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

EXAMINATION REPORT NO. 50-320/86-12(OL)

FACILITY DOCKET NO. 50-320

FACILITY LICENSE NO. DPR-73

LICENSEE: GPU Nuclear Corporation
P.O. Box 480
Middletown, Pennsylvania 17057

FACILITY: Three Mile Island Unit 2

EXAMINATION DATES: September 3-5, 1986

CHIEF EXAMINER: D. J. Coe — 10/10/86
D. Coe, Lead Reactor Engineer (Examiner) — Date

REVIEWED BY: RJ Dudley FOR RMK — 10/10/86
Robert Keller, Chief, Projects Section 1C — Date

APPROVED BY: HB Kister — 10/14/86
Harry Kister, Chief, Project Branch No. 1 — Date

SUMMARY: Written and oral examinations were administered to three Reactor Operator candidates. All three candidates passed both portions of the examination and were issued licenses.

REPORT DETAILS

TYPE OF EXAMS: Replacement

EXAM RESULTS:

	RO Pass/Fail
Written Exam	3/0
Oral Exam	3/0
Overall	3/0

1. CHIEF EXAMINER AT SITE: Mike King, EG and G Idaho

2. OTHER EXAMINERS: None

3. Summary of generic strengths or deficiencies noted on oral exams:

   None noted.

4. Summary of generic deficiencies noted from grading of written exams:

   a. Reasons why the end effector handling tool is water filled.

   b. Basic principle of operation of the debris vacuum system flow meter.

5. Personnel Present at Exit Interview:

   NRC Contractor Personnel

   Mike King, EG and G, Idaho

Facility Personnel

Adam W. Miller, Manager Plant Operations
William W. Thompson, Operator Training Manager
Christopher J. Dell, Licensing Technical Analyst
Ronald H Maag, Supervisor Licensed Operator Training

6. Summary of NRC Comments made at exit interview:

The NRC Contractor Examiner did not give preliminary results of the oral examinations. However, he stated that these candidates exhibited marked improvement over the previous class of operator candidates.

Attachments:

1. Written Examination and Answer Key (RO)
2. Facility Comments on Written Examinations made after Exam Review and Examiner Responses to Facility Comments

Attachment 1

U. S. NUCLEAR REGULATORY COMMISSION
REACTOR OPERATOR LICENSE EXAMINATION

FACILITY: TMI-2

REACTOR TYPE: PWR-B&W177

DATE ADMINISTERED: 86/09/03

EXAMINER: KING, M.

CANDIDATE: MASTER

INSTRUCTIONS TO CANDIDATE:

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	CANDIDATE'S SCORE	% OF CATEGORY VALUE		CATEGORY
25.00	25.51			1.	PRINCIPLES OF NUCLEAR POWER PLANT OPERATION, THERMODYNAMICS, HEAT TRANSFER AND FLUID FLOW
25.00	25.51			2.	PLANT DESIGN INCLUDING SAFETY AND EMERGENCY SYSTEMS
25.00	25.51			3.	INSTRUMENTS AND CONTROLS
23.00	23.47			4.	PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
98.00					Totals

Final Grade

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

Candidate's Signature

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. 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.

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

4. Print your name in the blank provided on the cover sheet of the examination.

5. Fill in the date on the cover sheet of the examination (if necessary).

6. Use only the paper provided for answers.

7. Print your name in the upper right-hand corner of the first page of each section of the answer sheet.

8. Consecutively number each answer sheet, write "End of Category __" as appropriate, start each category on a new page, write only on one side of the paper, and write "Last Page" on the last answer sheet.

9. Number each answer as to category and number, for example, 1.4, 6.3.

10. Skip at least three lines between each answer.

11. Separate answer sheets from pad and place finished answer sheets face down on your desk or table.

12. Use abbreviations only if they are commonly used in facility literature.

13. The point value for each question is indicated in parentheses after the question and can be used as a guide for the depth of answer required.

14. Show all calculations, methods, or assumptions used to obtain an answer to mathematical problems whether indicated in the question or not.

15. Partial credit may be given. Therefore, ANSWER ALL PARTS OF THE QUESTION AND DO NOT LEAVE ANY ANSWER BLANK.

16. If parts of the examination are not clear as to intent, ask questions of the examiner only.

17. You must sign the statement on the cover sheet that indicates that the work is your own and you have not received or been given assistance in completing the examination. This must be done after the examination has been completed.

18. When you complete your examination, you shall:

a. Assemble your examination as follows:

(1) Exam questions on top.

(2) Exam aids - figures, tables, etc.

(3) Answer pages including figures which are part of the answer.

b. Turn in your copy of the examination and all pages used to answer the examination questions.

c. Turn in all scrap paper and the balance of the paper that you did not use for answering the questions.

d. Leave the examination area, as defined by the examiner. If after leaving, you are found in this area while the examination is still in progress, your license may be denied or revoked.

QUESTION 1.Ø1 (1.ØØ)

What TWO conditions must exit for subcritical multiplication to occur?

QUESTION 1.Ø2 (2.ØØ)

Explain the differences between slow (thermal) and delayed neutrons.

QUESTION 1.Ø3 (1.ØØ)

Boron is added to the RCS to absorb neutrons. What neutron energy level (fast, epithermal, or thermal) does boron "prefer" ?

QUESTION 1.Ø4 (3.ØØ)

Because of a misalignment of valves a dilution of the RCS begins. The only indication to the operator is the following source range indications from the logs.

