August 29, 2014

Dr. Leah H. Jamieson, Dean
College of Engineering
Purdue University
West Lafayette, IN 47907

SUBJECT: EXAMINATION REPORT NO. 50-182/OL-14-01, PURDUE UNIVERSITY

Dear Dr. Jamieson:

On July 16, 2014, the U.S. Nuclear Regulatory Commission (NRC) administered operator licensing examinations at your Purdue University reactor. The examinations were conducted according to NUREG-1478, "Operator Licensing Examiner Standards for Research and Test Reactors," Revision 2. Examination questions and preliminary findings were discussed at the conclusion of the examination with those members of your staff identified in the enclosed report.

In accordance with Section 2.390 of Title 10 of the *Code of Federal Regulations*, a copy of this letter and the enclosures will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records component of NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room). The NRC is forwarding the individual grades to you in a separate letter which will not be released publicly. If you have any questions concerning this examination, please contact Mr. Patrick Isaac at (301) 415-1019 or via email Patrick.Isaac@nrc.gov.

Sincerely,

/RA/

Kevin Hsueh, Chief
Research and Test Reactors Oversight Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No.: 50-182

Enclosures:
1. Examination Report
   No. 50-182/OL-14-01
2. Facility Comments
   with NRC Resolution
3. Written examination
   with facility comments incorporated

cc w/o enclosures: See next page

August 29, 2014

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OFFICE	PROB:CE	IOLB:LA	PROB:BC
NAME	PIsaac	CRevelle	KHsueh
DATE	08/12/2014	08/13/2014	08/29/2014

OFFICIAL RECORD COPY

cc:

Mayor
City of West Lafayette
609 W. Navajo
West Lafayette, IN 47906

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Epidemiology Res Center/Indoor & Radiological Health
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Reactor Supervisor
Department of Nuclear Engineering
Purdue University
West Lafayette, IN 47907

Test, Research, and Training
Reactor Newsletter
University of Florida
202 Nuclear Sciences Center
Gainesville, FL 32611

U. S. NUCLEAR REGULATORY COMMISSION
OPERATOR LICENSING INITIAL EXAMINATION REPORT

REPORT NO.: 50-182/OL-14-01

FACILITY DOCKET NO.: 50-182

FACILITY LICENSE NO.: R-87

FACILITY: Purdue University

EXAMINATION DATES: July 16, 2014

SUBMITTED BY: **/RA/** **08/12/2014**
Patrick Isaac, Chief Examiner Date

SUMMARY:

On July 16, 2014, the U.S. Nuclear Regulatory Commission (NRC) administered operator licensing examination to one Senior Reactor Operator (SRO) license candidate. The candidate passed all applicable portions of the examinations.

REPORT DETAILS

1. Examiners: Patrick Isaac, Chief Examiner, NRC

2. Results:

	RO PASS/FAIL	SRO PASS/FAIL	TOTAL PASS/FAIL
Written	0/0	1/0	1/0
Operating Tests	0/0	1/0	1/0
Overall	0/0	1/0	1/0

3. Exit Meeting:

Patrick Isaac, NRC
Nader Satvat, Purdue University
Robert Bean, Purdue University

The NRC Examiner thanked the facility for their support in the administration of the examinations.

ENCLOSURE 1

FACILITY COMMENTS WITH NRC RESOLUTION

Question B.2 [1.0 point]

An experimenter wishes to irradiate three specimens with reactivity worth's of 0.5% ∆k/k, 0.13% ∆k/k, and 0.27% ∆k/k. Can these specimens be placed together in the reactor as SECURED experiments and why (or why not)?

a. Yes, the sum of the three specimens is less than 1.5% ∆k/k.
b. No, the sum of the three specimens is greater than 0.5% ∆k/k.
c. Yes, each specimen is less than0.3% ∆k/k.
d. No, one of the specimens is greater than 0.4% ∆k/k.

Answer: b
Reference: Technical Specifications section 3.1.

Facility Comment: We agree that answer "b" is correct because, as reference in the PUR-1 Technical Specifications Section 3.1(g), the maximum excess reactivity worth of all secured experiments (together) cannot exceed 0.5% ∆k/k. However, The PUR-1 Technical specifications also state in Section 3.1(e) that the excess reactivity worth of any single secured experiment shall not exceed 0.4% ∆k/k. One of the experiments listed in Question B.2 has a reactivity worth greater than 0.4%∆k/k, and so would not be allowed under any circumstances, whether alone or in combination with the other experiments, thus making "d" a correct answer as well.

