U. S. NUCLEAR REGULATORY COMMISSION REGION I
OPERATOR LICENSING EXAMINATION REPORT

EXAMINATION REPORT NO. 50-247/85-28(OL)

FACILITY DOCKET NO. 50-247

FACILITY LICENSE NO. DPR-26

LICENSEE: Consolidated Edison Company of New York, Inc.
Buchanan, New York 10511

FACILITY: Indian Point 2

EXAMINATION DATES: December 10-13, 1985

CHIEF EXAMINER: for GD Audey — 1-21-86
D. H. Coe, Reactor Engineer (Examiner) — Date

REVIEWED BY: RM Keller — 1/27/86
R. M. Keller, Chief, Projects Section 1C — Date

APPROVED BY: HB Kister — 1/28/86
H. B. Kister, Chief, Projects Branch No. 1 — Date

SUMMARY: Written exams were administered to 5 SRO's and one Instructor Certification candidate (1 Upgrade and 4 Instant). Oral and simulator exams were administered to four SRO's (Instant) and one Instructor Certification. All candidates successfully passed all portions of the examination.

REPORT DETAILS

TYPE OF EXAMS: Replacement

EXAM RESULTS:

	SRO Pass/Fail	Inst. Cert. Pass/Fail
Written Exam	5/0	1/0
Oral Exam	4/0	1/0
Simulator Exam	4/0	1/0
Overall	5/0	1/0

1. CHIEF EXAMINER AT SITE: D. H. Coe, NRC

2. OTHER EXAMINERS: D. G. Ruscitto, NRC

1. Summary of Generic Deficiencies Noted from Written Exam

RO Exam - Not given.

SRO Exam - (6 candidates).

The following were minor areas of weakness:

- ATWS procedure (FR-S.1) methods for emergency boration.
- Basis for Technical Specification limits on RCS pressure, flow rate, and Tave.
- Knowledge of the contents of OAD-5, Procedure Adherence and Use.
- Proper sequence of emergency plan implementing procedure (IP-1001) steps during a declared alert.
- Understanding of the dilution factor (Xu/Q).

2. Interface with Plant Staff During Exam Period

The training staff were helpful in providing the necessary administrative support for the examination. While the simulator exams were in progress, several individuals entered the simulator room without first getting permission from the Chief Examiner. Distractions of this nature must be strictly avoided during future examinations.

3. Personnel Present at Exit Interview

NRC Personnel

D. Coe, Chief Examiner
L. Rossbach, Senior Resident
P. Kelley, Resident

Facility Personnel

J. Basile, General Manager - Operations
A. Giorgio, Training Manager
D. Koutouzis, Nuclear Training
M. Mueller, Simulator Instructor
T. Mansell, Simulator Instructor
W. Kriebel, Simulator Instructor

4. Summary of NRC Comments Made at Exit Interview

In accordance with present regional policy, no preliminary results were given. There were no generic knowledge or training deficiencies noted during the oral or simulator exams.

Comments were made regarding simulator performance. Several simulator malfunctions disrupted the continuity and/or accurate simulation of the scenarios the examiners were running. This distracts candidates from the "real" casualty and makes evaluation more difficult for examiners due to unexpected changes in the scenario. Examples of this included electrical loads dropped from an energized bus as if the bus had lost power, pumps that start or stop when they should not, and pumps that cannot be turned on or off when they should. The simulator froze twice during a single scenario and required more than one minute each time to restart. Although a small number of simulation difficulties are expected during NRC exams since new and different scenarios are always run, the number of problems being experienced at the IP2 simulator is approaching that level which will require excessive NRC examiner time spent pre-running and modifying scenarios. This time must necessarily be spent on the same day the scenario is used for exam purposes, lengthening each exam day.

The NRC is presently formulating minimum standards for facility simulators that may be used for NRC examinations. Until these standards are approved, the IP2 simulator may be considered adequate for exam purposes unless the Chief Examiner onsite deems otherwise due to excessive malfunctions.

5. Open Items Which Were Closed

85-16-03 RMS is not modeled where it is needed to confirm LOCAs.

RMS model responded properly during a LOCA conducted as part of this examination.

85-16-06 Initial Condition #1 is for solid conditions only.

I.C. #1 is now available with a nitrogen bubble in the pressurizer.

85-16-09 No remote shutdown or operations procedures are permanently located at remote shutdown stations.

Procedures are now located at the alternate safe shutdown panel in the PAB.

85-16-10 Remote S/G and Pressurizer level indications were not labeled at the remote shutdown panel. All indications read in inches of water D/P with no available conversion table.

Indications are now labeled and a conversion chart is posted.

85-16-11 No dedicated phone system is available for the operators of the several remote shutdown stations. Presently, walkie-talkies are the only instantaneous direct communication method available, and these must be brought from the guard house when needed.

As per Mr. Murray Selman's letter dated December 30, 1985 to Mr. Richard Starostecki, Director, Division of Reactor Projects, Region I, dedicated walkie-talkies for the exclusive use of operators evacuating the control room were placed just outside the control room. An in-plant wireless communication system is still being acquired but the dedicated walkie-talkies satisfy the intent of the open item. The effective use of the portable walkie-talkies was demonstrated during the ASSS, Appendix R, walkthrough conducted for an NRC inspection team on September 16, 1985.

Attachments:

1. Written Examination and Answer Key (SRO)
2. Facility Comments and Resolutions

MASTER

Attachment 1

U. S. NUCLEAR REGULATORY COMMISSION
SENIOR REACTOR OPERATOR LICENSE EXAMINATION

FACILITY: INDIAN POINT 2

REACTOR TYPE: PWR-WEC4

DATE ADMINISTERED: 85/12/10

EXAMINER: BARBER, S.

APPLICANT: _____

INSTRUCTIONS TO APPLICANT:

Use separate paper for the answers. Write answers on one side only. Staple question sheet on top of the answer sheets. Points for each question are indicated in parentheses after the question. The passing grade requires at least 70% in each category and a final grade of at least 80%. Examination papers will be picked up six (6) hours after the examination starts.

CATEGORY VALUE	% OF TOTAL	APPLICANT'S SCORE	% OF CATEGORY VALUE	CATEGORY
25.00	25.00			5. THEORY OF NUCLEAR POWER PLANT OPERATION, FLUIDS, AND THERMODYNAMICS
25.00	25.00			6. PLANT SYSTEMS DESIGN, CONTROL, AND INSTRUMENTATION
25.00	25.00			7. PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
25.00	25.00			8. ADMINISTRATIVE PROCEDURES, CONDITIONS, AND LIMITATIONS
100.00	100.00			TOTALS

FINAL GRADE _____%

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

_____
APPLICANT'S SIGNATURE

QUESTION 5.01 (3.00)

a. Provide a definition of DNB. (1.0)

b. Would DNB be more likely, less likely, or neither if the following parameters were decreased while at power (and prior to any trip)? (1.0)

1) RCS Pressure
2) RCS Flow
3) Tave
4) Total Steam Flow

c. A DNBR of 1.3 was chosen as the limit for the IP-2 Safety Limit curves depicting the maximum allowable combination of reactor power, RCS temperature, pressure, and flow. This value provides for operation with a margin from actual DNB (DNBR = 1.0). What made this margin necessary? (1.0)

QUESTION 5.02 (2.25)

Answer the following questions using the provided IP-2 data. Show all work and state all assumptions.

