RESULTS OF WRITTEN EXAMINATION PERFORMANCE ANALYSIS

Consideration was given to questions having less than a pass rate of less than 60% (i.e. four or more students missed the question). Questions meeting such a metric were: 1, 40, 55, 70, 71, 76 and 93.

This subset of was judged to contain one question with an answer which was keyed incorrectly. Such question was number 55. Every applicant answered question 55 with A.

Question 55 follows:

Given the following:

- Unit 1 was operating at 100% power when a Safety Injection occurred due to a large steam line break resulting in a peak containment pressure of 3.8 psig.
- Containment pressure is now 2.2 psig,
- The Safety Injection Signal has **NOT** been reset.

Based on the given conditions, which ONE of the following completes the statements below?

By depressing and then releasing the Phase A reset pushbuttons on 1-M-6, the Phase A Containment Isolation signal __(1)__ be removed.

By depressing and then releasing the Phase B reset pushbuttons on 1-M-6, the Phase B Containment Isolation signal __(2)__ be removed.

	(1)	(2)
A.	Will	will
√B.	will **NOT**	will
C.	will	will **NOT**
D.	will **NOT**	will **NOT**

DISTRACTOR ANALYSIS:

A. *Incorrect, it is plausible because had the safety injection signal been reset, the action taken to reset the phase A would have been effective. However, in this case, the phase A retentive memory would toggle OFF briefly while the reset pushbutton was depressed and then immediately toggle back as the pushbutton was released. To this point, the phase A signal would not be removed.*

Also, plausible because the phase B signal would be removed with the actions taken.

B. *Correct, the phase A signal would not be removed with the actions taken. The phase B signal would be removed with the actions taken.*

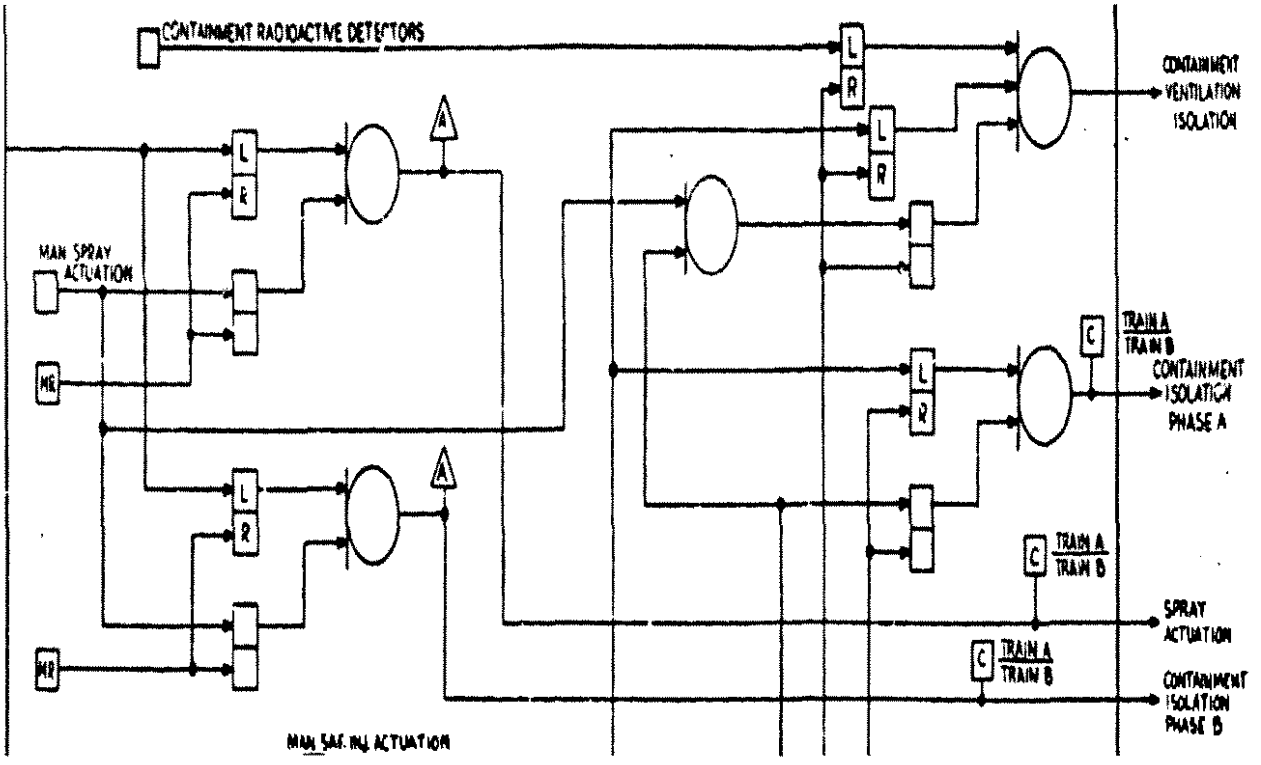
C. *Incorrect, it is plausible because had the safety injection signal been reset, the action taken to reset the phase A would have been effective. However, in this case, the phase A retentive memory would toggle OFF briefly while the reset pushbutton was depressed and then immediately toggle back as the pushbutton was released. To this point, the phase A signal would not be removed.*

