FACILITY POST-EXAMINATION COMMENTS

FOR THE PERRY INITIAL EXAM - FEBRUARY 2007

FENOC

FirstEnergy Nuclear Operating Company

Perry Nuclear Power Station
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March 12, 2007
PY-CEI/OIE-0697L

United States Nuclear Regulatory Commission
2443 Warrenville Road, STE 210
Lisle, Illinois 60532-4352

Attention: Mr. Bielby, Chief Examiner
Operations Branch Region III

Perry Nuclear Power Plant
Docket No. 50-440
NRC Initial Post-Examination Material

Dear Mr. Bielby,

In accordance with NUREG-1021, ES -501, Section C.1, the following items are submitted following completion of the Perry written examinations and operating tests during the period of February 26 to March 5, 2007.

Attachment 1 contains the graded written examinations (i.e., each applicant's original answer and examination cover sheets) and a clean copy of each applicant's answer sheet. Attachment 2 contains the questions asked by and answers given to the applicants during the written examination. Attachment 3 contains comments made by the applicants after the written examination. Attachment 4 contains the written examination seating chart. Attachment 5 contains the completed Forms ES-403-1, "Written Examination Quality Checklist". Attachment 6 contains the results of the written examination performance analysis.

No changes were made to the master examinations and answer keys during the administration and grading of the examinations. Therefore, the master examinations and answer keys will not be forwarded.

Original Form(s) ES-201-3, "Examination Security Agreement" will be forwarded when all post-examination signatures have been obtained.

If you require further clarification on the items submitted, or any other additional item, contact Dan Zielinski at (440) 280-5277.

Sincerely,

Attachments:

1. Applicants Written Examinations Including Graded Answer Sheets
2. Applicants Questions and Answers Provided During the Written Examination
3. Applicants Post-Written Examination Comments
4. Written Examination Seating Chart
5. Completed Forms ES-403-1, "Written Examination Quality Checklist"
6. Results of the Written Examination Performance Analysis

File w/o attachments

PERRY INITIAL LICENSE EXAM

CLASS 05-01

Note: NRC answers are bolded. Proposed changes are bolded and italicized.

Question 11 RO:

The plant is operating at 100% reactor power when one Reactor Recirculation Pump trips. All systems respond as designed to this event.

How will RPV Water Level initially respond and what is the reason for this response?

RPV Water Level will:

_____ **A.** **INCREASE due to the displacement of water into the downcomer by increased steam voiding.**

_____ B. INCREASE due to the continuing addition of feedwater at 100% rated feedwater flow.

_____ C. DECREASE due to the lack of coolant velocity to sweep voids into the steam separator.

_____ D. DECREASE due to the runback of feedwater pumps to minimum speed

Comment: Candidates believe that answer B is also correct. No documentation available to support candidate position. Event was run in simulator, feedwater flow follows steam demand immediately.

Licensee Position: Reject candidate comment. No supporting material to defend position. Question to remain as is.

Question 19 RO:

The plant is in MODE 4 with the following plant conditions.

- RHR B is operating in the Shutdown Cooling Mode when the pump trips.
- RHR A is not available.
- No Reactor Recirculation Pumps are operating.
- No RWCU Pumps are operating.
- RPV Water Level is currently 230 inches on SHUTDOWN RANGE

ONI-E12-2, Loss of Decay Heat Removal would require __(1)__ and reactor water temperature monitoring would be from __(2)__ per IOI-12 Maintaining Cold Shutdown.

_____ A. (1) raising RPV Water Level to greater than 250 inches
(2) bottom head drain

_____ **B. (1) starting a Reactor Recirculation Pump**
(2) recirc suction

_____ C. (1) starting a Reactor Water Cleanup Pump
(2) bottom head drain

_____ D. (1) starting a Reactor Water Cleanup Pump
(2) recirc suction

Comment: Candidates argue that Off Normal Instruction supplemental actions are not required to be known from memory. First part of answer is supplemental action memory question.

Licensee Position: Reject candidate comment. Supplemental actions are not required to be known from memory. However, to answer this question students needed to know what are available temperature monitoring methods in Mode 4. Once identified, all methods listed for ONI-E12 are viable but only one would provide for temperature monitoring. Editorial change to question as shown below.