Inspecting the readings yields:

Time	12ØØ	13ØØ	14ØØ	15ØØ	16ØØ	17ØØ
NI.1	1.25	1.25	1.47	1.79	2.22	2.97

a. If the cause of the increase is not found when would (could) the reactor go critical. [1.5]

b. If Keff of the core before the unplanned dilution was .7. what was Keff at 16ØØ. [1.5]

QUESTION 1.Ø5 (3.ØØ)

A variable speed centrifugal pump operating at 36ØØ rpm requires 25Ø horsepower to pump 1ØØ gpm at 125 psig. Suppose you change the pump speed such that discharge pressure is 75 psig. What is the new SPEED, FLOW, and POWER (Show all formulas and work.) ?

(***** CATEGORY Ø1 CONTINUED ON NEXT PAGE *****)

QUESTION 1.Ø6 (3.ØØ)

Select one advantage and one disadvantage for each type of pump below.

PUMP	ADVANTAGE	DISADVANTAGE
a. positive displacement	1. Operate in harsh environments.	1. Low capacity.
b. jet	2. High flow rates.	2. pump light fluids only.
c. centrifugal	3. Metered flow.	3. Additional piping required.

QUESTION 1.Ø7 (1.ØØ)

Heat exchangers are designed to have turbulent flow : (choose the correct answer)

a. To increase heat transfer.

b. To reduce tube fouling.

c. To prevent water hammer.

d. To reduce tube vibration.

(***** CATEGORY Ø1 CONTINUED ON NEXT PAGE *****)

QUESTION 1.Ø8 (3.ØØ)

Identify each of the following temperature-pressure pairs as sub-cooled, saturated, or superheated. (Assume water systems)

a. 28Ø F, 34.5 psig

b. 2Ø4 C, 232.3 psig

c. 32Ø F, 195.5 psig

d. 36Ø F, 145.4 psig

[4 @ Ø.75 ea.]

QUESTION 1.Ø9 (3.ØØ)

a. Explain how insufficient flow thru a pump can cause damage to the pump. [2.Ø]

b. List a method of maintaining sufficient flow thru the pump. [1.Ø]

QUESTION 1.1Ø (2.ØØ)

Explain why neutrons are best shielded by light materials and gammas are best shielded by heavy materials.

QUESTION 1.11 (3.ØØ)

Describe HOW and WHY centrifugal pump discharge flow is affected by the each of the following.

a. Suction pressure decreases.

b. Throttling down on the discharge valve.

c. An increase pump speed (RPM's).

(***** END OF CATEGORY Ø1 *****)

QUESTION 2.Ø1 (3.5Ø)

Concerning the END EFFECTOR HANDLING TOOL

a. What design feature protects the hydraulic hoses from damage or entangling (Ø.5)?

b. Why is the handling tool water filled (3 reasons) (3.Ø)?

QUESTION 2.Ø2 (2.5Ø)

List five different tanks that relieve to the waste gas relief header through relief valves.

QUESTION 2.Ø3 (3.ØØ)

List five end effectors AND briefly describe the use or function of each.

QUESTION 2.Ø4 (2.ØØ)

How and why is the BANDING TOOL used ?

QUESTION 2.Ø5 (2.ØØ)

What two design features prevent radiation streaming through the work platform of the Shielded Work Platform ?

QUESTION 2.Ø6 (1.ØØ)

What is the purpose (function) of the Debris Vacuum system ?

QUESTION 2.Ø7 (1.ØØ)

Why must loaded canisters be removed from the vessel through the canister removal port ?

(***** CATEGORY Ø2 CONTINUED ON NEXT PAGE *****)

QUESTION 2.Ø8 (1.5Ø)

Name three sources of electricity to the 23Ø KV Substation at TMI.

QUESTION 2.Ø9 (2.5Ø)

Draw a one line diagram of the normal RCS letdown to a RCBT. (Include RCS connection, all major valves and equip, letdown flow instrument, and location of containment boundry)

QUESTION 2.1Ø (1.ØØ)

After a station blackout occurs, when (time) AND how many NSRW pumps will start ? (Assume diesel generators auto-start normally)

QUESTION 2.11 (2.ØØ)

Briefly describe the Bulk Defueling Phase that will be used after the "Early Defueling Phase." Include an overall description of the tools and description of expected core conditions.

QUESTION 2.12 (3.ØØ)

A required action due to a leak in SDS is to secure the appropriate feed pump. For SIX of the SEVEN following SDS feed pumps (your choice), list one location to stop (secure) each pump.

a. SWS-P-1 (RB jet pump)

b. WDL-P-5A (RC waste transfer pump)

c. DWC-P-5 (DWC booster pump)

d. WDL-P-6A (Misc. waste transfer pump)

e. WDL-P-8A (Neutralizer tank pump)

f. FCC-P-1 (FTC deep end pump)

g. SDS-P-1A (monitor tank pump)

(***** END OF CATEGORY Ø2 *****)

QUESTION 3.Ø1 (2.ØØ)

What is the purpose (function) of the 3Ø second timer in the NSRW control circuit AND why is it needed ?

QUESTION 3.Ø2 (1.ØØ)

The diesel generators can operate up to ___a___ without cooling water flow[1.Ø].

QUESTION 3.Ø3 (1.5Ø)

List three systems or sub-systems that have liquid radiation monitors

QUESTION 3.Ø4 (2.ØØ)

Match the following radiation instruments with the type(s) of radiation they are used to monitor.

