivity anomaly?
				b.	What action(s) is/are required if a reactivity anomaly were to occur?
40	TAA	20	A.	a.	An anomaly is essentially something that deviates in excess of normal variation. In the case of reactivity anomalies, they are specifically defined as a 1% deviation of the actual boron concentration versus the predicted boron concentration over core life. (1)
				b.	A reactivity anomaly must be reported to the NRC immediately (within 24 hours), but does not require plant shutdown, unless subsequent evaluation dictates shutdown as a necessary action. (1)

15	TAA (3)	8	Q.	What are the indications for a loss of natural circulation flow?
16	TAA	8	A.	a. Increasing loop delta T's indicate that natural circulation flow is decreasing. With insufficient flow through the core, core exit temperature will rise. Core exit thermocouples and wide range T hot will be the first indications of insufficient core cooling and their indications will start to increase. b. Increasing T cold indicates insufficient heat is being removed by the steam generator. If actions are not taken to increase secondary cooling, T hot will also start to increase. This will result in higher secondary steam pressures and lower margin to saturation in the reactor coolant.
17*	TAA (2)	9	Q.	Discuss the effects of an inadvertent initiation of ECCS during power operation. Assume the spurious SI signal <u>does not</u> cause a reactor trip/turbine trip. Discuss the effects of this transient on major RCS parameters and overall unit load.
18	TAA	9	A.	If the Reactor Protection System does not produce an immediate trip as a result of the spurious SIS signal, the reactor experiences a negative reactivity excursion due to the injected boron causing a decrease in reactor power.

a. The power mismatch causes a drop in Tavg and consequent coolant shrinkage in the system results in pressurizer pressure and water level drop.

b. Load will decrease due to the effect of reduced steam pressure on load after the turbine throttle valve is fully open.

c. If automatic rod control is used, these effects will be lessened until the rods have moved out of the core. The transient is eventually terminated by the Reactor Protection System low pressure trip or by manual trip.

d. The time to trip is affected by initial operating conditions including core burnup history which affects initial boron concentration, rate of change of boron concentration and Doppler and moderator coefficients.

91	TAA (1)	46	Q.	In performing transient analysis, results of such analysis are compared to criteria specified in 10CFR100. What are the criteria?
92	TAA	46	A.	Whole body dose < 25 REM Thyroid dose < 300 REM Both for a two hour stay time at the exclusion area boundary.

95	TAA (1)	48	Q.	For a steam generator tube rupture what principal indication(s) distinguish this event from other RCS inventory loss transients?
96	TAA	48	A.	Steam Jet Air Ejector Rad Monitor Alarms or Condenser Off-Gas Rad Monitor Alarm. Steam Flow/Feed Flow mismatch. Main steam line rad monitor alarms. S/G Blowdown rad monitor alarm. Increased S/G Level on affected S/G.
99	TAA (1)	50	Q.	Upon identifying that an ATWT event has occurred, there are three things an operator must do to mitigate the event irrespective of the type of ATWT. List the three basic actions.
100	TAA	50	A.	1. Try to trip the reactor 2. Try to trip the turbine 3. Insure that a heat sink is available
61	MCD (2)	31	Q.	a. What are the RCP trip criteria specified by EOP 0.0 Rx Trip or Safety Injection? b. Why is it recommended to trip RCP's with the above criteria on a small break LOCA?

62	MCD	31	A.	a. Component Cooling is lost and upper or lower bearing temperature is greater than 200°F. OR SI is on and RCS pressure ≤ 1700 psig. b. Westinghouse recommends tripping RCP's because RCP's will tend to pump water out of the system for some break locations. Also, their power supply is not safety related and, therefore, not guaranteed. During a small break LOCA, a loss of the RCP's could cause a more severe condition than analyzed.
89	MCD (3.0)	45	Q.	What are the RCS operational leakage limits as specified by Technical Specifications? No action statements required!
90	MCD	45	A.	(.5 each) a. No pressure boundary leakage b. Max of 1 gpm unidentified leakage c. 1 gpm S/G primary/secondary leakage total or 500 gpd/S-G d. 10 gpm identified leakage e. 40 gpm controlled leakage at 2235 ± 20 psig f. 1 gpm from any RCS Pressure Isol. Valve at 2235 ± 20 psig

115* MCD (3.5) 58 Q.

a. What are the six Critical Safety Functions in order of priority from most important to least important? (1.5)

b. Choose two CSF items and explain what parameters/ systems must be monitored to determine if the CSF is satisfied. (2.0)

116 MCD 58 A.

a. (.25 each)
1. Subcriticality
2. Core Cooling
3. RCS Integrity
4. Heat Sink
5. Containment
6. Inventory

b. (1 each)

1. <u>Subcriticality</u>

SR, IR, PR Scales

SR, IR SUR meters

2. <u>Core Cooling</u>

<u>Subcooling Margin</u>:

Thermocouples; loop wide range temperature, Pzr pressure, Loop pressure

3. <u>RCS Integrity</u>

RCS pressure (Pzr or Loop)
vs.
RCS temperature
(Thermocouples, Loop temperatures Th, Tc)

4. <u>Heat Sink</u>

RHR Sys Parameters
Thermocouples
Aux Feed Flow
S/G Narrow Range Levels
S/G Pressures
Steam Dump or atm relief availability

5. <u>Containment</u>

Pressure
Radiation Level
Sump Level

6. <u>Inventory</u>

Pressurizer Level

37	ERG (1)	19	Q.	In the Emergency Contingency Action procedures related to "Loss of All AC Power" and its recovery, special attention is given to the Reactor Coolant Pump Seals. Why?
38	ERG	19	A.	The RCP Seals are the only normal unisolable RCS leak paths (0.5). They are very sensitive to quick temperature changes and can therefore be damaged due to thermal shock causing a large increase in RCS leakage. (0.5)
67	ERG (1)	34	Q.	State 4 different methods of restoring the primary heat sink or other means of removing heat from the primary as described in FRH-0.1 "Response to Loss of Secondary Heat Sink".
68	ERG	34	A.	1. Establish AFW flow to the steam generators (.25) 2. Establish MFW flow to the steam generators (.25) 3. Feed a steam generator with a condensate pump (.25) 4. Remove heat from the RCS using feed and bleed - SI to RCS and bleed through the PORV's (.25)

21	ERG (1)	11	Q.	List four (4) actions that must be taken to isolate the ruptured steam generator(s) per EOP-3.0 (SGTR).
22	ERG	11	A.	a. Isolate auxiliary feedwater. (.25) b. Close main steam isolation valve, bypass valve and drains. (.25) c. Verify S/G PORV's closed. (.25) d. If appropriate, close steam supply valve from affected steam line to AFW pump
9	DG (2)	5	Q.	List the automatic start signals for the diesel. Can the diesel be auto started with the mode selector switch in local?
10	DG	5	A.	Undervoltage on the respective safeguards bus. Undervoltage on the preferred power source. Safety injection. When the selector switch on the local diesel control panel is in local, the automatic start signals are blocked.

Shift Advisor Examination Results

SHIFT ADVISOR	EXAM 1	EXAM 2	EXAM 3	COURSE AVERAGE
D. E. Burton	83	80	73[2]	79
D. R. Campbell	79[1]	80	69[2]	76
H. C. Crummey	90	90	85	88
L. J. Ryan	87	85	75[2]	82
S. Stevens	88	89	79[2]	85
F. D. Pauli[3]				

NOTES:
1. Upgrade Training Completed.
2. Upgrade Training Scheduled.
3. Training Not Completed.