   Also, it is plausible that the phase B could act as the phase A in that a SI reset would be required prior to the phase B's ability to reset. However, this is not the case.

D. *Incorrect, plausible as it is correct that the phase A signal would not be removed with the actions taken. Also, it is plausible that the phase B could act as the phase A in that a SI reset would be required prior to the phase B's ability to reset. However, this is not the case.*

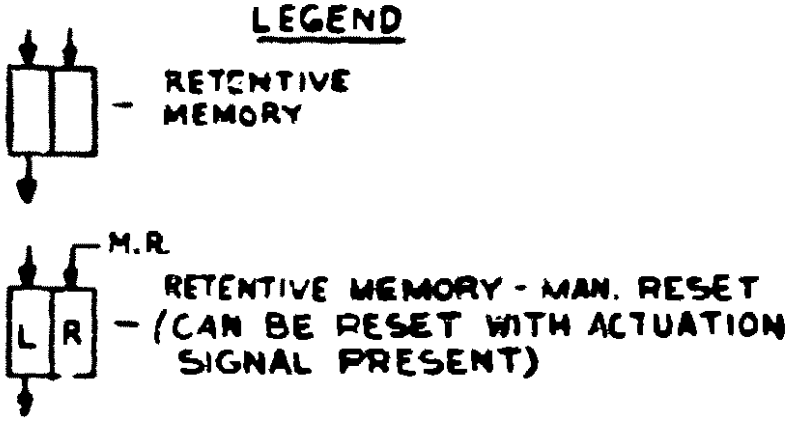
The keyed answer is B. The keyed answer claimed that the Phase A containment isolation signal will not be removed.

When the utility representatives modified this question in Atlanta, they failed to realize that the ON/OFF retentive memory affiliated with the Phase A isolation signal will change to the OFF state with a safety injection signal present.