INSTRUMENTS	TYPES OF RADIATION
a. E-52Ø	1. ALPHA
b. RO-2	2. GAMMA
c. PAC-6	3. BETA
d. PNR-4	4. NEUTRON

(4 @ Ø.5 EA.)

QUESTION 3.Ø5 (2.5Ø)

What are five preoperational checks to be made prior to use of survey instruments ? (5 @ Ø.5 ea.)

QUESTION 3.Ø6 (1.5Ø)

Explain the method used to position the in-core monitor cameras. (Include in your answer what is used to manipulate the cameras.).

(***** CATEGORY Ø3 CONTINUED ON NEXT PAGE *****)

QUESTION 3.Ø7 (2.ØØ)

Explain the basic principle of operation of the debris vacuum system flow meter.

QUESTION 3.Ø8 (2.ØØ)

a. What is the purpose (function) of the sleeve locking device on the canister positioning system (CPS)?

b. How is the sleeve locking device actuated ?

QUESTION 3.Ø9 (3.5Ø)

a. List five alarms associated with the Debris Vacuum System [2.5].

b. With the vacuum system in use, what common action should be taken upon receipt of one of the above alarms [1.Ø]?

QUESTION 3.1Ø (2.ØØ)

What two signals will automatically trip the hydraulic system pump ?

QUESTION 3.11 (3.ØØ)

Describe the automatic actions which will occur as a result of an undervoltage on the IE bus due to a loss of all offsite power.

QUESTION 3.12 (2.ØØ)

The MDHR system is operating at a flow of 1ØØ gpm through the debris filter in preparation for RCS cleanup operations via the SDS System. Loose material from the RCS dislodges and completely clogs the MDHR filter. List four indications available to you in the Control Room that would alert you to this condition.

(***** END OF CATEGORY Ø3 *****)

QUESTION 4.Ø1 (.ØØ)

Question/answer/reference deleted from exam.

QUESTION 4.Ø2 (2.ØØ)

Explain why knockout canisters are loaded only at the 324' 11" elevation AND fuel canisters are loaded only at the 321' Ø" or 317' Ø" level ?

QUESTION 4.Ø3 (2.ØØ)

Concerning the fuel transfer system:

a. What are three prerequisites for carriage movement ?
[3 @ Ø.33 ea.]

b. What are three prerequisites for upending a canister ?
[3 @ Ø.33 ea.]

QUESTION 4.Ø4 (2.ØØ)

What must be performed prior to the addition of any hydraulic fluid to the hydraulic pump reservoir ?

QUESTION 4.Ø5 (2.ØØ)

What are the major differences between a TCN and a TCN-2 ?

QUESTION 4.Ø6 (2.5Ø)

List five documents that should be reviewed during the course of the shift per procedure 4210-ADM-3020.Ø1, Conduct of Plant Operations.

(***** CATEGORY Ø4 CONTINUED ON NEXT PAGE *****)

QUESTION 4.07 (2.00)

Explain the following terms as they apply to a UWI.

a. QC witness point [1.0]

b. QC Hold Point [1.0]

QUESTION 4.08 (2.00)

The cancellation date of a TCN shall not exceed ___a___ from the date of the ____b____.

QUESTION 4.09 (2.00)

A UWI-WRA requires a revision. Under what provisions may work continue?

QUESTION 4.10 (2.00)

a. What is required by procedure 4000-ADM-3240.01, Access to and Work in the Containment Bldg, to remove equipment from the containment [1.0]?

b. Who's (position title) approval is required [1.0]?

QUESTION 4.11 (2.50)

List five indications of a leak in the SDS per procedure 4210-EAP-3527.03, Leakage in the SDS Submerged Ion Exchanger.

QUESTION 4.12 (1.00)

Why is RCS sampling frequency increased if the IIF processing system is in automatic control mode ?

(***** CATEGORY 04 CONTINUED ON NEXT PAGE *****)

QUESTION 4.13 (1.ØØ)

If the diesel is started and cooling water is lost the operator must: (choose the correct answer) [1.Ø]

a. monitor diesel temp locally.

b. trip the diesel.

c. operate the diesel at <= 5Ø % load.

d. unload the diesel until cooling water flow is restored

(***** END OF CATEGORY Ø4 *****)
(********** END OF EXAMINATION **********)

ANSWERS -- TMI-2 -86/09/03-KING, M.

ANSWER 1.01 (1.00)

1. neutron source present [0.5]
2. fissionable fuel present [0.5]

REFERENCE
TMI-2 Lesson Plan #55, 11.2.01.179, pg 4

ANSWER 1.02 (2.00)

"Slow" refers to the energy level of the neutron. A fast neutron that has been thermalized[0.5]. Slow or thermal neutrons could have come from either instantaneous or delayed sources[0.5]. Delayed refers to neutrons that are not direct results of fission [0.5]but rather appear as a result of the decay of fission products[0.5].