Tave= 547 F
All rods out
Boron worth=100 ppm per % delta rho
Doppler only Power Coeff= -9 pcm per % power
MTC= -4 pcm/ F
Rod control is in manual

a. Assuming no operator action, calculate the new Tave if power is increased from 90 to 100%. Reactivity coefficients are constant with power and temperature. (1.5)

b. How large a Boron addition or dilution would be necessary to maintain a constant Tave for the power escalation of part a? (Full credit given correct process). (0.75)

(***** CATEGORY 05 CONTINUED ON NEXT PAGE *****)

QUESTION 5.03 (3.00)

a. The IP-2 RCS is designed to allow and promote natural circulation. What RCS design feature ensures that natural circulation (NC) will occur? (1.0)

b. If, during stable NC cooldown, AFW flow is suddenly stopped, how will NC flow initially repond and why? (1.0)

c. If a NC cooldown and concurrent depressurization is conducted too rapidly, a void could occur in the vessel head region. Specifically, what causes this to occur? (1.0)

QUESTION 5.04 (2.50)

a. Which one of the following descriptions best supports the reason why Xenon reactivity increases sharply after a trip from 1000 hrs. at 100% power ? (0.5)

1) Xenon decays less rapidly due to a reduction in the neutron flux.
2) Iodine half-life is much shorter than Xenon half-life.
3) Iodine production is greatly reduced and Xenon production is greatly increased due to the reduction in neutron flux.
4) Due to reduced neutron absorption, Iodine concentration increases, and Xenon decays directly from Iodine, thus Xenon increases.

b. Give two reasons why Sm-149 is not as much of a concern to an operator after a reactor trip as is Xe. (1.0)

c. A Xe oscillation in a reactor core might be produced by certain types of rod motion. How would the Xe oscillation resulting from the following two cases be different? Explain. (1.0)

I. A turbine runback occurs with rods in auto. Rods drive 60 steps.
II. Rods are driven 60 steps starting from the same position as in Case I, but slowly over 4 days time.

(***** CATEGORY 05 CONTINUED ON NEXT PAGE *****)

QUESTION 5.05 (2.50)

a. What is the subcooling margin (SCM) of the plant if the following conditions exist ? (1.0)

Th =580 F Ppzr=2185 psig
Tave=550 F Psg =850 psig
Tc =520 F

b. If plant power is raised from 50 to 100%, how will SCM change(increase, decrease,stay the same) ? Why ? (0.75)

c. Which of the following would give a smaller SCM? Assume identical RCS pressures. Briefly explain why.

1) SCM during a controlled natural circulation cooldown immediately following a reactor trip from loss of flow.
2) SCM from continued operation at 5% power
3) SCM produced when all RCP's are operated at normal no-load temperature after extended shutdown.

QUESTION 5.06 (1.50)

a. How does Beta Bar change(increase,decrease,stay the same), if at all, if temperature is raised 5 F in a short period of time ? Why ? (0.75)

b. Which condition would result in a higher startup rate; a rod ejection accident at BOL or EOL ? Explain. (0.75)

QUESTION 5.07 (4.00)

a. If core power is increased from 50% to 100%, how, if at all, will differential rod worth change(increase,decrease,stay the same) for the following 3 cases ? Why ?

1) Rod position and boron held constant, and temperature allowed to decrease. (1.0)
2) Boron constant, Bank D at 150 steps and is then fully withdrawn, temperature remains constant. (1.0)
3) Rod position constant, boron dilution used, temperature constant(1.0)

b. Indicate whether the following statement is True or False and explain your answer:

The differential rod worth of Bank D rods at the moment of criticality during a startup will be the same as when the rods are at the identical height during power range operations. (1.0)

(***** CATEGORY 05 CONTINUED ON NEXT PAGE *****)

QUESTION 5.08 (2.25)

For the following 3 cases, state whether the criticality of the reactor can be determined. If criticality can be determined, state so. If not, state the action that could be taken to determine criticality. (2.25)

	Case 1	Case 2	Case 3
Rod motion in progress	Yes	No	No
Boron dilution in progress	No	No	Yes
SR level status(CPS)	5+E05 increasing	4+E04 increasing	3+E05 increas.
SUR status(DPM)	+0.4 oscillating slightly	+0.3 oscillating slightly	+0.0 oscill. positive

QUESTION 5.09 (2.50)

Two identical reactors are taken critical using continous rod withdrawal. Reactor A has a rod speed of 48 steps per minute and reactor B has a rod speed of 24 steps per minute.

a. Which reactor will have the highest source range counts at criticality? Why? (1.5)

b. How will 10^{-8} critical rod heights compare in the two reactors? Explain briefly. (1.0)

QUESTION 5.10 (1.50)

Assume that a reactor has tripped and that no heat is removed from the primary coolant AFTER Tave stabilizes at its no load value. Assume the following parameters are constant and calculate the length of time it will take for pressurizer safeties to lift if primary pressure is maintained at exactly saturated conditions and no boiling occurs.

Mass of water in the RCS = 214,000 lbm
Cp = 1.2 BTU/lbm-degree F
RCP heat input to primary = 15 MW
Decay heat is 5% of full power

(***** END OF CATEGORY 05 *****)

QUESTION 6.01 (2.75)

a. Why can't the High Main Steam Flow SI signal provide the initial protective action for a Main Steam Line Break upstream of an MSIV. (1.0)

b. Initiating a High Containment pressure actuation signal requires deenergizing 2 of 3 pressure control devices. Yet, a High-High signal requires 2 sets of 2 of 3 pressure devices to operate. What is the purpose of this redundancy and why is it necessary ? (0.5)

c. If an automatic SI signal is received in which only busses 2A and 5A are energized will the motor driven AFW pumps start ? If so, why ? If not, why not ? (0.75)

d. What 2 actions must occur in order to defeat an automatic SI condition at the IP-2 plant ? (0.5)

QUESTION 6.02 (3.50)

Explain HOW and WHY each of the following rod control components is used to modify a power mismatch signal. Include relative gains chosen (high,low), if appropriate. (3.5)

Impulse-Lag unit
Non-Linear Gain unit
Variable Gain unit

QUESTION 6.03 (1.50)

What is the purpose of/reasons for the following operational limitations.

a. Stop charging flow prior to stopping letdown flow. (1.0)

b. Letdown(LD)flow is automatically bypassed to the VCT when LD temperature is 145 F. (0.5)

(***** CATEGORY 06 CONTINUED ON NEXT PAGE *****)

QUESTION 6.04 (2.50)

Answer the following questions regarding the Reactor Coolant Pumps.

a. What is the most probable cause of a low thermal barrier delta P alarm ? (0.5)

b. What design features of the component cooling water system prevent overpressurization in the event of a leak in the thermal barrier HX ? (1.5)

c. The RCP seal package performs various functions, one of these is bypassing the #1 Seal. What is the purpose of this function ? (0.5)

QUESTION 6.05 (2.00)

a. What are the 2 automatic start signals for the turbine driven AFW pump ? Include coincidences, if appropriate. (1.0)

b. What automatic action occurs if flow from a motor driven AFW pump drops to 25 gpm ? (0.5)

c. If flow is reestablished at a maximum of 45 gpm, will any further automatic action take place ? Why or why not ? Explain (0.5)

QUESTION 6.06 (1.75)

a. What is the chemical compound used in the spray additive tank ? Give 2 reasons why it is used. Be specific. (1.25)

b. An automatic signal initiates containment spray and the reactor operator resets the signal that controls the spray pumps and valves after the signal clears. What if anything, will happen if a subsequent valid signal is recieved after the pumps are stopped and the valves returned to normal?(0.5)

(***** CATEGORY 06 CONTINUED ON NEXT PAGE *****)

QUESTION 6.07 (3.75)

a. List 2 conditions that will cause a diesel generator to auto start. Be specific. (0.5)

b. What 3 Emergency Engine Shutdown trips are inhibited (blocked) if an SI signal is present ? (0.75)

c. If Diesel Generator 21 was the only AC supply for Instrument Bus 21, what would be the status of the following inverter indications a short time after the diesel trips. Indicate the correct response and explain your answer. (2.5)