We recommend that both "b" and "d" be accepted as correct answers for Question B.2.

NRC Resolution: Comment accepted. The answer key for Question B.2 will be modified to reflect that both answers "b" and "d" are correct.

Question B.3 [1.0 point]

According to 10 CFR 55.53, To maintain 'ACTIVE STATUS' … the licensee shall actively perform the functions of an operator or a senior operator for a minimum of __ hours per calendar quarter.

a. 2
b. 4
c. 6
d. 8

Answer: c
Reference: 10 CFR 55.53(f)(2).

Facility Comment: The requirement for 6 hours per quarter of operator or senior operator duties in 10 CFR 50.55(f)(2) applies to operators who failed to maintain the required number of operations hours in the previous calendar quarter; 10 CFR 50.55(f) specifies that paragraph (f) applies only to those who do not meet the requirements of paragraph (e). Paragraph (e), e.g. 10 CFR 50.55(e) requires that "To maintain active status … licensee shall actively perform the functions of an operator or senior operator for a minimum of four hours per calendar quarter" for test and research reactors.

We recommend that the correct answer be changed to "b" for Question B.3.

NRC Resolution: Comment accepted. The answer key for Question B.3 will be modified to accept answer "b" as the only correct answer.

Question B.8 [1.0 point]

When performing a reactor startup, the procedure, 91-1, states that the period meter should not indicate less than:

a. 45 seconds.
b. 30 seconds.
c. 20 seconds.
d. 15 seconds.

Answer: b
Reference: Procedure 91-1, Reactor Startup, Part A, step 6.

Facility Comment: We agree that procedure 91-1 states that the period should not be shorter than 30 seconds. However, the PUR-1 Operating Manual (1965) states, on page 8, that the reactor should not be operated with a period shorter than 20 seconds.

We recommend that both "b" and "c" be accepted as correct answers for Question B.8.

NRC Resolution: The reactor startup procedure, 91-1, clearly states that that operator should not let the period meter indicate less than a 30 second period. That makes "b" the correct answer. Answer "c" would violate the procedure. Therefore, no change to the answer key is needed for Question B.8

U. S. NUCLEAR REGULATORY COMMISSION
NON-POWER INITIAL REACTOR LICENSE EXAMINATION

FACILITY: Purdue University

REACTOR TYPE: MTR

DATE ADMINISTERED: 07/16/2014

CANDIDATE: _____

INSTRUCTIONS TO CANDIDATE:
Answers are to be written on the answer sheet provided. Attach the answer sheets to the examination. Points for each question are indicated in brackets for each question. A 70% in each section is required to pass the examination. Examinations will be picked up three (3) hours after the examination starts.

Category Value	% of Total	% of Candidates Score	Category Value	Category
15.0	50.0	_____	____	B. Normal and Emergency Operating Procedures and Radiological Controls
15.0	50.0	_____	____	C. Facility and Radiation Monitoring Systems
30.0		_____	____%	TOTALS
			FINAL GRADE	

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

_____
Candidate's Signature

ENCLOSURE 3

Section B Normal, Emergency and Radiological Control Procedures

A N S W E R S H E E T

Multiple Choice (Circle or X your choice)
If you change your answer, write your selection in the blank.

MULTIPLE CHOICE

001 a ____ b ____ c ____ d ____

002 a b c d ___

003 a b c d ___

004 a b c d ___

005 a b c d ___

006 a b c d ___

007 a b c d ___

008 a b c d ___

009 a b c d ___

010 a b c d ___

011 a b c d ___

012 a b c d ___

013 a ____ b ____ c ____ d ____

014 a. REQ NOT

b. REQ NOT

c. REQ NOT

d. REQ NOT

(***** END OF SECTION B *****)

Section C Facility and Radiation Monitoring Systems

A N S W E R S H E E T

Multiple Choice (Circle or X your choice)
If you change your answer, write your selection in the blank.