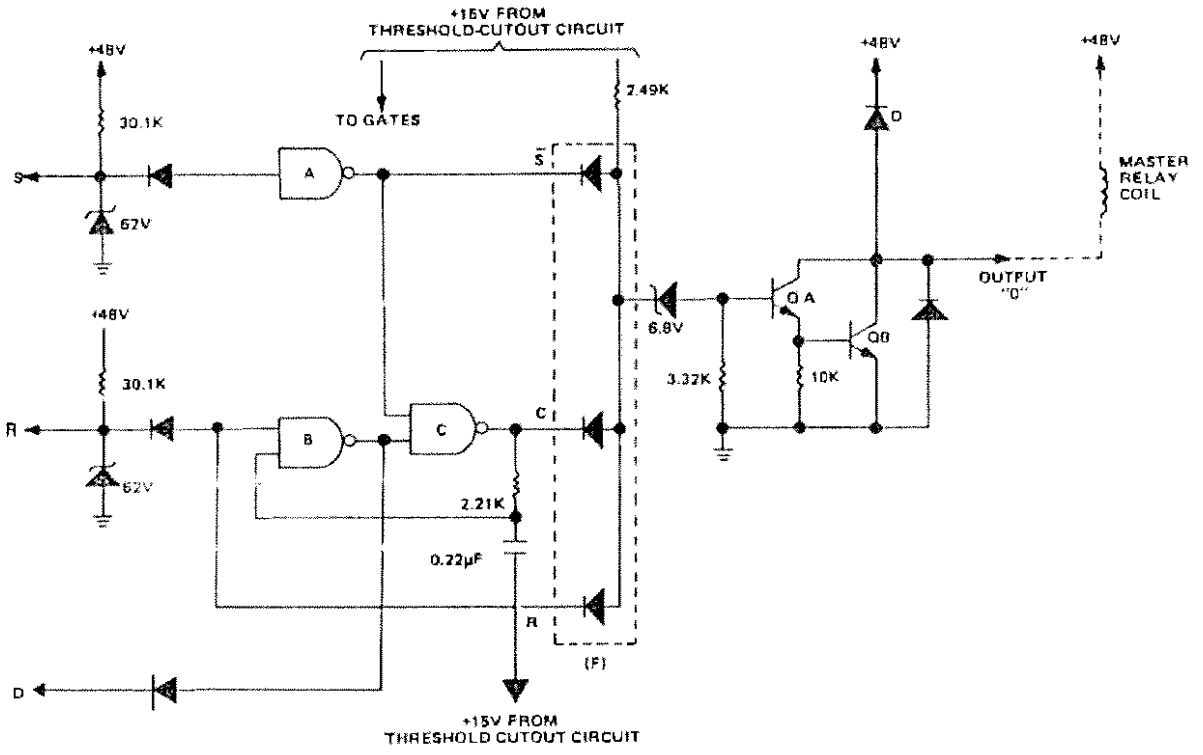
Excerpt from the Westinghouse print 1082H70-1

Inspection of the Westinghouse print 1082H70-1 reveals a key detail not contained in the TVA logic prints. This content is that the retentive memory affiliated with the Phase A containment isolation is able to be reset with the actuation signal present. This type of retentive memory is depicted by the use of the L and R designators.



Excerpt from the Westinghouse print 1082H70-1

The Westinghouse print 1082H70 summarizes information contained in the following diagram:



Schematic of a Westinghouse safgeguards driver board

The containment isolation signals are effected through the use of safeguards driver boards. The operation of a safeguards driver board is contained in the following discussion.

Case 1: No actuation signal exists and no reset push-button is depressed

1. The Set signal, S, is high. The S input is inverted by NAND gate A and applied as a low to Point F.
2. Point F is low. This low is applied to the cathode of the 6.8 vdc Zener Diode. With a low on its cathode, the Zener diode does not conduct.
3. With the Zener diode not conducting, Q_A has no base current and turns off.
4. With Q_A off, Q_B has a low at its base and is reverse biased. Q_B is turned off.
5. Q_B is in the current path of the load. With Q_B off, there is no load current. If the load were a Master Relay, it would be deenergized.
6. The low out of NAND gate A is applied as an input to NAND gate C.
7. This low into NAND C is inverted to a high and fed back to the input NAND B as a high.
8. Since Reset is high, both inputs to NAND B are high and its output is low.
9. At this point, both inputs to NAND C are low and its output remains high.
10. The memory circuit is now ready for Set to go low representing the need for safeguards actuation.

Case 2: An actuation signal exists and the reset push-button is not depressed

1. The Set signal, S, goes low representing a trip.
2. S is inverted by NAND gate A to a high. This removes the low signal that was pulling Point F low. (Note: The output of NAND C is high and R is high.)
3. All of the inputs to Point F are high and are blocked by the three diodes feeding into Point F. +15 vdc is now applied to the cathode of the 6.8 vdc Zener diode through the 2.49K ohm pull-up resistor. This causes the Zener diode to conduct.
4. The Zener now provides base current to transistor Q_A turning it on.
5. With Q_A conducting, a sufficiently positive voltage is placed on the base of Q_B to forward biased it. Q_B now conducts.
6. Since the emitter of Q_B is connected directly to ground, when Q_B turns on, a ground is essentially placed on one side of the load.
7. The other side of the load is already connected to +48 vdc. Thus the Driver Circuit sinks current to ground through Q_B. The load, usually a Master Relay, is energized.
8. The high at the output of NAND A is applied as one input to NAND C.
9. However, since R is high, the output of NAND B is low. This low is fed to NAND C as its second input.
10. The output of NAND C thus remains high.
11. This high is fed back to NAND B keeping it output low.
12. The low out of NAND B seals the output of NAND C high.