DC input voltage (V2)	higher/same/lower
Inverter output voltage (V1)	higher/same/lower
Inverter supplying load light (PL1)	on/off
In synch light (PL2)	on/off
Alternate source available light (PL5)	on/off

QUESTION 6.08 (2.25)

a List, in sequence, the design features that operate to mitigate (lessen) the effect of a pressure increase from normal operating pressure to the RCS pressure safety limit. (1.0)

b. For a pressurizer level and pressure decrease during a LOCA, what automatic actions will function to protect equipment and prevent the loss of pressurizer level? (0.75)

c. An insurge into the pressurizer causes a pressure increase and a variable high level alarm at 5% above program level. So then, why do all pressurizer heaters come on in this condition ? Wouldn't this cause a larger pressure excursion ? Explain. (0.5)

(***** CATEGORY 06 CONTINUED ON NEXT PAGE *****)

QUESTION 6.09 (3.00)

Answer the following concerning the Nuclear Instrumentation System:

a. Explain the response of the reactor protection system upon a simultaneous loss or failure of both IR channels (where both channel outputs go to zero) for each of the following two cases. Briefly explain the differences, if any.

(1) The reactor is in the middle of the IR during a startup.
(2) The reactor is at 20 % steady state power. [1.0 each]

b. Assume that while at 100% power one IR channel fails HIGH. If a reactor trip occurs while in this condition, what additional action must be taken during the emergency procedures to ensure the proper operation of the NI system? Why? [1.0]

QUESTION 6.10 (2.00)

In the event of the loss of normal, AND alternate, AND emergency sources of power to the four IP2 480vac busses, there exists a method of supplying backup electrical power to certain IP2 components from a normally de-energized source.

a. What is the location of the breakers which will feed this backup power to these components? (0.5)

b. List six types of components to which this backup power source may be directly connected. (1.5)

(***** END OF CATEGORY 06 *****)

QUESTION 7.01 (2.50)

a. Which one of the following plant conditions by itself will automatically initiate SI ? (0.5)

1) Pressurizer pressure of 1872 psig
2) Pressurizer level of 4%
3) Steam pressure of 585 psig
4) Containment pressure of 3 psig
5) S/G level of 18%

b. Which one of the following plant conditions by itself will automatically trip the reactor ? (0.5)

1) Pressurizer pressure of 2335 psig
2) Steam pressure of 600 psig
3) Pressurizer level of 4%
4) S/G level of 18%
5) Containment pressure of 1 psig

c. TRUE/FALSE
If IP2 equipment and instrumentation is operating as designed and P-7 is satisfied, a turbine trip will always cause a reactor trip. (0.5)

d. TRUE/FALSE
Adverse containment conditions allow manual SI termination at a lower pressurizer level due to excessive localized heating of the reference leg (0.5)

e. Which one of the following conditions represents the maximum allowable EDG loading during a LOCA. (0.5)

1) A load of 1750 kW for 2000 hours
2) A load of 1950 kW for 2000 hours
3) A continuous load of 1750 kW
4) A continuous load of 1950 kW

QUESTION 7.02 (1.75)

a. Per the ATWS procedure (FR-S.1), what 2 conditions require emergency boration of the RCS ? (0.5)

b. During an ATWS, if emergency boration can't be established and subsequent attempts to establish normal boration fail, the operator must perform 3 manual actions. What are they ? (0.75)

(***** CATEGORY 07 CONTINUED ON NEXT PAGE *****)

QUESTION 7.03 (2.00)

a. The IP2 Tech. Specs. allow a rod misalignment of "+" or "-" 12 steps when bank demand is less than or equal to 210 steps and "+" 17 and "-" 12 steps when above 210 steps. Why is the tolerance band wider at higher rod heights ? (0.5)

b. Per SOP 15.5, Dropped Rod and Malpositioned Rod Verification, what 2 indications are used to verify the existence of a potentially misaligned rod. (0.5)

c. During the realignment of a dropped rod certain rod control design features ensure only the affected rod is moved. What are they and what operator actions are necessary to ensure their operation ? (1.0)

QUESTION 7.04 (2.00)

Answer the following questions concerning IP2 Procedure ~~A 49,~~ FR-I.3 Response to Voids in Reactor Vessel.

a. If venting is performed to remove voids in accordance with this procedure, a maximum venting time must be computed. Why? (0.5)

~~b. Attachment 3 of this procedure provides an alternate method to estimate RCS voids without RVLIS. Under what specific plant condition is this alternate method intended to be used? (0.5)~~

~~c. An Indirect Symptom/Indication states that during spraying operations a rapid increase in pressurizer level indicates a gaseous RV head void. However, a similar response might be observed for spray operation with a RV steam void. How would the on-shift SRO differentiate between a gas and a steam void in these circumstances ? (1.0)~~

Replaced

b. If the void is composed of steam, what 2 general methods are used to eliminate the void? (1.0)

c. If the void is composed of non-condensible gases, what method is used to eliminate the void? (0.5)

(***** CATEGORY 07 CONTINUED ON NEXT PAGE *****)

QUESTION 7.05 (2.00)

Answer the following questions concerning the IP2 Plant Heatup and Startup Procedures.

a. Prior to reactor startup, a minimum temperature is imposed based on RCS boron concentration. What is the purpose of this limit ? Why is it necessary ? (1.0)

b. An additional limitation is imposed on the minimum permissible combination of RCS temperature and pressure. What is the purpose of this limit ? (0.5)

c. A minimum condition for criticality requires a minimum temperature be reached before startup can commence. If nuclear heat can't be used because this limit is not met, then how's the heatup accomplished ? (0.5)

QUESTION 7.06 (2.75)

a. What does the SWS's signature on the Job Specific RWP signify? Be specific. (0.75)

b. The IP2 plant is in cold shutdown and 2 operators are venting the RCS side of the regenerative H.X. Pre-job planning indicated that radiation levels during venting should jump from 300 mR/hr to 2 R/hr. During the actual venting radiation levels jump to 4R/hr, but the operators attribute it to fission product gases which they believe will decay off shortly. What actions are you, the SWS, going to take ? Why ? (1.0)

c. As a part of the Radioactive Waste Reduction program, bags of waste are color coded as to type and content. Match the contents of each bag with its color. (1.0)

___ Contaminated tools	1) Orange
___ Contaminated trash	2) Yellow
___ Contaminated anti-c's	3) Green
___ Clean trash	4) Red
___ Clean tools	5) Clear
	6) White

(***** CATEGORY 07 CONTINUED ON NEXT PAGE *****)

QUESTION 7.07 (2.75)

a. You are the SRO monitoring Fuel Handling in the ~~Fuel Building.~~ V.C. You notice that the bridge operator moving a fuel assembly (FA) sets it precariously on the top corner of ~~one of the storage racks.~~ another F.A. In which direction, if at all, will the dillon load cell change (increase/decrease/stay the same) ? What is the potential consequence, if any, of the bridge operator's action ? ~~Assume Dillon load cell limits are not in effect.~~ (0.75) Assume neither slack cable nor overload limits have been reached.

b. If a high radiation alarm is sensed by R-~~5~~12 Fuel Building ARM), 3~~4~~ automatic actions are performed. List them. (1.0)

c. Containment Fuel Handling bridge and trolley movement interlocks are bypassed and an inattentive bridge operator slams the fuel handling masts into the cavity side wall at full speed. You, as the SRO supervising fuel handling, anticipate that the FA he was carrying was severly damaged. What actions should you take ? (1.0)