MULTIPLE CHOICE

001 a b c d ___

002 a ____ b ____ c ____ d ____

003 a b c d ___

004 a b c d ___

005 a b c d ___

006 a b c d ___

007 a b c d ___

008 a b c d ___

009 a b c d ___

010 a ____ b ____ c ____ d ____

011 a b c d ___

012 a b c d ___

013 a b c d ___

014 a b c d ___

015 a b c d ___

(***** END OF SECTION C *****)

(********** END OF EXAMINATION **********)

NRC RULES AND GUIDELINES FOR LICENSE EXAMINATIONS

During the administration of this examination the following rules apply:

1. Cheating on the examination means an automatic denial of your application and could result in more severe penalties.

2. After the examination has been completed, you must sign the statement on the cover sheet indicating that the work is your own and you have neither received nor given assistance in completing the examination. This must be done after you complete the examination.

3. Restroom trips are to be limited and only one candidate at a time may leave. You must avoid all contacts with anyone outside the examination room to avoid even the appearance or possibility of cheating.

4. Use black ink or dark pencil only to facilitate legible reproductions.

5. Print your name in the blank provided in the upper right-hand corner of the examination cover sheet and each answer sheet.

6. Mark your answers on the answer sheet provided. USE ONLY THE PAPER PROVIDED AND DO NOT WRITE ON THE BACK SIDE OF THE PAGE.

7. The point value for each question is indicated in [brackets] after the question.

8. If the intent of a question is unclear, ask questions of the examiner only.

9. When turning in your examination, assemble the completed examination with examination questions, examination aids and answer sheets. In addition turn in all scrap paper.

10. Ensure all information you wish to have evaluated as part of your answer is on your answer sheet. Scrap paper will be disposed of immediately following the examination.

11. To pass the examination you must achieve a grade of 70 percent or greater in each category.

12. There is a time limit of two (2) hours for completion of the examination.

13. When you have completed and turned in you examination, leave the examination area. If you are observed in this area while the examination is still in progress, your license may be denied or revoked.

EQUATION SHEET

$$\dot{Q} = \dot{m} c_P \Delta T = \dot{m} \Delta H = UA\Delta T$$

$$P_{\max} = \frac{(\beta - \rho)^2}{(2\alpha \ell)}$$

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

$$P = P_0 \; e^{t/\mathrm{T}}$$

$$SCR = \frac{S}{-\rho} \cong \frac{S}{1 - K_{eff}}$$

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

$$SUR = 26.06 \left[\frac{\lambda_{eff} \rho + \dot{\rho}}{\overline{\beta} - \rho} \right]$$

$$CR_1 (1 - K_{eff_1}) = CR_2 (1 - K_{eff_2})$$

$$CR_1 (-\rho_1) = CR_2 (-\rho_2)$$

$$P = \frac{\beta (1 - \rho)}{\beta - \rho} P_0$$

$$M = \frac{1}{1 - K_{eff}} = \frac{CR_2}{CR_1}$$

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

$$M = \frac{1 - K_{eff_1}}{1 - K_{eff\,2}}$$

$$SDM = \frac{1 - K_{eff}}{K_{eff}}$$

$$\mathrm{T} = \frac{\ell^*}{\rho - \overline{\beta}}$$

$$\mathrm{T} = \frac{\ell^*}{\rho} + \left[\frac{\overline{\beta} - \rho}{\lambda_{eff} \rho + \dot{\rho}} \right]$$

$$T_{\frac{1}{2}} = \frac{0.693}{\lambda}$$

$$\Delta\rho = \frac{K_{eff_2} - K_{eff_1}}{K_{eff_1} K_{eff_2}}$$

$$\rho = \frac{K_{eff} - 1}{K_{eff}}$$

$$DR = DR_0 \, e^{-\lambda t}$$

$$DR_1 \, d_1^{\,2} = DR_2 d_2^{\,2}$$

$$DR = \frac{6 Ci \, E(n)}{R^2}$$

$$A_f = A_o (1 - e^{-\lambda t})$$

$$I = I_{oe^{-\mu x}}$$

$$\mu_m = \frac{\mu}{\rho}$$

DR – Rem/hr, Ci – curies, E – Mev, R – feet

1 Curie = 3.7 x 10^{10} dis/sec

1 kg = 2.21 lbm

1 Horsepower = 2.54 x 10^3 BTU/hr

1 Mw = 3.41 x 10^6 BTU/hr

1 BTU = 778 ft-lbf

°F = 9/5 °C + 32

1 gal (H_2O) ≈ 8 lbm

°C = 5/9 (°F - 32)

c_P = 1.0 BTU/hr/lbm/°F

c_p = 1 cal/sec/gm/°C

Question B.1 [2.0 points, ½ each]
Identify each of the following actions as either a channel **CHECK**, a channel **TEST**, or a channel **CAL**ibration.

a. Prior to startup you place a radioactive source near a radiation detector, noting meter movement and alarm function operation.

b. During startup you compare all of your nuclear instrumentation channels ensuring they track together.

c. At power, you perform a heat balance (calorimetric) and determine you must adjust Nuclear Instrumentation readings.

d. During a reactor shutdown you note a -80 second period on Nuclear Instrumentation.