REFERENCE
TMI-2 NET 2-12, pg 12.1-5 & NET 3-1

ANSWER 1.03 (1.00)

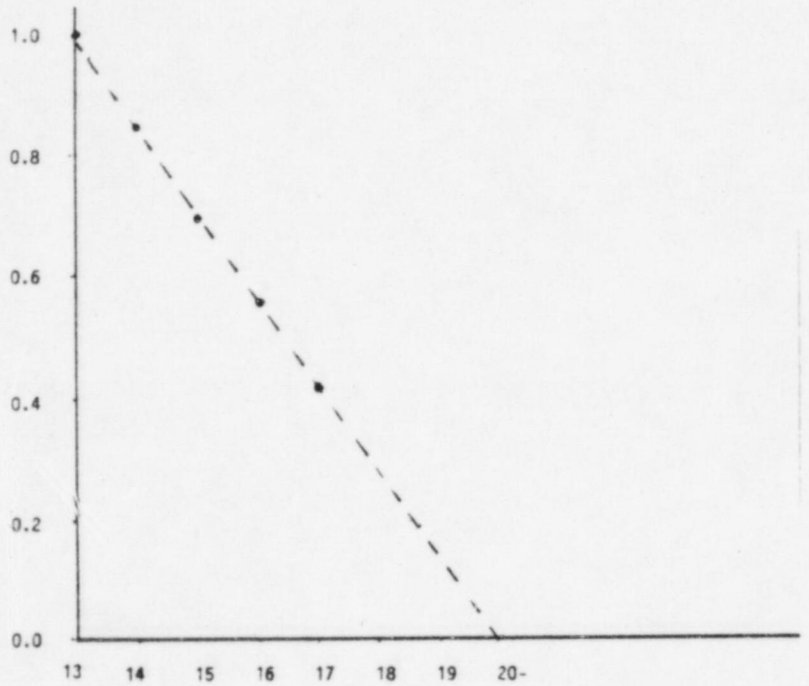
Thermal neutrons

REFERENCE
TMI-2 NET 3-1 pg 14-2

ANSWERS -- TMI-2 -86/Ø9/Ø3-KING, M.

ANSWER 1.Ø4 (3.ØØ)

a. [Ø.75 for 1/m plot] [Ø.75 for answer]



b. cr1/cr2 = (1-k2)/(1-k1) [Ø.5 for formula]

1.25/2.22 = (1-k2)/(1-.7)

.563 (.3) = 1-k2 [Ø.5 for math]

.169 = 1-k2

1-.169 = k2

.831 = k2 [Ø.5 for answer]

REFERENCE
TMI-2 NET 3-12, pg 12.2-1 - 12.2-3

ANSWERS -- TMI-2 -86/09/03-KING, M.

ANSWER 1.05 (3.00)

(E = exponent, ~ = proportional)

SPEED

N-E2 ~ head [0.33 for formula]

(3600-E2)/(x-E2) = 125/75 [0.33 for math]

x-E2 = (3600-E2)(75)/125

x = 2788 rpm(new pump speed) [0.33 for answer]

FLOW

N ~ flow [0.33 for formula]

3600/2788 = 100/x

1.292 = 100/x [0.33 for math]

x = 77.4 gpm [0.33 for answer]

POWER

N-E3 ~ power [0.33 for formula]

(3600-E3)/(2788-E3) = 250/x

2.1529 = 250/x [0.33 for math]

x = 116 HP [0.33 for answer]

REFERENCE
TMI-2 Lesson Plan #52, 11.2.01.114, pg 44-46

ANSWER 1.06 (3.00)

a. 3 1

b. 1 3

c. 2 2 (6 @ 0.5 ea.)

ANSWERS -- TMI-2 -86/Ø9/Ø3-KING, M.

REFERENCE
TMI-2 #52, 11.2.Ø1.114, pg 14, 23-25, 39

ANSWER 1.Ø7 (1.ØØ)

a

REFERENCE
TMI-2 Lesson Plan #48, 11.2.Ø1.Ø47, pg 16-17

ANSWER 1.Ø8 (3.ØØ)

a. saturated

b. saturated

c. sub-cooled

d. super-heated

[4 @ Ø.6 ea.]

REFERENCE
Steam Tables

ANSWER 1.Ø9 (3.ØØ)

a. Heat is added to the fluid in the pump due to "pump work". If the flow is insufficient to remove this heat then cavatation may result and cause damage to the pump components. Pump components (such as seals) may be damaged by heat/temp alone.[2.Ø]

b. A recirc line to allow minimum required flow.
OR
Maintain system flow greater than the minimum required flow.
[1 @ 1.Ø]

REFERENCE
TMI-2 NET 4-6, Pumps and Fluid flowhermodynamics

ANSWERS -- TMI-2 -86/09/03-KING, M.

ANSWER 1.10 (2.00)

Neutrons have no electrical charge and lose/reduce their energy by collisions. Maximum energy is lossed with collisions with small/light atoms. [1.0]

Gammas have neither mass or electrical charge and lose/reduce their energy thru gamma interactions with matter. This require a high density/heavy material to maximize the gamma interactions with the shield. [1.0]

REFERENCE
TMI-2 NET 2-7, pg 7.4-1

ANSWER 1.11 (3.00)

a. Pump flow decreases. AND/OR: As NPSH approches zero the pump cavitates, flow will fluctuate or go to zero.[1.0]

b. Flow decreases as the system resistance increases.[1.0]

c. Flow will increase as pump speed increases, i.e. pump laws.[1.0]

REFERENCE
TMI-2 NET 4-6, Pumps and fluid flow.

ANSWERS -- TMI-2 -86/09/03-KING, M.