QUESTION 7.08 (3.00)

a. One cause for concern during a Steam Generator (S/G) tube rupture is that the leak will BYPASS one of the three boundaries that keep fission products from reaching the public. What are these 3 boundaries and which one is BYPASSED during a S/G tube leak ? (1.0)

b. What are 4 methods that can identify which S/G has a tube rupture per E-3, S/G Tube Rupture ? Setpoints are not required. (1.0)

c. If a fuel failure accompanied a steam generator tube rupture, what might be the consequences of isolating the affected steam generator significantly above 541 F ? (1.0)

QUESTION 7.09 (2.25)

a. A control room atmospheric condition exists that requires evacuation. If plant power is 100%, what immediate action should the SRO take? (1.0)

b. Who (title), by what method, and where is S/G feeding being controlled from outside the control room? Assume normal heat removal capabilities. (0.75)

c. If adequate SDM doesn't exist, what action should the SRO take or have taken? Individual steps are not necessary. (0.5)

(***** CATEGORY 07 CONTINUED ON NEXT PAGE *****)

QUESTION 7.10 (1.50) Answer the following questions from ECA 0.0 (Loss of all AC Power)

a. What method is used to keep the core cooled when Indian Point Station loses normal and emergency AC power ? (1.0)

b. The ~~supplementary~~ actions of ECA 0.0 Loss of ~~Normal and Emergency~~ All AC require letdown be isolated ~~and temperature maintained > 443 F by Incore T/C's~~. What is the purpose of ~~these~~ this action~~s~~ ? (0.5)

QUESTION 7.11 (1.50)

The following critical safety functions are listed in alphabetical order. Re-order them in their correct order of priority.

a. Containment
b. Core cooling
c. Heat sink
d. Integrity
e. Inventory
f. Subcriticality

QUESTION 7.12 (1.00)

Several hours after a large LOCA has occurred, what criteria is used to determine whether high or low head recirculation must be established? Numbers are not required. (1.0)

(***** END OF CATEGORY 07 *****)

QUESTION 8.01 (2.50)

a. Briefly explain why IP2 was allowed to hydrostatically test the RCS to 3110 psig when the RCS pressure safety limit is 2735 psig. (1.0)

b. IP2 Tech Spec. 2.1 requires the limitation of RCS Tave, pressurizer pressure and RCS flow rate to specific and independent values. What is the basis for these limits? Time limits are not required. (0.5)

c. If the IP2 total nuclear peaking factor was found to contain extra unnecessary conservatisms and the next cycle's Reload Core Design eliminated them, how, if at all, would peaking factor change ? (increase/decrease/stay the same) Briefly explain your answer. (1.0)

QUESTION 8.02 (2.00)

Answer the following questions concerning IP2 facility staffing. Assume plant power is 100% unless otherwise specified.

a. Due to unforseen circumstances only one Radiological technician is available to relieve the offgoing shift. Is this permissible by Tech Specs ? (0.5)

b. What is the minimum number of fire brigade members ? What is the minimum number of operators necessary for safe shutdown ? Is it permissible to use an individual required for safe shutdown as a member of the fire brigade ? (1.0)

c. Per Tech Specs, select the one set of crew manning that best represents the minimum requirement for reactor startup. An STA is on-shift. Do not consider the SWS in your answer. (0.5)

1) 2 SROs, 1 RO in the control room, 1 NPO
2) 2 SROs, 2 ROs in the control room, 2 NPOs
3) 1 SRO, 2 ROs in the control room, 2 NPOs
4) 1 SRO, 1 RO in the control room, 1 NPO

QUESTION 8.03 (2.00)

a. Why are the MSIVs required to be closed within 5 seconds of receipt of a close signal ? 2 reasons. (1.0)

b. What Tech Spec actions are required if a CST discharge is found shut ? (1.0)

(***** CATEGORY 08 CONTINUED ON NEXT PAGE *****)

QUESTION 8.04 (3.00)

For each of the 3 cases below identify which, if any, Tech Spec operational leakage limits are violated. Justify your answer.

a. 21 S/G leakage is 0.2 gpm; leakage through RHR/RCS valves has increased from 2.0 to 3.0 gpm; Primary PORV leakage is 3.0 gpm; leakage from the packing of the manual valve upstream of the Letdown Isolation valve (LCV-459) is 2.5 gpm; unidentified leakage is 0.4 gpm. (1.0)

b. 23 S/G leakage is 0.15 gpm; leakage through the RHR/RCS valves has increased from 0.5 to 3.5 gpm; Primary PORV leakage is 2.5 gpm; leakage from a downstream weld on the body of the manual valve upstream of LCV-459 is 0.4 gpm; unidentified leakage is 0.2 gpm. (1.0)

c. 22 S/G leakage is 0.25 gpm; leakage through RHR/RCS valves has increased from 3.5 to 4.1 gpm; PORV leakage is 5.1 gpm; leakage from an upstream weld in the body of the manual valve upstream of LCV-459 is 0.2 gpm; unidentified leakage is 0.2 gpm. (1.0)

QUESTION 8.05 (3.00)

Answer the following questions concerning OAD-5, Procedure Adherence and Use.

a. What type of procedure (SOP,AOI,etc.) requires that its steps be followed in their proper sequence ? What action is required before deviating from a step sequence ? (0.75)

b. Under what circumstances is a written procedure document not required to be in active use ? What requirements exist under these circumstances ? (0.75)

c. OAD-5 specifically allows operators to depart from the intent of procedures, Tech Specs and other license requirements under certain circumstances. In one case prior approval is needed, in the other case only notification is necessary. Describe each case including either the necessary notifications, or in the case where prior approval is needed, what lowest authority (by title) may give such approval? (1.5)

(***** CATEGORY 08 CONTINUED ON NEXT PAGE *****)

QUESTION 8.06 (3.50)

Answer the following questions concerning the IP2 Emergency Plan.

a. Per IP-1013, which one of the following sets of factors best represents the considerations of the SWS (ED) when making shelter and evacuation recommendations to the counties and N.Y. state. (0.5)

1) Plant conditions, Risk/Benefit to Public, Event class
2) Plant conditions, Duration of Release, Evacuation time
3) Release rates, Duration of Release, Event class
4) Release rates, Risk/Benefit to Public, Evacuation time

b. You, as the SWS have declared an alert due to plant conditions at IP2. Place the following EP actions in their proper sequence as you implement IP-1001 during off-normal hours. (1.0)

1) Prepare a list of personnel who have called in
2) Prepare a message for beeper transmittal
3) Assign a CCR communicator
4) Authenticates original emergency phone call
5) Assign personnel to perform minimum job function per form 40

c. How would an increase in each of the following factors affect the thyroid dose (increase, decrease, no change) at 2 miles from the IP2 site boundry? Briefly explain why. Consider each separately. (2.0)

1) I-131 concentration
2) Noble Gas concentration
3) Wind speed
4) Dilution factor (Xu/Q)

(***** CATEGORY 08 CONTINUED ON NEXT PAGE *****)

QUESTION 8.07 (2.00)

Answer the following questions concerning Tech Spec Instrumentation.

a. Give two reasons for isolating main feedwater lines upon actuation of the Safety Injection System? (0.5)

b. Tech Spec Table 3-1 specifies the setting limits for ESF instrumentation In which reactor operating condition is the table applicable. (Select the best answer) (0.5)

1) Not in cold shutdown
2) Not in hot shutdown
3) Cold shutdown
4) Hot shutdown

c. According to Tech Specs, the only single item required before an Instrument Tech removes the cover plate on the rear of the ESF panel is (0.5)

1) Tave < 350 F
2) No ESF instrumentation out-of-service
3) Safety Injection bypassed
4) Watch Supervisor permission
5) A signed off work order

d. Which one of the following lists best represents the operational safety instrumentation covered by Tech Specs Sect. 3.5. (0.5)