Question B.2 [1.0 point]
An experimenter wishes to irradiate three specimens with reactivity worth's of 0.5% Δk/k, 0.13% Δk/k and 0.27% Δk/k. Can these specimens be placed together in the reactor as SECURED experiments and why (why not)?

a. Yes, the sum of the three specimens is less than 1.5% Δk/k.

b. No, the sum of the three specimens is greater than 0.5% Δk/k.

c. Yes, each specimen is less than 0.3% Δk/k.

d. No, one of the specimens is greater than 0.4% Δk/k.

Question B.3 [1.0 point]
According to 10 CFR 55.53, "To maintain *'ACTIVE STATUS'* … the licensee shall actively perform the functions of an operator or a senior operator for a minimum of __ hours per calendar quarter."

a. 2

b. 4

c. 6

d. 8

Question B.4 [1.0 point]
The Emergency Planning Zone (EPZ) for the Purdue PUR-I reactor is defined as …

a. the reactor room.

b. specific contamination levels of airborne, radiological dose or dose rates that may be used as thresholds for establishing emergency classes.

c. the area **BEYOND** the SITE BOUNDARY where the Laboratory Director has direct authority over all activities.

d. is the area bounded by a 150 meter radius as measured from the centerline of the PUR-I core.

Question B.5 [1.0 point]
While working on an experiment, you receive the following radiation doses: 100 mrem (β), 25 mrem (γ), and 5 mrem (thermal neutrons). Which one of the following is your total dose?

a. 175 mrem

b. 155 mrem

c. 145 mrem

d. 130 mrem

Question B.6 [1.0 point]
Consider two point sources, each having the ***SAME*** curie strength. Source A's gammas have an energy of 0.5 MeV, while Source B's gammas have an energy of 1.0 MeV. Using a Geiger-Müller detector the reading from source B will be … (NOTE: Ignore detector efficiency.)

a. four times that of source A.

b. twice that of source A.

c. the same.

d. half that of source A.

Question B.7 [1.0 point]
In accordance with the Emergency Plan, the site boundary is:

a. the Nuclear Engineering Laboratories.

b. Reactor Room B-70A.

c. the Emergency Support Center.

d. the geographical area of the West Lafayette Campus of Purdue University.

Question B.8 [1.0 point]
When performing a reactor startup, the procedure, 91-1, states that the period meter should not indicate less than:

a. 45 seconds.

b. 30 seconds.

c. 20 seconds.

d. 15 seconds.

Question B.9 [1.0 point]
The Technical Specifications require that the radioactive material content of encapsulated experiment should be limited to prevent the release of isotope of:

a. Nitrogen-16.

b. Argon-41.

c. Iodine-128.

d. Cesium-137.

Question B.10 [1.0 point]
When performing a reactor startup, to avoid a reactor setback or scram turn the range switch for channel 3 COUNTER-CLOCKWISE when the console meter reads ? and CLOCKWISE when the console meter
reads ? .

	COUNTER-CLOCKWISE	CLOCKWISE
a.	above 75%	between 20 and 25%
b.	between 100 and 125%	below 20%
c.	above 65%	between 20 and 25%
d.	between 70 and 75%	below 20%

Question B.11 [1.0 point]
Identify the condition which is a reportable occurrence.

a. A shutdown margin of 1.5% ΔK/K.

b. Disagreement between actual and expected critical positions of more than 0.25% ΔK/K.

c. An unexpected short-term reactivity change causing a period of 5 seconds.

d. Discovering the setback setpoint for the linear channel was set at 105% power.

Question B.12 [1.0 point]
Which one of the following correctly defines a Safety Limit?

a. Limits on important process variables which are found to be necessary to reasonably protect the integrity of certain physical barriers which guard against the uncontrolled release of radioactivity.

b. The Lowest functional capability of performance levels of equipment required for safe operation of the facility.

c. Settings for automatic protective devices related to those variables having significant safety functions.

d. A measuring or protective channel in the reactor safety system.