The plant is in MODE 4 with the following plant conditions.

- RHR B is operating in the Shutdown Cooling Mode when the pump trips.
- RHR A is not available.
- No Reactor Recirculation Pumps are operating, ***but are available***.
- No RWCU Pumps are operating, ***but are available***.
- RPV Water Level is currently 230 inches on SHUTDOWN RANGE

Question 22 RO:

With the reactor operating at 100% power the Main Steam Isolation Valves closed.

No Control Rod motion occurred. No operator actions have been taken.

Which one of the following correctly describes the initiating signal and actuation(s) produced by the Redundant Reactivity Control System (C22) which will reduce reactor power?

_____ A. High Reactor Pressure will immediately trip the Reactor Recirculation Pumps off.

_____ **B. High Reactor Pressure will downshift the Reactor Recirculation Pumps to Slow Speed and then trip the Reactor Recirculation Pumps off.**

_____ C. RPV Water Level 2 will immediately trip the Reactor Recirculation Pumps off.

_____ D. RPV Water Level 2 will downshift the Reactor Recirculation Pumps to Slow Speed and then trip the Reactor Recirculation Pumps off.

Comment: Candidates argue that answer C is also correct since the stem of the question does not ask which will come first.

Licensee Position: Candidates comment is accurate. This question was raised during the exam and the proctor placed on the board; "Based on given conditions which will occur first." Since this additional information was put out to all candidates, only answer B is correct.
Question to change as shown below.

With the reactor operating at 100% power the Main Steam Isolation Valves closed.

No Control Rod motion occurred. No operator actions have been taken.

Based on given conditions which of the listed initiating signals produced by the Redundant Reactivity Control System (C22) will occur first to reduce reactor power?

Question 24 RO:

PEI-T23, Containment Control has been entered due to a scram discharge volume rupture.

Containment Sprays have been initiated due to rising Containment temperature and pressure.

Containment Spray operation is required to be terminated:

_____ **A.** **before Containment Pressure is reduced below 0.0 psig.**

_____ B. before Containment Pressure is reduced below 0.5 psig.

_____ C. after Containment Temperature is reduced below 95°F.

_____ D. after Containment Temperature is reduced below 185°F.

Comment: Candidates argue that answer B is an Operation expectation and is taught and practiced.

Licensee Position: Reject candidate comment. What is emphasized is that Containment sprays are secured at 0.5 psig so that they are off prior to 0.0 psig.
Question to remain as is.

Question 28 RO:

Certain ATWS conditions require the operators to deliberately lower RPV Water Level in order to lower Reactor Power.

Which of the following describes why Reactor Power decreases as RPV Water Level is lowered?

_____ **A.** **Reducing natural circulation causes increased void formation in the core.**

_____ ***B.*** Uncovering the feedwater spargers reduces the core inlet subcooling to the core.

_____ C. Equalizing the density of the water inside and outside the shroud lowers the void distribution throughout the core.

_____ D. Reducing the NPSH available to the Jet Pumps reduces the natural circulation flow the Jet Pumps deliver to the core.

Comment: Candidates argue that answer B is also correct. Excerpt from PEI Bases page 5 is provided below. PEI Bases page 5 is attached for review.

Lowering RPV water level to two feet below the feedwater spargers (100 in.). This is done to reduce core-inlet subcooling. This is an effective action to mitigate the consequences of large power oscillations. This action reduces core flow and inlet subcooling by preheating cold feedwater with vessel steam, which reduces reactor power and the likelihood of instabilities.

Licensee Position: Candidate comment valid. Answer B would add negative reactivity and cause Reactor Power to decrease.
Question to change as shown below.

Certain ATWS conditions require the operators to deliberately lower RPV Water Level in order to lower Reactor Power.

Which of the following describes why Reactor Power decreases as RPV Water Level is lowered?

_____ A. Reducing natural circulation causes increased void formation in the core.

_____ B. Uncovering the feedwater spargers ***increases*** the core inlet subcooling to the core.

_____ C. Equalizing the density of the water inside and outside the shroud lowers the void distribution throughout the core.