1) Pzr pressure, Containment pressure, Turbine trip (overspeed)
2) Pzr pressure, Radiation monitoring, AFW flow
3) Pzr level, Containment pressure, AFW flow
4) Pzr level, Radiation monitoring, Turbine trip (overspeed)

(***** CATEGORY 08 CONTINUED ON NEXT PAGE *****)

QUESTION 8.08 (2.50)

Answer the following questions concerning OAD-19, Tagout Log

a. Identify (by name or color and size:nrrmal or small) the type of tag to be used in each of the following situations. (1.0)

1) Tags on the suction and discharge valves of a pump to be removed for bench testing
2) Tags on a pump only allowing it to be run during emergency situations
3) Tags on a CCR charging flow gauge OOS due to maintenance
4) Tags on a breaker supplying power to a motor operated valve to be removed for rebuilding.

b. Who (title) normally prepares tagouts at IP2 ? Who (title) independently verifies the tagout ? (0.5)

c. What 2 evolutions/operations require an independent check of the placement and restoration (removal) of stop tags. (0.5)

d. Per the Caution in OAD-19, what action is necessary if an independent verifier finds a valve stuck on its open seat when it's supposed to be closed. (Select the best answer) (0.5)

1) Close the valve and notify the on-watch RO
2) Inform the on-watch RO
3) Inform the on-watch SWS
4) Close the valve and notify the on-watch SWS

QUESTION 8.09 (3.00)

a. If containment integrity is not met at Hot Full Power, then what 2 options does the SRO have for corrective action ? Time periods are not required. (1.0)

b. When is containment integrity required ? (0.5)

c. For each of the following situations, indicate (yes,no) if containment integrity is preserved. If it is violated, explain what would be necessary restore it. (1.5)

1) The equipment door is properly closed. Maintenance is repairing a crimped closed penetration pressurization supply line to the door.
2) The inside door of the personnel air lock is properly closed. The outside door is wedged open with a 2 x 4 to allow for a detailed inspection of the knife (door) seals.
3) The outside containment purge exhaust valve has the operator removed but the valve is closed.

(***** CATEGORY 08 CONTINUED ON NEXT PAGE *****)

QUESTION 8.10 (1.50)

Diesel Generator 21's operability load test, which is required every 31 days, is scheduled for today. The last three tests were completed 36, 68, and 102 days ago respectively. The plant is at 100% power. Are Technical Specifications being met? Explain why or why not.

(***** END OF CATEGORY 08 *****)
(********** END OF EXAMINATION **********)

Equations

$Q = M\Delta h$

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

$Q = UA\Delta t$

$h_L = K\dot{V}^2$

$\pi = 3.14$

$e = 2.72$

$$SUR = 26 \frac{(\lambda\rho + \dot{\rho})}{\bar{\beta}_{eff} - \rho}$$

$$\rho = \frac{1}{\tau K_{eff}} + \frac{\beta}{1 + \lambda\tau}$$

$$SUR = \frac{26\,\rho}{\ell^* + (\beta - \rho)\,\tau}$$

$C_1(1-K_1) = C_2\,(1-K_2)$

$P = Po\ 10^{\ sur\ (t)}$

$P = Po\ e^{t/\tau}$

$$SUR = \frac{26.06}{\tau}$$

$$CR = \frac{S}{1-K_{eff}}$$

$$\tau = \frac{\rho}{\rho - \beta}$$

$$\frac{1}{M} = \frac{CR_1}{CR_2}$$

$$\lambda = \frac{0.693}{t_{1/2}}$$

$\ell^* = 10^{-4}$ secon

Conversions

1 curie = 3.7×10^{10} dps

1 gal = 3.78 liters

1 in = 2.54 cm

1 yr = 2.15×10^7 sec.

1 MW = 3.41×10^6 BTU/HR

1 kg = 2.2lbs

1 gm/cm³ = 62.4 lbs/ft³

1 ft³ = 7.48 gal

1 gal. = 8.3453 lbm.

ANSWERS -- INDIAN POINT 2 -85/12/09-BARBER, S.

ANSWER 5.01 (3.00)

a. DNB is the point at which a small increase in heat flux results in a large increase in clad temperature or a significant reduction in heat transfer coefficient.(A drawing of the heat transfer curve (Qdot vs. delta T) would be acceptable if the above concept is included) (1.0)

b. 1) more
2) more
3) less
4) less (0.25 each)

c. The curves that were plotted were a direct result of a computer model of predicted DNB conditions. Since a computer model was chosen there exists a reasonable uncertainty with a reasonable probability that DNB may exist if no tolerance is allowed (i.e. DNBR=1.0) (1.0)

REFERENCE

IP-2,Thermo., pg. 9-33,9-37
IP-2,Thermo., pg. 9-37,38,40
IP-2,Tech. Specs., Sect. 2 Basis

ANSWER 5.02 (2.25)

a.(For the plant to remain critical the positive reactivity inserted by MTC must counter the negative reactivity due to Doppler. Void reactivity is assumed to be negligible.)

(10% pwr)(-9.0 pcm/ %pwr)= -90 pcm (0.5)

(-90 pcm)/(-4 pcm/ F)= 22.5 F decrease (0.5)

Tave=524.5 F (0.5)

b. (100 ppm/ % delta rho)(.090 %delta rho)= 9 ppm (0.5)
dilution (0.25)

No double jeopardy to part a.

REFERENCE
IP2,Thermo., pg.5-70,71

ANSWERS -- INDIAN POINT 2 -85/12/09-BARBER, S.

ANSWER 5.03 (3.00)

a. The heat sink must be at a higher elevation than the heat source. (1.0)

b. Initially, NC flow will be reduced (0.2) due to less cold feed water entering the S/G causing less heat removal (0.2) which causes higher RCS temperatures in the U-tubes and reduces the thermal driving head (temperature difference between U-tubes and core) (0.6)

c. The head contains a large mass of stored energy which can't be adequately cooled during a rapid NC cooldown. (1.0)

REFERENCE
IP2, Thermo., pg 9-34
IP2, ES-0.2, pg. 7

ANSWER 5.04 (2.50)

a. 2 (0.5)

b. Sm-149 has a smaller absorption cross section and therefore less reactivity worth than Xe (0.5), and does not decay away like Xe (0.5). (will not add positive reactivity)

c. Case I would be a more noticeable Xe transient (0.2) because the local power changes occured rapidly with respect to Xenon's ability to maintain equilibrium with local power. (0.8)

REFERENCE
IP2,Reactor Theory, pg. 6-14,20,21,23,24

ANSWERS -- INDIAN POINT 2 -85/12/09-BARBER, S.

ANSWER 5.05 (2.50)

a. From the C-E Stm Tables,

Tsat for 2200 psia= 649.5 F (0.5)

SCM= Tsat-Th= 649.5-580= 69.5 F (0.5)

b. decrease (0.25)
Th increases as unit delta T increases with power (0.5)

c. 1 (0.25)
Core delta T during natural circulation cooldown will approach full load delta T. Thot is greater than in the other 2 cases. (0.5)

REFERENCE
IP2, Thermo, Sect. 2
IP2,Vol. 1, pg. 14, RCS Sys. Descr.

ANSWER 5.06 (1.50)

a. Stay the same (0.25)
Beta Bar's magnitude is strictly dependent on the concentrations of U-235, U-238, Pu-239, and Pu-241 and they change only with life and not with temperature. (0.5)

b. EOL (0.25)
Since the beta of the core is smaller a larger SUR would result for a given reactivity insertion. (0.5)

REFERENCE
IP2, Reactor Theory ,pg. 4-14 to 4-18

ANSWERS -- INDIAN POINT 2 -85/12/09-BARBER, S.