ANSWER 2.01 (3.50)

a. The hoses are inside the (3") tool segments. (0.5)

b. 1. Prevent radiation streaming. [1.0]
2. Make the tool more stable when in use. [1.0]
3. Make the tool lighter (when out of the water) [1.0]

REFERENCE
TMI-2 Lesson Plan #29, 12.2.01.145, pg 6.0

ANSWER 2.02 (2.50)

1. Reclaimed boric acid tank
2. Concentrated waste tank
3. Misc. waste hold-up tank
4. Spent resin storage tank
5. Aux. Bldg. sump tank
6. Reactor coolant bleed tank
7. Reactor coolant evap.
8. Waste gas decay tank.

(5 @ 0.5 ea.)

REFERENCE
TMI-2 Lesson Plan #19, 12.2.01.093, pg 12-13

ANSWER 2.03 (3.00)

1. Single rod shears (vertical,horizontal)[0.30]. Used to cut single fuel rods [0.30]. (0.6)

2. Parting wedge [0.30]. Used to separate core material for handling or easier vacuuming [0.30]. (0.6)

3. Grippers (3 point and 4 point) [0.30]. Used to pick up odd shaped pieces [0.30]. (0.6)

4. Heavy duty tong tool [0.30]. Used to grasp partial length fuel assemblies (from any two sides) [0.30]. (0.6)

5. Spade bucket tool [0.30]. Used to scoop debris from the core to deposit it into a debris bucket (Fuel/Filter canister)[0.30]. (0.6)

6. Clamshell tool [0.30]. Used to scoop debris from the core (like spade bucket) to deposit it into a debris bucket (Fuel/Filter canister)[0.30]. (0.6)

7. Partial fuel assembly loading tool [0.30]. Used to pick up partial fuel assemblies (with upper end fittings intact) [0.30]. (0.6)

8. Heavy duty shear [0.30]. Used to cut fuel bundles to sizes suitable for insertion into fuel canisters OR to remove end fittings [0.30]. (0.6)

9. Grapple [0.30]. Used to lift end fittings for disposal OR move debris (to allow easier vacuuming) [0.30]. (0.6)

(5 of 9 @ 0.6 ea.)

REFERENCE
TMI-2 Lesson Plan #29, 12.2.01.145, pg 7-10

ANSWER 2.04 (2.00)

HOW: Used to "band" (wrap,strap,tie,etc.) fuel bundles in the area of a (desired) cut.

Why: To keep the cut pieces wrapped in shape so they will fit into fuel canisters.

(2 @ 1.0 ea.)

ANSWERS -- TMI-2 -86/09/03-KING, M.

REFERENCE
TMI-2 Lesson Plan #29, 12.2.01.145, pg 15

ANSWER 2.05 (2.00)

1. The plates (3" SS shielding plates) are placed with the joints over "webs" (I-beam) when possible [1.0].

2. Joints, not over webs, are "stepped" [1.0].

REFERENCE
TMI-2 Lesson Plan #30, 12.2.01.147, pg 14

ANSWER 2.06 (1.00)

To remove particles [0.33] up to the size of fuel pellets [0.33] from the core region [0.33].

REFERENCE
TMI-2 Lesson Plan # 34, 12.2.01.155, pg 9

ANSWER 2.07 (1.00)

The cannister removal port is designed with extra radiation shielding specifically for canister removal.[1.0]

REFERENCE
TMI-2 Lesson Plan #35, 12.2.01.156, pg 6

ANSWER 2.08 (1.50)

1. Unit 1 generator output (Accept Unit 1 main)

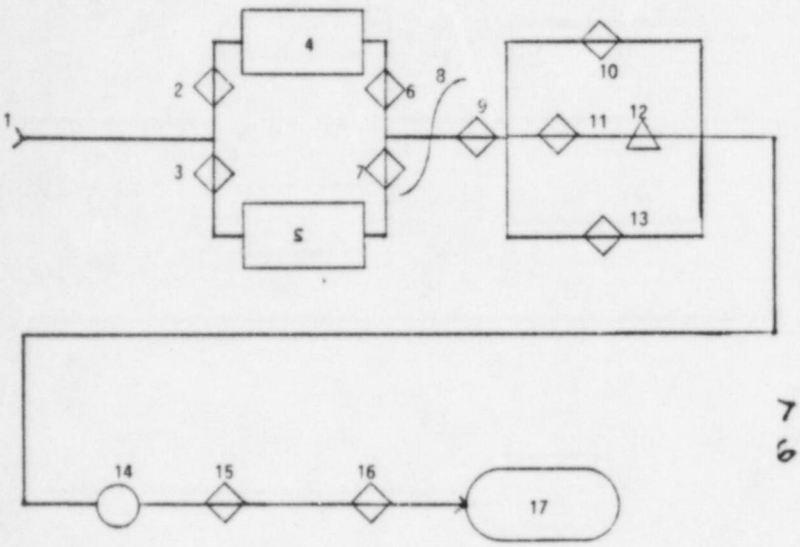
2. 500 KV substation (Accept Auto-transformer

3. Middletown Junction Line

4. Jackson Line (3 @ 0.5 ea.)

REFERENCE
TMI-2 Elec. Diagram, Dwg 3002

ANSWER 2.09 (2.50)



1. RCS RC-P-1A pump suction [.15]
2. V1A [.15]
3. V1B [.15]
4. C-1A [.15]
5. C-8 [.15]
7 6. V2B [.15]
6 7. V2A [.15]
8. Containment [.15]
9. V376 [.15]
10. V100 [.15]
11. V4 [.15]
12. Block Orifice [.15]
13. V5 [.15]
14. Flow Inst. [.15]
15. V105 [.15]
16. V8 [.15]
17. RCBT [.1]

REFERENCE
TMI-2 DWG 2024, rev 29

ANSWER 2.10 (1.00)

The pumps will start in 21 sec (+/- 3). [0.5]
2 pumps start (one in each loop). [0.5]

REFERENCE
TMI-2 Lesson Plan #45, 12.2.01.175, pg 23

ANSWER 2.11 (2.00)

The BDP will be used at the completion of the early defueling phase. The remaining debris will vary in thickness from 0' to 6'and be fused together. The BDP tool will be heavy duty equipment to break up,fracture, cut or lift remaining fuel/material from the vessel.[2.0]

(Answer need not be verbatim to the above.)