_____ D. Reducing the NPSH available to the Jet Pumps reduces the natural circulation flow the Jet Pumps deliver to the core.

EMERGENCY PROCEDURES GUIDELINE (EPG) RATIONALE (Cont.)

Postulated Severe accidents beyond design basis have dictated that the PEI's include drastic measures such as:

- **Lowering RPV water level to two feet below the feedwater spargers (100 in.).** This is done to reduce core-inlet subcooling. This is an effective action to mitigate the consequences of large power oscillations. This action reduces core flow and inlet subcooling by preheating cold feedwater with vessel steam, which reduces reactor power and the likelihood of instabilities. In addition, the suppression pool heat load is also reduced by up to 40% because of the steam that is condensed in the downcomer. For this action to be effective against power oscillations and to minimize the suppression pool heat load, the water level reduction is directed upon entering PEI-B13 (ATWS).

- ***Venting containment exceeding offsite dose release rates.*** Venting the containment assures that the containment can again be closed up to prevent further radioactive material release. Failure to do this can have serious consequences including: almost certain failure of the containment; loss of the pressure suppression function; loss of long term cooling capability; and possible loss of capability to provide any core cooling. It is preferred to release a measured amount of radioactive material for a relatively short time, than to lose the capability to cool the core and at the same time lose the capability to isolate the containment. Without initially venting containment, a serious accident resulting in considerable release of radioactive material to the environment could result. Venting also helps ensure that all releases are via monitored HVAC vent paths, thus enhancing post accident monitoring. Some gases may escape through open building doors, procedural steps are provided to notify Radiation Protection and Chemistry so that auxiliary monitoring can be set up.

- **Lowering RPV water level to below the top of active fuel.** This is done to reduce reactor power such that containment limits are approached slowly, giving operators time to protect the containment and shut the reactor down by other methods.

Some of the other conditions and actions that are provided in the PEIs include:

- Specific conditions under which boron injection is required.
- Additional methods of assuring adequate core cooling when RPV water level indication is lost.
- Control of hydrogen in containment.
- Conditions under which Automatic Depressurization System (ADS) automatic initiation may (in some cases must) be prevented.
- Conditions under which ADS must be initiated.
- Use of steam cooling to cool the core if required.
- Alternate methods of inserting control rods.
- Proper control of a marginally shutdown reactor to prevent fuel damage if and when criticality occurs.

Question 45 RO:

During a reactor startup, the following conditions exist:

- ALL Source Range Monitor (SRM) detectors are fully inserted.
- ALL SRM Channels indicate 9 x 10^4 cps.

Per IOI-1, Cold Startup, which one of the following describes the correct operation of Source Range Monitor detectors?

SRM detectors are:

_____ A. fully inserted until the reactor is at the Point of Adding Heat. Then the SRM detectors are fully withdrawn.

_____ B. fully inserted until IRM overlap is confirmed. When IRMs are on Range 2, then the SRM detectors are fully withdrawn.

_____ C. **fully inserted until IRM overlap is confirmed. When IRMs are on Range 3, then the SRM detectors are fully withdrawn.**

_____ D. partially withdrawn to maintain 10^2 to 10^5 cps until IRM overlap is confirmed and the reactor is at the Point of Adding Heat. Then the SRM detectors are fully withdrawn.

Comment: Candidates argue that answer D is also correct. Can perform IOI steps in any order and IOI allows withdrawal of SRM's to maintain 100 to 1.0e5 cps.

Licensee Position: Reject candidate comment. Answer D is not correct. SRM's can not be withdrawn until IRM/SRM overlap is confirmed per Surveillance requirement 3.3.1.1.6.
Question to remain as is.

Question 63 RO:

Following a transient, INST AIR CNTMT ISOL 1P52-F200 and INST AIR DRYWELL ISOL 1P52-F646 have isolated.

Which one of the following describes the effect of this isolation on the Safety Relief Valves (SRVs)?