ANSWER 5.07 (4.00)

a.
1) decrease (0.3)lower temperature reduces the rods "sphere of influence" by reducing the number of neutrons the rod sees. (0.7)
2) Decrease (0.3)
Rods are moved from a high flux region to a low flux region; rod worth decreases. (0.7)
3) Increase (0.3)
Decrease in boron increases the rods "sphere of influence" by increasing the number of neutrons the rod sees. (0.7)

b. True (0.2) DRW is essentially independent of power as long as the relative neutron flux (local flux divided by total core flux) remains constant (0.8)
(will accept False as correct if accompanied by an explanation of temperature, Doppler, and Xe effects that change relative flux from HZP to power operation.)

REFERENCE
a. IP2, Reactor Theory, pg. 7-19 to 7-21 and fig. 7.16.
b. pg. 7-23,7-25

ANSWER 5.08 (2.25)

1) Criticality is uncertain, (0.25); Stop rod motion (0.5)
2) Reactor is critical (0.75)
3) Criticality is uncertain, (0.25); Stop boron dilution (0.5)

REFERENCE
IP2,POP 1.2, step 3.17

ANSWERS -- INDIAN POINT 2 -85/12/09-BARBER, S.

ANSWER 5.09 (2.50)

a. B (0.25) because A will reach critical rod height sooner than B (0.25) and the closer Keff is to one, the longer it takes to reach a new steady state neutron level (more neutron generations are required to achieve the larger population)(0.5), thus B will allow its neutron population more time to achieve a higher subcritical level than A (0.5).

b. Same (0.5), critical rod height is dependent only upon the reactivity characteristics of the core, not on neutron level. (0.5)

REFERENCE
IP2 Rx Theory Text pp. 4-48 to 4-56 and pg. 3-22

ANSWER 5.10 (1.50)

5% decay heat = (0.05) 2758MW = 137.9 MW [0.1]

Safeties lift at 2485 psig = 2500 psia [0.1]

Tsat at 2500 psia = 668 F [0.3]

delta T required = 668 - 547 = 121 F [0.1]

(1.2 Btu/lbm-F)(214,000lbm)(121F) = 3.10×10^{7} Btu [0.3]

137.9 MW + 15 MW = 153 MW (56.896 BTU/min/KW)(1000KW/MW)

= 8.7×10^{6} Btu/min [0.3]

$3.10 \times 10^{7} / 8.7 \times 10^{6}$ = 3.5 minutes [0.3]

REFERENCE
CE steam tables
Tech Specs (Pzr safety setpoint and thermal power rating)
FSAR Vol 2 (primary mass)
Thermo text pg 1-10 and 1-31 (definition of Cp)

ANSWERS -- INDIAN POINT 2 -85/12/09-BARBER, S.

ANSWER 6.01 (2.75)

a. The affected non-return MS check valve would close(0.5) and the High MS flow SI signal must sense high MS flow on 2 MS lines.(0.5)

b. To minimize the possibility of generating a false signal since initiation of containment spray (NaOH) would cause unnecessary corrosion (0.5)

c. No (0.25)
Busses 6A and 3A must receive an SI signal and energize before the motor driven pumps start. (0.5)

d. Safeguards actuation sequence finished (0.25 ea. x 2 req'd)
SI manual reset PB's depressed { 2 minute time-out, Low pressure permissive defeat Keys }

REFERENCE
a. IP2, Vol. 10, pg. 9 footnote, ESF Sys. Descr.
b. pg. 12
c. pg. 22,23
d. pg. 14, and SD 28

ANSWER 6.02 (3.50)

Impulse-Lag unit: On a load change, it senses the rate of change of the difference of the 2 inputs.Its output reflects the magnitude of the rate of change of Pimp and NI power. (Steady state differences result in zero output) (0.5)

Initiates(Anticipates) a fast response to a change in load (0.5)

Non Linear Gain unit: Converts the output of the Impulse-Lag unit to a temperature error.(0.5)
Low gain is used for small (<1%) mismatch and higher gain is used for larger mismatches (0.5)

Initiates rod motion more quickly with a larger change in power. (0.5)

Variable Gain unit: Selects a higher gain at a lower power and vice versa. (0.5)

Reactivity insertions at a high power have larger effect than those at low power. (0.5)

ANSWERS -- INDIAN POINT 2 -85/12/09-BARBER, S.

REFERENCE
a. IP2, Vol. 15, pg. 84-87, Core Design and Control Sys. Descr.

ANSWER 6.03 (1.50)

a. Prevents thermal shocking of RC piping due charging flow. (1.0)

b. Protects demin resin (0.5)

REFERENCE
a. IP2,Vol. 1, pg. 5, RCS Sys. Descr.
b. pg. 11

ANSWER 6.04 (2.50)

a. Loss of seal injection (0.5)

b. Check valve upstream and motor operated valve downsteam with connecting piping are rated for RCS pressure. ~~(1.0)~~ (0.5)

High flow is sensed on a flow element which closes the motor operated outlet valve. (0.5) Relief valve (0.5)

c. Establishs the additional lower radial bearing cooling flow needed at low RCS pressure. (0.5)

REFERENCE
a. IP2, Vol. 1, pg. 33, RCS Sys. Descr.
b. pg. 46,47
c. pg. 50

ANSWERS -- INDIAN POINT 2 -85/12/09-BARBER, S.

ANSWER 6.05 (2.00)

a. Low-Low level (0.25) on 2 of 4 S/G's (0.25)
Loss of outside power concurrent with a Main TG trip (provided an SI signal doesn't exist) (0.5)

b. Recirc flow is established.(SOV-1321 opens to open the recirc valve) (0.25)
A timer is started.(Trips pump if 55 gpm is not established w/in time period) (0.25)

c. Yes, if the timer times out and flow is less than 55 gpm , the motor driven AFW pump will trip. (0.5)

REFERENCE
a. IP2, Vol. 21, pg. 70, FW Sys. Descr.
b.&c. pg. 71

ANSWER 6.06 (1.75)

a. NaOH (0.25)

Limits offsite thyroid doses (to less than 10CFR 100 guidelines) by trapping iodine (inorganic) into a liquid phase. (0.5)

Increases sump pH (to about 8.5) to minimize general corrosion due to boric acid. (0.5)

b. Spray pumps will start , valves will stroke to their SI position (discharge valves open). Spray is initiated (0.5)

REFERENCE
a. & b. IP2, Vol. 10.2, pg. 5,16, Containment Spray Sys. Descr.

ANSWERS -- INDIAN POINT 2 -85/12/09-BARBER, S.

ANSWER 6.07 (3.75)

a. UV on busses 2A,3A,5A ~~and~~ OR 6A. (0.25)
SI signal (0.25)

b. Emergency stop button (0.25 ea.)
Overcurrent relay (51V)
Reverse power relay (32)

c. lower (0.1 ea.) Loss of EDG causes a loss of the alternate AC feed
same (MCC 26A)and the battery charger output to Battery
on 21. Battery voltage will decrease due to loading.
off Inverter output voltage remains the same since the
off it will put out 118 VAC for any DC input between 105 VDC and 140 VDC. The inverter is still carrying the load from its DC supply so PL1 is on. Since the alternate feed is deenergized the In-synch light is off. PL5 is off since MCC 26A is deenergized.
(5 items @ 0.4 ea.)

REFERENCE
c. IP2, Vol. 27.1, pg. 71-73, Electrical Sys. Descr. and Fig. 1 pg. 96
a.&b. IP2, Vol. 27.3, pg. 37, Diesel Generator Sys. Descr.