REFERENCE
TMI-2 Lesson Plan #46, 12.2.01.177, pg 4-5

ANSWER 2.12 (3.00)

a. Near CN-PNL-1 or controller on east wall.

b. PNL9-C.R. or Rad. waste panel

c. DWC-LCP-1

d. Radwaste panel

e. Radwaste panel

f. CN-PNL-1 (Fuel Handling Bldg.)

g. Next to pumps and FHB east wall (347' elevation)

(6 @ 0.5 ea.)

REFERENCE
TMI-2 Proc. 4210-EAP-3527.02, pg 3
Lesson Plan for each system for pump control

ANSWERS -- TMI-2 -86/09/03-KING, M.

ANSWER 3.01 (2.00)

Automatically opens the discharge valve 30 seconds after pump start [1.0].

Allows purging of air in the pump discharge through the vent/vacuum breaker to prevent water hammer [1.0].

REFERENCE
TMI-2 Lesson Plan #45, 12.2.01.175, pg 20

ANSWER 3.02 (1.00)

2 minutes

REFERENCE
TMI-2 Lesson Plan #45, 12.2.01.175, pg 19

ANSWER 3.03 (1.50)

DC-R-3399 DHCCW loop a
DC-R-3400 DHCCW loop b
NS-R-3401 NSCCW
SF-R-3402 Spent Fuel
CN-RE-IX04 SDS Ion Exchanger
CN-RE-LC05 Leakage Containment
ALC-RM-7 CC-T-2 influent (EPICOR II)
(3 @ 0.5 ea.)

(NOTE: Instrument designation not required, SYSTEM name is required)

REFERENCE
TMI-2 Lesson Plan #59, 12.2.01.070, pg 20

ANSWER 3.04 (2.00)

a. 2 (gamma)
b. 2/3 (beta,gamma)
c. 1 (alpha)
d. 4 (neutron)

REFERENCE
TMI-2 Lesson Plan #28, 12.2.01.143, pg 5-8

ANSWERS -- TMI-2 -86/09/03-KING, M.

ANSWER 3.05 (2.50)

1. CAL date check.
2. Physical inspection.
3. Battery check
4. Meter zero check
5. Response time setting.
6. Source check. (5 @ 0.5 ea.)

REFERENCE
TMI-2 Lesson Plan #28, 12.2.01.143, pg 9-11

ANSWER 3.06 (1.50)

The cameras are manually [0.5] positioned through the long handled tool slot [0.5] with (special) camera handling tools.[0.5]

REFERENCE
TMI-2 Lesson Plan #33, 12.2.01.152, pg9

ANSWER 3.07 (2.00)

The flow meter functions on the cooling effect [0.5] of water flow [0.5] on a heated wire [0.5] changing the wires resistance [0.5].

REFERENCE
TMI-2 Lesson Plan #34, 12.2.01.155, pg 23

ANSWER 3.08 (2.00)

a. To lock the canister support sleeves to the CPS at the various (3) levels [1.0]

b. Manually, by a long handled socket tool.[1.0]

REFERENCE
TMI-2 Lesson Plan #35, 12.2.01.156, pg 10

ANSWERS -- TMI-2 -86/09/03-KING, M.

ANSWER 3.09 (3.50)

a. 1. Knockout canisters wet weight high (>= 2343.5 lbs).
2. Filter canister wet weight high (>= 2345.4 lbs)
3. Filter canister dp high (>=38 psid)
4. Knockout canister dp high (>= 14 psid)
5. Backflush dp high (>=40 psid)
6. Low flow (< 60 gpm)
(5 @ 0.5 ea.)

b. If an alarm is received, cease vacuuming operations. (by "pulling the nozzle up") [1.0]

REFERENCE
TMI-2 Lesson Plan #34, 12.2.01.155, Precations & limits (4.6.2)

ANSWER 3.10 (2.00)

1. Low fluid level [1.0]

2. Suction line valve position (closed) [1.0]

REFERENCE
TMI-2 Lesson Plan #38, 12.2.01.159, pg 12

ANSWER 3.11 (3.00)

1. Upon UV,Bus Sheds loads

2. Normal supply breaker opens

3. Alternate supply breaker closes.

4. Diesel generator starts.

5. Alternate breaker opens.

6. Diesel generator breaker closes.

7. Commence sequence loading.

REFERENCE
TMI-2 Lesson Plan #5, 12.2.01.020, pg 5 & figure (no page no.)

ANSWER 3.12 (2.00)

a. High dp alarm on filter (>65 psid)

b. System low flow indication

c. System low flow alarm (<80 gpm)

d. MDHR pump low suction pressure indication

e. MDHR pump low suction pressure alarm (<16 psig)

f. MDHR pump low discharge pressure indication

(4 @ 0.5 ea.)