Case 3: The actuation signal exists and the reset push-button is depressed

1. The Reset signal, R, goes low when the operator pushes the reset push button.
2. This low is applied directly to Point F, pulling it low.
3. With Point F low, the Zener diode stops conducting. Q_A and Q_B turn off. This deenergizes the load.
4. In the Memory Circuit, with R low, the output of NAND B is high.
5. Now, both inputs to NAND C are high and its output is low. This low is fed back to the input of NAND B keeping its output high even after the Reset signal goes back high (as it will when the operator releases the reset push button.)
6. Both inputs to NAND C remain high keeping the output of NAND C low. Point F is seal low.
7. With Point F low, the load remains deenergized.

Question 55 asked the applicants to consider whether the Phase A containment isolation could be reset if its initiating signal had NOT been reset. Given the aforementioned circuit design, the correct answer should be that it could. Therefore, the keyed answer to question 55 should be A.

The facility recommends changing the answer to question 55 to A.

SUBSTANTIVE COMMENTS

In accordance with ES-402, E.4, the facility received, considered and elected to sponsor a comment received from applicant [redacted]. This applicant presented a comment regarding question 88. Question 88 follows:

Given the following:

0000 Unit 1 is operating at 28% power.

0001 SG #4 main feedwater line ruptures between Turbine Building wall and the South Valve Vault Room.

0002 AOI-38, "Main Steam or Feedwater Line Leak," is entered and the SRO directs a reactor trip.

Which ONE of the following completes the statements below?

Procedural direction to ensure the leak is isolated will be directed __(1)__ the transition from 1-E-0, "Reactor Trip or Safety Injection," to the applicable procedure.

In accordance with NPG-SPP-03.5, " Regulatory Reporting Requirements," an 8-hour notification would be required due the actuation of __(2)__.

REFERENCE PROVIDED

	(1)	(2)
A.	prior to	a single system
√B.	only after	multiple systems
C.	only after	a single system
D.	prior to	multiple systems

The answer indicated on the key is B.

DISTRACTOR ANALYSIS:

A. *Incorrect, Plausible because the leak being isolated prior to the transition from 1-E-0 is correct due to the automatic FWI with Lo/Tavg. It is plausible to believe that an 8 hour report would only be made in accordance with 50.72(b)(3)(iv)(A) (e.g. make a report based solely on a rx trip). An eight hour reports based upon the systems listed in 50.72(b)(3)(iv)(B) would in fact be required. At a minimum, reports based upon 50.72(b)(3)(iv)(B)(1), "reactor trip" and 50.72(b)(3)(iv)(B)(6), "auxiliary feedwater" would be required.*

B. *Correct, The transition from 1-E-0 will be to ES-0.1 and while this transition will be made prior to the step that initiates the Attachment to ensure the isolation of main feedwater, a MFW isolation will have automatically occurred due to the Reactor trip with Low Tavg. It is correct that at a minimum, reports based upon 50.72(b)(3)(iv)(B)(1), "reactor trip" and 50.72(b)(3)(iv)(B)(6), "auxiliary feedwater" would be required.*

C. *Incorrect, Plausible because if a safety Injection had of occurred then the a check of the isolation of the feedwater would have occurred prior to the transition from 1-E-0. It is plausible to believe that an 8 hour report would only be made in accordance with 50.72(b)(3)(iv)(A) (e.g. make a report based solely on a rx trip). An eight hour reports based upon the systems listed in 50.72(b)(3)(iv)(B) would in fact be required. At a minimum, reports based upon 50.72(b)(3)(iv)(B)(1), "reactor trip" and 50.72(b)(3)(iv)(B)(6), "auxiliary feedwater" would be required.*

D. *Incorrect, Plausible because if a safety Injection had of occurred then 1-E-0 would have directed action to ensure MFW isolation have occurred prior to the transition from 1-E-0 and because both a four hour and an eight hour notification is required as stated in the correct answer analysis. It is correct that at a minimum, reports based upon 50.72(b)(3)(iv)(B)(1), "reactor trip" and 50.72(b)(3)(iv)(B)(6), "auxiliary feedwater" would be required.*