Question B.13 [1.0 point, 0.25 each]
Match the 10CFR55 requirements for maintaining an active operator license in column A with the corresponding time period from column B.

Column A	Column B
a. Renew License	1 year
b. Medical Exam	2 years
c. Pass Requalification Written Examination	4 years
d. Pass Requalification Operating Test	6 years

Question B.14 [1.0 point, 0.25 each]
Identify whether each of the following conditions requires (REQ) or does not require (NOT) SRO presence for recovery from an unplanned (unscheduled) shutdown.
Note: Circle the correct answer

a. Reactor scram due to trainee generating a 6 second period

b. High school student on tour accidentally hits scram button.

c. Loss of electrical power due to electrical storms.

d. Building evacuation due to a fire drill.

Section C Facility and Radiation Monitoring Systems

Question C.1 [1.0 point]
Which one of the following is the method used to minimize mechanical shock to the control rods on a scram?

a. A small spring located at the bottom of the rod.

b. An electrical-mechanical brake energizes when the rod down limit switch is energized.

c. A piston (part of the connecting rod) drives air out of a dashpot as the rod nears the bottom of travel.

d. A piston attached to the upper end of the safety rod enters a special damping cylinder as the rod approaches the full insert position.

Question C.2 [1.0 point, 0.25 each]
Match the following instrumentation channels with their correct protective functions.

Column A	Column B
a. Startup Channel	1. Setback and Slow Scram
b. Log-N Period Channel	2. Setback and Fast Scram
c. Pool Top Radiation Area Monitor	3. Slow Scram Only
d. Continuous Air Monitor	4. None

Question C.3 [1.0 point]
Following an inadvertent hit of the gang-lower switch, how may the reactor operator stop the rods from inserting?

a. Reenergizing the Log Count Rate Channel.

b. Ranging UP on the Linear Level Channel.

c. Momentarily placing the Raise-Lower switch in either the raise or lower position.

d. Not required. Rod insertion will stop when the gang lower switch is released.

Question C.4 [1.0 point]
What is the purpose of the Startup channel drive mechanism?

a. To allow automatic rod control.

b. To prevent burnout of the U235 coating on the detector during high power.

c. To maintain coupling between the fission chamber and the neutron source as they are both withdrawn from the core.

d. To prevent shorting out the preamplifier due to detector saturation

Question C.5 [1.0 point]
Which one of the listed radioisotopes is best detected by the Continuous Air Monitor?

a. Rb88

b. N16

c. Ar41

d. Xe136

Question C.6 [1.0 point]
Which ONE of the following correctly describes how gamma radiation is compensated for in the Log-N channel?

a. A compensating current equal to and opposite the signal due to gammas is generated by the detector.

b. The detector is positioned in towards and out away from the core to compensate for gammas.

c. The output of the detector is put through a discriminator circuit which passes only pulses caused by neutron interactions.

d. Lead shielding around the detector decreases the signal due to gammas low enough such that compensation is not required.

Question C.7 [1.0 point]
While performing a reactor startup, you establish a period of 100 seconds-1. Which one of the following approximate times to double reactor power would indicate that the period instrument is working properly?

a. 30 seconds

b. 50 seconds

c. 70 seconds

d. 100 seconds

Question C.8 [1.0 point]
Which ONE of the following conditions will NOT prohibit withdrawal of the shim-safety rods?

a. Reactor period at 12 seconds.

b. Linear channel reading 112% range.

c. Startup channel Count Rate at 1 cps.

d. Log Count Rate Selector in USE position.

Question C.9 [1.0 point]
In event of a spill, spread of radioactive material is prevented by …

a. running the ventilation system normally (egress of radioactive material stopped by HEPA filter).

b. manually securing the ventilation system, which closes dampers for the inlet and the outlet piping.

c. an alarm on any of the RAMs will automatically secure the ventilation system, shutting the inlet and outlet dampers.

d. an alarm the CAM will automatically secure the ventilation system, shutting the inlet and outlet dampers.

Question C.10 [1.0 points, 0.25 each]
Match the Radiation Detection Systems in Column A with its corresponding detector type from Column B.