REFERENCE
TMI-2 Lesson Plan #13, 12.2.01.063, Sec A, Control & Instrumentation, pg 25

ANSWERS -- TMI-2 -86/09/03-KING, M.

ANSWER 4.01 (.00)

Question/answer/reference deleted from exam.

REFERENCE
Question/answer/reference deleted from exam.

ANSWER 4.02 (2.00)

1. The connections to the vacuum system are only at the 324' 11" elevation. Knockout cannisters must be connected to the vacuum system [1.0].

2. Fuel canisters are loaded at the 321' and 317' elevations due to shielding reasons [1.0].

REFERENCE
TMI-2 Lesson Plan #35, 12.2.01.156, pg 7

ANSWER 4.03 (2.00)

a.1. The carriage control switch must be in the on position.

2. Transfer tube gate valve must be open.

3. & 4. Reactor building & fuel handling building upenders must be in the frame down position.

5. & 6. Reactor building & fuel handling building latches must be engaged.

[3 @ 0.33 ea.]

b.1. Carriage and upender must be properly aligned in the indexed position.

2. Winch brakes must be engaged.

3. Basket latch must be disengaged

4. Low hydraulic alarm cleared. [3 @ 0.33 ea.]

REFERENCE
TMI-2 Lesson Plan #37, 12.2.01.158, pg 17

ANSWERS -- TMI-2 -86/Ø3/Ø3-KING, M.

ANSWER 4.Ø4 (2.ØØ)

All hydraulic lines, fittings, hoses, valves, pumps, gauges & couplings must be inspected for looseness.
All fragile parts such as gauges, hoses and couplings must be inspected for damage such as cracks or distortion.
This must include the hydralic tools on the SWP [1.Ø].

All additions of APPROVED hydraulic fluid to the hydraulic system must be AUTHORIZED by the FHSRO (and the amount of that fluid added recored in the FHSRO log.)[1.Ø]

REFERENCE
TMI-2 Lesson Plan #38, 12.2.Ø1.159 pg 14

ANSWER 4.Ø5 (2.ØØ)

A TCN may change the intent of a procedure (and a TCN-2 may not) and has to complete the full review, concurrence and approval requirements prior to implementation. A TCN-2 requires fewer (usually 4) signatures prior to implementation amd has 14 days to complete review and approval requirements.

REFERENCE
TMI-2 Admin proc. 4ØØØ-ADM-3ØØØ.Ø1, pg 12

ANSWER 4.Ø6 (2.5Ø)

a. Active tagging book

b. Locked valve book

c. Surveillance schedules

d. TCN book

e. SOP book

f. Operations memo book

g. Revision Review Book (5 @ Ø.5 ea.)

ANSWERS -- TMI-2 -86/09/03-KING, M.

REFERENCE
TMI-2 Admin proc. 4210-ADM-3020.01, pg 4

ANSWER 4.07 (2.00)

a. QC Witness Points may be intentionally deleted, by-passed, or inserted at the option of the QC Supervisor. Activities may continue provided QC was notified of the time to witness and is not present at the start time [1.0].

b. QC Hold Points may not be by-passed or deleted without documented justification and the approval of the QC Manager. The QC Inspector's signature on the UWI indicates satisfactory completion of the specific step(s) that the Hold Point addresses and permits the activity to proceed [1.0].

(Answers need not be verbatim per above.)

REFERENCE
TMI-2 Admin proc. 4000-ADM-3000.01, pg 16-17

ANSWER 4.08 (2.00)

a. 90 days

b. Responsible Supervisors signoff

REFERENCE
TMI-2 Admin proc. 4000-ADM-3000.01, pg 16

ANSWER 4.09 (2.00)

Work not affected by the revision may continue [0.5] provided the planning group indicates to the work supervisor [0.5] the portions of the UWI that may and may not be worked [0.5] and the work or steps deferred as a result of the revision is/are clearly not a prerequisite or sequence dependent to the continued work or steps[0.5].

OR

Work may be stopped or continued as directed by the Work/Shift Supervisor

ANSWERS -- TMI-2 -86/09/03-KING, M.

REFERENCE
TMI-2 Admin proc. 4000-ADM-3000.01, pg 19-20

ANSWER 4.10 (2.00)

a. A containment transfer record is required to be completed [1.0].

b. Radwaste engineer approval (Accept Shift Supervisor, Fuel Handling Shift Supervisor, Rad Con Engineer or Radwaste engineer)[1.0].

REFERENCE
TMI-2 Admin proc. 4000-ADM-3240.01, pg 3.0

ANSWER 4.11 (2.50)

1. Visible leak
2. Unexplained change in receiving tank level rise
3. Unexplained pressure decrease/loss on system gauges
4. loss of system flow indication.
5. Unexplained increase on radcon instruments
   CN-RIT-LC05 (in containment)
   RC area or IX manifold area
   aux bldg. vent
   fuel handling vent.
   SDS vent
   cation effluent
   (NOTE: each of these is a separate indication of a leak.)
6. Unexplained increase in "B" spent fuel pool level.
7. Unexplained increase in off-gas separater tank level

(5 @ 0.5 ea.)

REFERENCE
TMI-2 Admin proc. 4210-EAP-3527.03, pg 2-3

ANSWER 4.12 (1.00)

To detect any inleakage that could cause an undetected deboration of the RCS.