The facility's intent in constructing this question was to elicit the knowledge that 1-E-0 did not contain any guidance to ensure that the feedwater leak was isolated. The facility did not consider the fact that TI-12.04, "User's Guide For Abnormal And Emergency Operating Instructions" contains the following in section 2.2.4 Immediate Action Steps:

> *B. During immediate operator action steps the operators will ensure automatic actions have occurred or initiate signals as appropriate. Diagnostic or repair actions will be delayed until the immediate actions are complete to allow for evaluation of plant response.*

The applicant's comment is that while the Operator at the controls is performing the immediate actions of 1-E-0, the Balance of Plant Operator (and the Unit Supervisor) would verify that as Reactor Coolant System average temperature lowered to less than 564°F, a feedwater isolation occurred. Therefore three facts exist:

1. TI-12.04 contains the verbiage that "operators will ensure automatic actions have occurred."
2. TI-12.04 is in effect when 1-E-0 is entered.
3. A feedwater isolation is an automatic action.

When a feedwater isolation signal occurs, both the Main Feed Regulating Valves and the Main Feed Isolation valves will close. The Main Feed Regulating Valves are located inside of the Turbine Building and the Main Feed Isolation Valves are located inside of the applicable Valve Vault Room. For the #4 Steam Generator, the Main Feed Isolation Valve is located inside of the South Valve Vault Room. Because the question indicated

that the Feedwater leak was on the #4 S/G supply line between the Turbine Building wall and the South Valve Vault Room, the feedwater isolation would cause the leak to be isolated.

The facility considered the amount of time between a reactor trip (initiated on the basis of a sufficiently sized feedwater leak. Using its simulator, the facility ran a test case which placed a 3% feedwater leak on the feed line for the #4 S/G (the criteria presented in AOI-38, "MAIN STEAM OR FEEDWATER LINE LEAK" which requires a reactor trip). The facility validated that a feedwater isolation occurred well before the OAC completed his immediate actions. Because the isolation occurs before the OAC had completed his immediate actions, it occurs before a transition out of 1-E-0 exists. **Included with this enclosure is a DVD containing a film of such a test case.**

Given the aforementioned, the following deductions must be made:

1. Procedural guidance exists which directs the operators to ensure that a feedwater isolation occurs.
2. The feedwater isolation will isolate the leak presented in the question.
3. The isolation will occur before a transition out of 1-E-0.

Therefore, the facility agrees that procedural direction to ensure the leak is isolated will be directed prior to the transition from 1-E-0, "Reactor Trip or Safety Injection," to the applicable procedure.

The facility recommends that the correct answer be keyed as D.

2.2.3 Foldout Page

A. This page presents actions or transitions which are applicable at any time in the given instruction. Upon transition from an instruction, the current instruction's foldout page becomes applicable and use of the previous instruction's foldout page is discontinued.

1. In the control room, the foldout page information is presented on the back of each page of instructions for which there is a foldout page.

2. The information on the foldout page should be continuously monitored to determine when operator action is necessary.

B. Transitions to other instructions allow immediate response to new symptoms as they appear.

2.2.4 Immediate Action Steps

Steps that have been designated as "Immediate Actions" are contained in three emergency instructions and selected AOIs. These steps are intended to be performed, if necessary, without the written instruction being available.

A. Operators are required to be able to complete the intent of immediate operator action steps.

B. During immediate operator action steps the operators will ensure automatic actions have occurred or initiate signals as appropriate. Diagnostic or repair actions will be delayed until the immediate actions are complete to allow for evaluation of plant response.

C. The immediate actions of E-0 will be addressed as follows:

1. Steps 1 through 4 will be performed in order by the OAC and completion, along with any discrepancies, will be communicated to the Procedure Reader.

2. The BOP will acknowledge alarms as necessary to reduce the noise level, and perform backup verification of steps 1-4.

3. Procedure Reader will read the immediate action high level step. The OAC will confirm the high level step by verbalizing the low level steps to the procedure reader.

4. When re-entering E-0 from another EOI, the first 4 high level steps must be reconfirmed, it is **NOT** necessary to re-perform each low level action.