_____ A. ONLY the ADS SRVs can be opened.

_____ **B. ALL SRVs can be opened at least once in the Relief Mode.**

_____ C. ALL SRVs will open ONLY in the Safety Mode.

_____ D. ALL SRVs cannot be opened.

Comment: Candidates argue that answer A is also correct. Excerpt from PEI Bases page 120 is provided below. PEI Bases page 120 is attached for review.
Defeating all isolation interlocks for the SRV pneumatic supply and restoring pneumatics promotes more stable pressure control should SRVs be required to augment pressure stabilization. These actions are performed after the system isolation dependent upon time, manpower, and the need or anticipated need for SRV use. Loss of the continuous pneumatic supply to the SRVs limits the number of times that SRVs can be cycled manually since this mode of valve operation requires pneumatic pressure. While the SRV accumulators provide a reserve pneumatic supply, leakage through in-line valves, fittings, and actuators may deplete the reserve capacity. There is thus no assurance as to the number of SRV operating cycles remaining following loss of the continuous SRV pneumatic supply. For these reasons, if the continuous pneumatic supply is or becomes unavailable when SRVs must be used to augment RPV pressure control, the valves should be closed to limit the number of cycles and conserve pneumatic pressure so that the SRVs will be available if emergency RPV depressurization is later required. If other pressure control systems are not capable of maintaining RPV pressure below the lowest SRV lift setpoint, SRVs will still open when the lift setpoint is reached.

Licensee Position: Reject candidate comment. Additional reference supports argument that answer B is correct. Isolation of air limits the number of times an SRV will cycle but all SRV's have an accumulator and will open at least once.
Question to remain as is.

DISCUSSION (Continued)

The main turbine bypass valves are the preferred means of controlling RPV pressure, since they provide good control capability, are of relatively large capacity, and do not add heat to the suppression pool. The direction to use the bypass valves implicitly permits opening the MSIVs and placing the main condenser in service if such actions are necessary and conditions permit. It does not, however, constitute authorization to defeat any MSIV isolation interlocks.

If the main turbine bypass valves are unavailable or if the steam generation rate exceeds the bypass capacity, other methods must be used to stabilize RPV pressure. No prioritization is specified, since the appropriate choice of systems will depend upon the nature of the event, while the guidelines must accommodate a full spectrum of plant conditions and event scenarios.
SRVs, if used, should generally be opened manually in this step. Manual operation affords direct, positive control over valve operation and thus minimizes the possibility of inadvertent pressure and power transients under failure-to-scram conditions. Automatic operation controlled by the Low-Low Set System may be acceptable if it is not expected that manual operation will result in a more stable RPV pressure or if personnel are temporarily unavailable to assign to the manual control function.

Defeating all isolation interlocks for the SRV pneumatic supply and restoring pneumatics promotes more stable pressure control should SRVs be required to augment pressure stabilization. These actions are performed after the system isolation dependent upon time, manpower, and the need or anticipated need for SRV use. Loss of the continuous pneumatic supply to the SRVs limits the number of times that SRVs can be cycled manually since this mode of valve operation requires pneumatic pressure. While the SRV accumulators provide a reserve pneumatic supply, leakage through in-line valves, fittings, and actuators may deplete the reserve capacity. There is thus no assurance as to the number of SRV operating cycles remaining following loss of the continuous SRV pneumatic supply. For these reasons, if the continuous pneumatic supply is or becomes unavailable when SRVs must be used to augment RPV pressure control, the valves should be closed to limit the number of cycles and conserve pneumatic pressure so that the SRVs will be available if emergency RPV depressurization is later required. If other pressure control systems are not capable of maintaining RPV pressure below the lowest SRV lift setpoint, SRVs will still open when the lift setpoint is reached.

When manual SRV actuation is required for RPV pressure control, the opening sequence located on P601 is preferred which distributes heat uniformly throughout the suppression pool to avoid high local pool temperatures which may result in inefficient pool cooling. The opening sequence also uniformly distributes the total number of SRV actuations among the total number of SRVs.

A pressure band should be directed to allow the operator to control pressure without undue attention to the parameter. The use of a 200# pressure band is recommended. When pressure control is being maintained on the bypass valve pressure regulator and Lo-Lo Set has not been activated, a pressure band of 800# to 1000# is recommended. This band allows the pressure regulator to control pressure and prevents lifting of SRVs on hi pressure and places the operator in band when it is established. When Lo-Lo Set is active 700# - 900# is recommended to prevent the auto opening of relief valves due the their lower lift pressures (as low as 1018#), and allow them to close due to their reduced closure pressure (as low as 926#).