REFERENCE
TMI-2 Lesson Plan #26, 12.2.01.136, pg 26-32

ANSWERS -- TMI-2 -86/09/03-KING, M.

ANSWER 4.13 (1.00)

b. (trip the diesel)

REFERENCE
TMI-2 Lesson Plan #45, 12.2.01.175, pg 19

ATTACHMENT 2

Resolution to Facility Comments on NRC
RO Operator Licensing Exam of 9/3/86.

Facility comment on question/answer 2.02:

Allow facility abbreviations

Reclaimed boric acid tank - RBAT
Concentrated waste tank - CWST
Misc. waste hold-up tank - MWHT
Spent Resin storage tank - SRST (2)
Aux. Bldg sump tank - ABST
Reactor coolant bleed tank - RCBT or RCBHT (3)
Reactor coolant evap. - RC Evap.
Waste gas decay tank - WGDT (2)

Examiner resolution:

Agree, per guideline 12 (NRC rules, guideline for license examinations) provided with exam, commonly used abreviations are permitted.

Facility comment on question/answer 2.08:

In answer part 1 do not accept aux. transformers. (main is okay)

In answer part 2 allow auto-transformer in place of 500 Kv.
Refereence dwg 3002.

Examiner resolution:

Agree, per supplied marked-up print.

Unit 1 aux transformer deleted from answer 1 and changed answer 2 to "500 Kv substation (500/230 Kv auto transformer).
Change does not affect question point value.

Facility comment on question/answer 2.12:

FCC-P-1 CN-PNL-1 (answer to CAF)
Reference TER 3527-006 App. No. 3

Examiner resolution:

Agree, supplied answer from Reference material incorporated as answer to part "f".

Facility comment on question/answer 3.03:

SF-R-3402 Spent Fuel (answer to CAF)
Add the following possible answers:
CN-RE-IX94 SDS Ion Excahnge
Reference L.P. 12.2.01.132 p. 9.0
CN-RE-LC05 Leakage Containment
Reference L.P. 12.2.01.132 p. 8.0
ALC-RM-7 CC-T-2 influent
Reference L.p. L2.2.0L.023

Examiner resolution:

Agree, SF-R-3402 name incorporated into answer and 3 liquid monitors added to answer key. ~~No~~ change does not affect question point value.

Facility comment on question/answer 3.09:

In answer parts 2 and 3, "fuel" should be "filter".

Examiner resolution:

Agree, fuel changed to filter.

Facility comment on question/answer 4.01:

The referenced evolution was never utilized and the lesson plan should be deleted. Some other answers should be added to the key. Possible answers about procedure requirements to prevent draining or recognize draining of the IIF follow:

Monitor RCS level periodically.
Reference 4210-OPS-3200.02 Step 4.1.4.1
Perform Reactor Coolant isolation checklist every 24 hours.
Reference 4210-OPS-3200.02 Step 4.2.6
Independent verification of valve lineups
Reference 4210-OPS-3200.02 Step 4.2.9

Examiner resolution:

Agree, information supplied during exit meeting explained the procedure was a contingency procedure and never implemented during the IIF installation and fill. The question is deleted and section 4 reduced to 23 points.

Facility comment on question/answer 4.04:

Other possible answers:

Approval by FHSRO

Reference 4210-OPS-3255.10 Step 4.2
Sampling for Boron
Reference 4210-OPS-3255.10 Step 4.5

Examiner resolution:

Agree, to "FHSRO approved addition of authorized hydraulic fluid (and record amount added)" and will be added to answer key. Point value redistributed to the 2 answers equally.

Disagree to boron sample as this applies to "before use of hydraulic system" not for hydraulic fluid additions.

Facility comment on question/answer 4.05:

For the second part of the answer, both the TCN and TCN-2 go through the same review cycle. The real difference is that the TCN-2 may be implemented prior to obtaining the SRO, NRC, and Site Ops Director signatures.

Reference 4000-ADM-3000.01 Step 4.3.4.2 and 4.3.4.1 2 (Both are approved in accordance with 4000-ADM-1218.02 section 4.6.6 but the TCN-2 has 14 days after implementation for the above signatures.)

Examiner resolution:

Agree, the answer will be changed to : A TCN may change the intent of a procedure (and a TCN-2 may not) and has to complete the full review, concurrence and approval requirements prior to implementation. A TCN-2 requires fewer (usually 4) signatures prior to implementation and has 14 days to complete review and approval requirements.

Facility comment on question/answer 4.08:

For answer b, the word "implementation" should be also allowed in place of Responsible Supervisor's signature because his signature implements the UWI.

Reference 4000-ADM-3000.01 Step 4.5.2 and 4.5.2.2.

Examiner resolution:

Disagree, the responsible supervisor's signature does not specifically implement the UWI. The signature is required only prior to start of the work.

Facility comment on question/answer 4.09:

Subject is taught as SRO level knowledge.

Examiner resolution:

Disagree, the existing answer is more at an SRO level but the

question knowledge should be known by RO's. The answer will be modified to accept the existing answer or "work may continue as directed by work/shift supervisor".

Facility comment on question/answer 4.10:

Subject is taught as SRO/FHSRO level.

Examiner resolution:

Disagree part a, a RO should know what is required to remove equipment from the reactor bldg.

Agree part b, the RO would be expected to request/report to the SS, FHSS, or Rad Con engr. The SS, FHSS, or Rad Con Engr will also be acceptable for part b.