Column A	Column B
a. Continuous Air Monitor (CAM)	1. Proportional Counter (Fission Chamber)
b. Radiation Area Monitor (RAM)	2. Geiger-Müeller
c. Startup Channel	3. Scintillation
d. Log N Channel	4. Ion Chamber

Question C.11 [1.0 point]
Which one accident below is designated as the Maximum Hypothetical Accident for the Purdue reactor?

a. Failure of a fueled experiment.

b. Fuel element handling accident.

c. Loss of coolant accident.

d. Failure of a movable experiment.

Question C.12 [1.0 point]
The regulating rod is Auto at 50% withdrawn position. An unexplained power excursion causes a reactor scram. Which one of the following describes the position of the regulating rod following the scram?

a. fully inserted (scrammed).

b. inserting at normal insertion speed to fully inserted.

c. steady at 50% withdrawn in MANUAL control

d. withdrawing to 100% out in AUTO control.

Question C.13 [1.0 point]
You are performing the pre-startup check when you discover that the magnet indicating lights are NOT on and the magnet current meters do NOT indicate a magnet current. Which ONE of the following choices would be the correct course of action for you to take? Check

a. the Log Count rate meter to ensure it is in the “CALIBRATE” position.

b. the position of the Safety-shim rods to ensure that they are at their lower limit.

c. the setback and scram initiation meter setpoints to ensure that they are set to proper values.

d. Log-N amplifier selector switch to ensure it is in the “OPERATE” position.

Question C.14 [1.0 point]
Which ONE of the following correctly describes how indicated power will compare to actual power for a loss of compensating voltage to the Linear Channel detector? Power level is at 150 watts, when the compensating voltage is lost.

a. Indicated power will peg high.

b. Indicated power is slightly higher than actual power.

c. Indicated power is slightly lower than actual power.

d. Indication will read zero.

Question C.15 [1.0 point]
According to the analysis for a total loss of coolant accident (LOCA) while operating at 100% of licensed power, which ONE of the following would occur?

a. Decay heat buildup would result in a core meltdown.

b. Decay heat buildup would result in melting the fuel cladding.

c. Loss of water would shut down the reactor.

d. Fission product gas buildup due to decay heat would result in fuel clad failure.

***** END OF EXAMINATION *****

B.1 a, Check; b, Check; c, Cal; d, Test
REF: Technical Specifications § *1.0 Definitions*.

B.2 b, d
REF: Technical Specifications 3.1

B.3 b
REF: 10 CFR 55.53(f)(2)

B.4 a
REF: Emergency Plan Definition 2.8

B.5 d
REF: A rem is a rem.

B.6 c
REF: Standard NRC Health Physics Question. G-M detector is not sensitive to incident energy levels.

B.7 a
REF: University of Purdue Emergency Plan.

B.8 b
REF: Procedure 91-1 Reactor Startup, Part A, step 6.

B.9 c
REF: PUR T.S 3.5f, 3.5g, and 4.5.

B.10 d
REF: Procedure 91-1 Reactor Startup, Part A, Approach to Critical.

B.11 c
REF: PUR T.S. 1.27.

B.12 a
REF: PUR T.S. 2.1

B.13 a, 6; b, 2; c, 2; d, 1
REF: 10CFR55.

B.14 a. REQ; b. NOT; c. NOT; d. NOT
REF: PUR T.S. 6.1.9.

C.1 c
REF: Shim-Safety Control Rod Drive, schematic

C.2 a, 1; b, 2; c, 3; d, 4
REF: Instrumentation Block Diagram

C.3 c
REF: PUR-1 Operating Manual 1962, Lockheed Nuclear Products, § 1.5.6.5.

C.4 b
REF: PUR-1 Operating Manual 1962, Lockheed Nuclear Products, § 1.5.6.3, Fission Chamber Drive System.

C.5 a
REF: Designed to detect particulate NOT gaseous radioactivity.

C.6 a
REF: System Description.

C.7 c
REF: x time = Ln(2) × 100 = 69.3 sec.

C.8 d
REF: Purdue Operator Requalification Exam 12/78, question E

C.9 b
REF: Purdue Operator Requalification Exam.

C.10 a, 2; b, 3; c, 1; d, 4
REF: Operating Manual '62, §§ 1.5.1, 1.5.3, and 1.5.7

C.11 a
REF: SAR for HEU to LEU, Section 13.1.

C.12 b
REF: Standard NRC Question

C.13 d
REF: PUR-I, Operating Manual, May 1965, Pre-Startup Procedure, step 14.

C.14 b
REF: Standard NRC Question

C.15 c
REF : SAR