Question 64 RO:

The plant is in MODE 5 with the following conditions:

- INST VOL NOT DRAINED and RPS INST VOL LEVEL HI are in alarm due to maintenance on the Division 1 and 2 trip units for SDV high level.
- INST VOL LEVEL HI SCRAM BYPASS CH A(B,C,D) Switches 1C71A-S4A(B,C,D) are in BYPASS.
- RPS Trip Systems A and B are reset.

Which one of the following describes the plant response when the Reactor Mode Switch is placed in the STARTUP/STANDBY position?

_____ A. The SDV Valves remain open and no RPS actuation occurs.

_____ B. The SDV Valves remain closed and no RPS actuation occurs.

_____ C. The SDV Valves remain open and a full RPS actuation occurs.

_____ D. **The SDV Valves remain closed and a full RPS actuation occurs.**

Comment: Candidates argue that the word "remain" in all distractors is confusing.

Licensee Position: Candidate comment valid.
Question to change as shown below.

_____ A. The SDV Valves remain open and no RPS actuation occurs.

_____ B. ***The SDV Valves close and no RPS actuation occurs.***

_____ C. The SDV Valves remain open and a full RPS actuation occurs.

_____ D. ***The SDV Valves close and a full RPS actuation occurs.***

Question 66 RO:

Following a transponder card failure, Control Rod 22-55 had its rod drive transponder bypassed in the Rod Gang Drive Cabinet.

In this condition, Control Rod 22-55 __(1)__ be moved in the Individual Drive Mode and __(2)__ be moved in the Gang Drive Mode when moving the same gang with a Control Rod other than 22-55 selected on panel H13-P680.

	(1)	(2)
_____ A.	can	cannot
_____ B.	can	can
_____ C.	cannot	cannot
_____ **D.**	**cannot**	**can**

Comment: Candidates argue that C is also correct since the transponder card failure has not been corrected or a specific transponder card failure is not in the stem.

Licensee Position: Candidate comment valid. References are attached for review. Depending on specific transponder card failure answer C could also be correct. Question to change as shown below.

Control Rod 22-55 has its rod drive transponder bypassed in the Rod Gang Drive Cabinet.

In this condition, Control Rod 22-55 __(1)__ be moved in the Individual Drive Mode and __(2)__ be moved in the Gang Drive Mode when moving the same gang with a Control Rod other than 22-55 selected on panel H13-P680.

	(1)	(2)
_____ A.	can	cannot
_____ B.	can	can
_____ C.	cannot	cannot
_____ D.	cannot	can

2-106 BRANCH JUNCTION MODULE. A Branch Junction Module is an enclosure mounted at the end of a cluster of HCUs. It serves as a mechanical termination point for cables arriving from the control room and adjoining BJMs, as a housing for a voltage regulating transformer and as a mounting place for a Branch Amplifier Card.

2-107 Branch Amplifier Card. The Branch Amplifier Card Contains a power supply and logic circuitry for the following functions: First to receive the "COMMAND" words on a balanced transmission line, shape, and retransmit them (balanced to the downstream BJM, and unbalanced to its associated cluster). Second, to receive "ACKNOWLEDGE" words on a balanced line from the downstream BJM, merge them with "ACKNOWLEDGE" words originating within its cluster and transmit them to the upstream BJM or RGDC, and, finally, to sense the phase and magnitude of the AC power supplying its cluster and append this data to those "ACKNOWLEDGE" words originating within the cluster.

2-108 TRANSPONDER. The Transponder is a printed circuit card located in an enclosure on the Hydraulic Control Unit (HCU) associated with each control rod. (Hence, there are as many Transponders as control rods.) See Figure 2-7 for Plant Arrangement of HCUs.

2-109 **The Transponder performs the following functions:**

A. Accepts information ("COMMAND" word) from the RGDC and controls the ac power to the directional control valves of its associated HCU; these valves, in turn, control the motion of a control rod in the reactor by means of a hydraulic drive mechanism.