ANSWER 6.08 (2.25)

a. Sprays initiate (2260 to 2310 psig) (0.25 ea.)
Primary PORVs open (2335 psig)
High pressure reactor trip (2385 psig)
Safety valves open (2485 psig)

b. All heaters off (18%) (0.25 ea.)
Letdown isolated (18%)
Low pressure SI or charging pump speed/flow increase.

c. A large insuge into the pressurizer causes it to become subcooled. The heaters come on to ensure the ensuing outsurge will be capable of flashing to steam. (0.5)

REFERENCE
a. IP2, Vol. 1, pg. 82, RCS Sys. Descr.
b. pg. 71
c. pg. 69-70

ANSWERS -- INDIAN POINT 2 -85/12/09-BARBER, S.

ANSWER 6.09 (3.00)

a. (1) The reactor will trip on SR high flux [0.5] due to P-6 dropping out and reenergizing SR Nuclear Instruments(NI). [0.5]

(2) The reactor will not trip [0.5] due to P-10 which prevents reenergization of the SR NI even if P-6 drops out. [0.5]

b. The Defeat P-6 Pushbuttons must be depressed [0.5] in order to allow the SR NI to reenergize. [0.5]

REFERENCE
IP2 SD 13 pg 60,61 Fig 13,27,32
IP2 SD 28 pg 22,23

ANSWER 6.10 (2.00)

a. IP1 Superheater Bldg. (0.5)

b. Service water pumps
Charging pumps
SI pumps
RHR pumps
CCW pumps
AFW pumps
MCC 27 (any 6 for 0.25 each)

REFERENCE
IP2 SD 27.1 pp. 86-91 and Fig. 32-36

ANSWERS -- INDIAN POINT 2 -85/12/09-BARBER, S.

ANSWER 7.01 (2.50)

a. 4

b. 4

c. ~~TRUE~~ FALSE (P-7 is satisfied when Power < 10%)

d. FALSE

e. 2

REFERENCE
a. IP2,E-0,pg. 1, Reactor Trip/SI
b. pg. 2
c. IP2,E-0,pg. 1, Reactor Trip/SI
IP2,Vol. 28,pg. 35, Unit Protection Sys. Descr.
d. IP2,ES-1.1,pg. 5,SI termination
e. IP2,E-1,pg. 8, Loss of Reactor/Secondary coolant

ANSWER 7.02 (1.75)

a. PR > 5% (0.25 ea.)
IR SUR not negative

b. Start 1 SI pump (0.25 ea.)
Block low pressure SI as necessary
Depressurize the RCS to 1400 psig

REFERENCE
a. IP2, FR-S.1, pg. 3, ATWS EOP
b. pg. 4

ANSWERS -- INDIAN POINT 2 -85/12/09-BARBER, S.

ANSWER 7.03 (2.00)

a. Rod worth is insufficient to significantly affect core peaking factors at higher core height. (0.5) (Will accept RPI inaccuracy for partial credit)

b. Thermocouples (0.25 ea.)
Incore detectors

c. Lift coil disconnect switches (0.5)
Unaffected rods' switches are opened (0.5)

REFERENCE
a. IP2, Tech. Spec. 3.10.5, Rod Misalignment
b. IP2, SOP 15.5, pg. 1
c. IP2, A 16.1.1, pg.3, Dropped or Misaligned Rod AOP

ANSWER 7.04 (2.00)

a. To prevent dangerous Hydrogen concentrations from building up inside containment. (0.5)

b. ~~Under adverse containment conditions. (0.5)~~ 1) Repressurize the RCS (0.5)
2) Start a RCP (0.5)

~~c. The RV head acts like a pzr when a steam void exists. Spraying will depressuize the system but flashing in the head will hold pressure up. Since no flashing occurs for a gaseous void a significant pressure decrease would be observed during spraying operations. (1.0)~~

c. Vent the RV head area (0.5)

REFERENCE FR-I.3
a. IP2, ~~A 43, pg. 7,8, Voids in RV head~~ Attach. 2, Step 2
b. ~~pg. 13~~ Step 6, 9
c. ~~pg. 2~~ Step 19

ANSWERS -- INDIAN POINT 2 -85/12/09-BARBER, S.

ANSWER 7.05 (2.00)

a. Ensures MTC is not positive (0.5)
Prevents unnecessary power excursions due to temperature increases during heatup. (0.5)

b. Prevents exceeding NDT limits (Fracture toughness concern) (0.5)

c. RCPs provide the necessary RCS heat input (0.5)

REFERENCE
a. IP2, POP 1.1, pg. 10, Plant Heatup procedure
b. IP2, POP 1.2, pg.2, Reactor startup procedure
c. IP2, Tech. Specs. 3.1.c

ANSWER 7.06 (2.75)

a. That plant conditions are stable and are not planned to change (0.25) at the job site (0.25) thus changing radiological conditions (0.25).

b. Stop work and notify radiation protection (0.5)
Radiological conditions differ than those expected during pre-job planning. (0.5)

c. 4,1,2,3,5 (0.2 ea.)

REFERENCE
a. IP2, SAO-302, pg. 7
b. IP2, SAO-303, pg. 8, ALARA Program, Sect. 4.10
c. IP2, Rad Worker Retraining Program, Sect. 18

ANSWERS -- INDIAN POINT 2 -85/12/09-BARBER, S.

ANSWER 7.07 (2.75)

a. Decrease (0.25) Damaged fuel assemblies
~~The gripper could disengage from the fuel assembly causing it to fall onto the core.~~ (It would be in a position other than assumed for fuel handling accidents) (0.5)

b. ~~Supply fans stop~~ VC purge supply & exhaust valves close ~~(4 @ 0.25 ea)~~ (0.33)
~~Supply dampers close~~ VC pressure relief line valves close (0.33)
~~Charcoal filter inlet and outlet dampers open~~ VC evacuation alarm sounds
~~Bypass dampers around charcoal filters close~~ (0.34)

c. Isolate containment ventilation (Any 4 @ 0.25 ea.)
Suspend all fuel handling operations
Evacuate containment
Monitor R-14. If release occurs refer to EP Document book for classification

REFERENCE

a. IP2, Vol. 17, pg. 21, Fuel handling Sys. Descr.
b. pg.10
c. IP2, A 17.1, pg.1, Irradiated Fuel Damage in the Reactor Cavity

ANSWER 7.08 (3.00)

a. clad (0.25 ea.)
RCS
containment

Containment is bypassed.

b. 1) Unexpected rise in S/G NR level (0.25 ea.)
2) High S/G sample radiation level
3) High steam line radiation
4) High S/G blowdown radiation

c. Since the S/G is a saturated system, isolation of the S/G at a saturation temperature with a pressure > than the steam dump and sec. PORV or safety setpoint would cause an unnecessary release to the public. (1.0)

REFERENCE

a.& b., IP2, E-3, Steam Generator Tube Rupture
c. pg. 5

ANSWERS -- INDIAN POINT 2 -85/12/09-BARBER, S.

ANSWER 7.09 (2.25)

a. Trip the reactor (by either tripping the turbine; tripping the reactor locally or prior to leaving the CCR), announce CCR evacuation over PA, take ~~graph books~~ 2 radios, ~~vital keys~~, SRO log, ~~EOP and AOP's~~ ~~(0.5)~~ (0.5) Designate first and second RO
Proceed to the local pressurizer level and pressure control station (0.4)

b. First RO (0.25) ~~Monitoring~~ Maintain S/G level ~~to ensure~~ using AFW ~~is maintaining~~ at proper level (~~60-65%~~ 87-93) (0.25) at the Aux Feed pump Bldg. local S/G level control panel (0.25).

c. Emergency borate (0.5)

REFERENCE A27.1.9 pg. 2,3
a. IP2, ~~A-5-A, Control Room Inaccessibility with Outside Power Available~~
b. pg. ~~2~~ 3
c. pg. 4

ANSWER 7.10 (1.50)

a. The steam driven AFW pump provides feed (0.5) and the sec. PORVs provide steam relief to promote natural circulation. (0.5)

b. Minimize RCS inventory loss (and shrinkage due to cooldown) (0.5)

REFERENCE
a. IP2, A-4-B, pg. 4, Loss of Normal and Emergency Power
b. pg. 7

ANSWER 7.11 (1.50)

a. Subcriticality
b. Core cooling
c. Heat sink
d. Integrity
e. Containment
f. Inventory

(0.25 each)

REFERENCE
IP2, ERG Status Trees

ANSWERS -- INDIAN POINT 2 -85/12/09-BARBER, S.