B. Returns to the RGDC (via the "ACKNOWLEDGE" word) information about the present state of:

1. Directional control valve drive circuits.

2. Accumulator pressure and liquid level limit switches.

3. Scram valve position switches.

4. Scram test switches (mounted in the RPS junction box near the top of the HCU)

C. Amplifies and shapes the received "COMMAND" signal for subsequent transmission to the adjacent HCU.

D. Amplifies and shapes the returned "ACKNOWLEDGE" signal for subsequent transmission to the adjacent HCU or back to the RGD.

Table 1-1. Reference Drawings (Continued)

TITLE	DRAWING NUMBER
TAB 8	
Branch Junction Module Assembly Drawing and Parts List	157C4612AAG12
Branch Junction Module Outline	157C4951AA
Branch Junction Module Schematic	163C1281AA
Branch Amplifier Card Assembly Drawing and Parts List	193B1252BAG2
Branch Amplifier Card Schematic	127D1532BA
Transponder Assembly Drawing and Parts List	145C3326BAG1 148C7970G2
Transponder Schematic	807E122BA 105E2333
Rod Action Control Cabinet Assembly Drawing and Parts List	865E140AAG2
Rod Action Control Cabinet Outline	945E385AF
Rod Action Control Cabinet Schematic	944E881
RACS Page Assembly Drawing and Parts List	851E980G1
RACS Page Wire List	272A7437
Scan Control Card Assembly Drawing and Parts List	195B9037AAG2
Scan Control Card Schematic	865E943AA
Control File Timing Diagram	828E302AA
ID Generator II Card Assembly Drawing and Parts List	195B9842AAG2
ID Generator II Card Schematic	865E131AA
Operation and Maintenance Instructions HCU Transponder Module	GEK-109828A

1. Transponder Timing Diagram, GE dwg 807E122BA, Rev0
2. HCU Transponder Module, Sheets 1 - 3, GE dwg 105E2333, Rev 2
3. Transponder Rod Drive Sys, GE dwg 145C3326BA, Rev 4
4. HCU Transponder Module, Sheets 1, GE dwg 148C7970, Rev 3

Question 18 SRO:

The plant is operating at 100% power with RHR Loop A in Standby Readiness.

RHR PUMP A DISCHARGE PRESSURE HI/LO alarm is momentarily received on panel H13-P601.

The operator reports RHR Pump A Discharge Pressure indication was low at 25 psig and has returned to normal at 45 psig on panel H13-P629.

This condition is indicative of potential leakage from the __(1)__ and the Unit Supervisor will __(2)__.

_____ A. (1) RHR Pump A, 1E12-C001A pump seals
(2) direct performance of RHR A High Point Vent per SOI-E12, Residual Heat Removal System to confirm the system is OPERABLE.

_____ B. (1) RHR Pump A, 1E12-C001A pump seals
(2) declare the system inoperable IMMEDIATELY.

_____ **C. (1) LPCS & RHR A Water Leg Pump, 1E21-C002 pump seals**
(2) direct performance of RHR A High Point Vent per SOI-E12, Residual Heat Removal System to confirm the system is OPERABLE.

_____ D. (1) LPCS & RHR A Water Leg Pump, 1E21-C002 pump seals
(2) declare the system inoperable IMMEDIATELY.

Comment: Candidates argue that the LPCS Hi/Lo Pressure alarm should be added to the stem of the question.

Licensee Position: Reject candidate comment. This additional information would help with the diagnosis of the problem but is not required to arrive at the correct answer. In addition if this additional information would be added then RHR A Pump Seal leak would not be plausible.
Question to remain as is.

Correct Answer: C

Momentary low pressure alarm may be indicative of leakage from the water leg pump seals. The alarm instruction directs a high point vent to confirm system operability.

Plausible Distractors:

A and B are plausible if the SRO does not know where the system low discharge pressure alarm is sensed (downstream of the RHR Pump discharge check valve). When RHR is in standby, leakage from the RHR Pump seals would not cause this alarm because the water leg pump will keep the RHR Pump discharge check valve seated.

D is plausible; it is not required to declare the system inoperable immediately due to the momentary nature of the alarm and normal system pressure indication.

Objective Link: OT-COMBINED-E12-K