ANSWER 7.12 (1.00)

RHR ~~injection~~ flowrate must be above a specified value. (1.0)

REFERENCE
IP2, ES-1.3, pg. 10, Transfer to cold leg recirc

ANSWERS -- INDIAN POINT 2 -85/12/09-BARBER, S.

ANSWER 8.01 (2.50)

a. The 2735 psig safety limit was only imposed with FA in the core. The hydro was done without the core loaded. (1.0)

b. To assure that the values assumed in accident analysis are not exceeded during normal plant operations. (0.5)

c. Decrease (0.25)
The peaking factor incorporates uncertainties which when eliminated would mean that there would be less error in determining the actual incore peak-to-average flux or power distribution. (0.75)

REFERENCE
IP2, Tech Specs Sect. 2.1

ANSWER 8.02 (2.00)

a. Yes (0.5)

b. 5- fire brigade (0.25)
4-safe shutdown (0.25)
No, operators required for safe shutdown must be excluded from the fire brigade (0.5)

c. 3 (0.5)

REFERENCE
IP2, Tech Specs Sect.6

ANSWER 8.03 (2.00)

a. Limit RCS cooldown rate (0.5) and reactivity insertion following a MSLB. (0.5)

b. Place AFW pump in ~~manual~~ pullout (0.4)
Within time limit(1hr), restore CST lineup or open city water supply to AFW pumps and return them to auto. (0.6)

REFERENCE
a. IP2, Tech Specs Sect 4.7 basis
b. IP2, Tech Specs Sect 3.4

ANSWERS -- INDIAN POINT 2 -85/12/09-BARBER, S.

ANSWER 8.04 (3.00)

a. No criteria are violated (1.0)

b. RHR/RCS leakage increase exceeded margin to 5 gpm limit by more than 50% (0.5)

(3.5-0.5)/(5.0-0.5)= 0.66 or 66% (0.5)

c. 0 gpm through an RCS pressure boundary (0.5)

upstream valve body leakage is unisolable (0.5)

REFERENCE
IP2, Tech Spec 3.1.f.2

ANSWER 8.05 (3.00)

a. EOP (0.25)
Ensure prerequsite steps are performed prior to deviating from the step sequence (0.5)

b. Routine and repetitive evolutions (0.25)
Precautions, limitations, and prerequisites must be either previewed or memorized prior to the evolution. (0.5)

c. Operators are allowed to deviate from procedures whenever neccessary for the prevention of injury to personnel or to the public; or damage to the facility (0.5)
Chief Ops Engr(Mgr. of Ops), Gen Mgr, or VP Nuc Pwr to be notified after the event (0.25)

Operators may depart from Tech Specs or from a licensed condition if no action consistent with these documents provides adequate or equivalent protection of the public health and safety and is immediately apparent. (0.5)

SRO approves prior to taking action (0.25)

REFERENCE
a. & b. & c. IP2, OAD-5, pg. 2, Procedure Adherence and Use

ANSWERS -- INDIAN POINT 2 -85/12/09-BARBER, S.

ANSWER 8.06 (3.50)

a. 2 (0.5) (will accept 3 for credit based on flow chart IP-1013)

b. 3,4,2,1,5 (0.2 ea.) (Will accept 3 and 4 in reverse order due to likely possibility of this order of steps)

c.

1) Increase, higher concentration of radioactivity will reach the thyroid
2) No effect, noble gases don't concentrate in the thyroid
3) Decrease, higher wind speed disperses the activity throughout the atmosphere
4) Increase, a larger number indicates less dilution in the atmosphere

(0.1) Direction
(0.4) Explanation

REFERENCE
a. IP2, E-Plan, IP-1013, pg. 1
b. IP2, E-Plan, IP-1001, pg. 5,6
c. IP2, E-Plan, IP-1007, pg. 5

ANSWER 8.07 (2.00)

a. To prevent excessive cooldown of the RCS (0.25)
Reduces consequesnces of a steam line break (0.25)

b. 1 (0.5)

c. 4 (0.5)

d. 1 (0.5)

REFERENCE
IP2, Tech Specs Sect. 3.5

ANSWERS -- INDIAN POINT 2 -85/12/09-BARBER, S.

ANSWER 8.08 (2.50)

a.
1) Stop or black with a diagonal white stripe(normal size) (4 @ 0.25 ea)
2) Caution or yellow (normal size)
3) Stop,small size for gauges
4) Stop (normal size)

b. On-watch RO (0.25 ea.)
SWS

c. Operating orders (0.25 ea)
Tags removed from safety related equipment

d. 3 (0.5)

REFERENCE
IP2, OAD-19, Tagout Log

ANSWER 8.09 (3.00)

a. Restore containment integrity (4 hrs) OR (0.5 ea.)
Go to cold shutdown

b. When ever reactor conditions are other than cold shutdown (0.5)

c.
1) No, must restore PP supply to the equipment door (0.5 ea.)
2) Yes
3) Yes

REFERENCE
IP2, Tech Specs, Sect. 1.7
IP2, Tech Specs, Sect. 3.6

ANSWER 8.10 (1.50)

No [0.3], each test is within 25% of the required time interval [0.6], but the three consecutive combined test intervals exceed 3.25 of the required interval [0.6].

REFERENCE
Tech Spec 1.10 pg 1.4

ATTACHMENT 2

FACILITY COMMENTS ON WRITTEN EXAMINATION AND RESOLUTIONS

6.01d	Comment:	Additional answers are possible since question did not specify whether SI had already been initiated.
	Resolution:	Three additional answers were added based on System Description 28.
7.01c	Comment:	Answer is FALSE since P-7 is considered "satisfied" when power is less than 10%.
	Resolution:	Accepted. Based on common usage of the term "satisfied."
7.02b	Comment:	Question asks for knowledge of steps in a Response Not Obtained column of an EOP. These are not required to be memorized according to Westinghouse Owners Group Emergency Response Guidelines Background Document (Low Pressure Version) E-0, Step 1, Note 1.
	Resolution:	Not accepted. Background Document for FR-S.1, Step 1, Note 1, states: "... since time is a critical factor during a full power ATWS event, manual actions to initiate emergency boration of the RCS is included as an immediate action." In view of the necessity for timely action in the above case, a competent operator should understand and be able to recall from memory the three basic steps asked for by this question.
7.03a	Comment:	RPI inaccuracy should be accepted as an answer.
	Resolution:	Will accept RPI inaccuracy for partial credit in accordance with Technical Specification 3.10-15.
7.09a and b	Comment:	Procedure A-5-A was replaced and has slightly different operator actions.
	Resolution:	Answer is changed to reflect current reference, Procedure A27.1.9, pages 2-3.
8.04	Comment:	Question is triple jeopardy.
	Resolution:	Not accepted. Question tests three different criteria for RCS leakage.

8.06a	Comment:	Answer #3 should be accepted based on the IP-1013 flow chart.
	Resolution:	Accepted.
8.06b	Comment:	Procedure requires memorization of steps of an E-Plan implementing procedure and is not required knowledge.
	Resolution:	Not accepted. The steps of the procedure are given in the question. The answer requires their proper ordering. This requires a knowledge of the procedural intent and how it is to be accomplished, which is required knowledge. Will accept a reversal of items 3 and 4 in the answer based on the likely possibility that the steps could be performed in that order.