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Timothy L. Arnold
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1CAN091601

September 5, 2016

Mr. Thomas Farina
Chief Examiner
U. S. Nuclear Regulatory Commission
1600 E. Lamar Blvd.
Arlington, TX 76011-4125

Subject: Initial Examination Completion of Post-Examination Analysis
Arkansas Nuclear One Unit 1 (B&W)
Docket No. 50-313

Dear Mr. Farina,

Contained in this submittal are the post examination materials as required per NUREG 1021, Revision 10 for the ANO Unit One initial license examination administered during the week of August 22, 2016 and the written exam administered on September 1, 2016. The examination security agreement which is enclosed has not been finalized and the completed form will be sent when all required signatures are obtained.

We also request that all examination materials related to the ANO Unit One 2016 NRC Operator License Examinations be withheld from public disclosure for a period of two years from this date.

If you have any questions regarding this submittal, please contact Randal Martin at (479) 858-6844.

Sincerely,

For Tim Arnold

Tim Arnold
Manager, Training
Arkansas Nuclear One

Attachment

cc w/o attachment: Licensing, ANO-DCC

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RO Final Written Examination Analysis

The threshold for determination of questions to be analyzed was a percentage of 50% incorrect responses. We also analyzed other questions based on candidate feedback following the examination.

#1

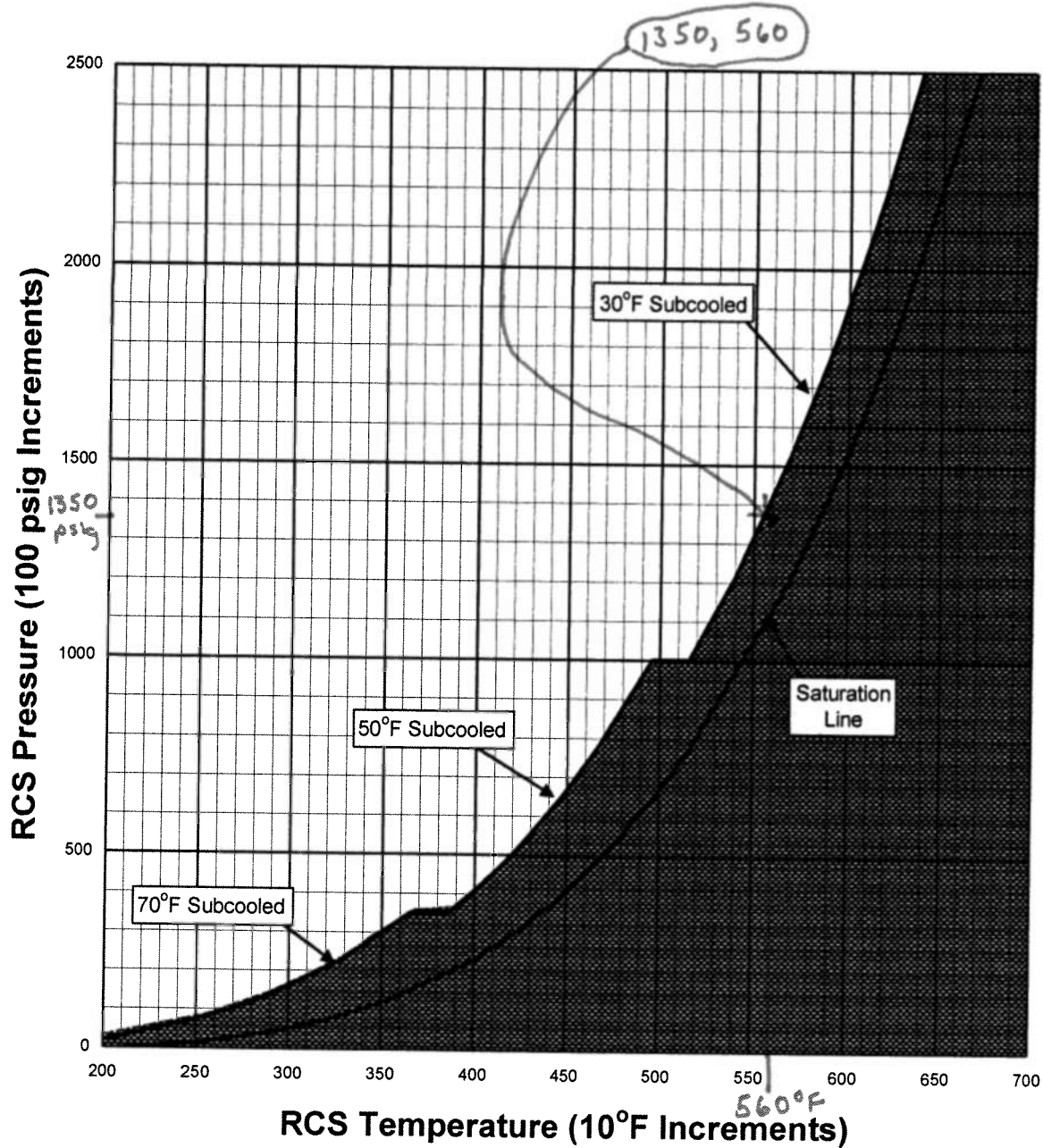
7/17 total candidates incorrect (41.1%)

All seven chose "C". The correct answer is "A".

This question involves a steam space leak and asks which of the choices given, and reason for that choice, will be used to control RCS pressure in accordance with RT-14. The correct answer "A" was to cycle the ERV to prevent challenges to the safeties. Candidate feedback during the exam de-brief on Friday, September 2, revealed that the reason the seven candidates chose "C" was based on the wording of the question. The question asks "...which of the following methods... **will be** used..." (italics and bold emphasis added for this report). The candidates missing this question reasoned this wording implied what will be used to control RCS pressure considering a given stable RCS temperature of 560 °F and a rapidly rising RCS pressure of 1350 psig. The candidates reasoned that subcooling margin (SCM) would thus be restored quickly since the RCS pressure and temperature given was just below the SCM line on Figure 1 of 1202.013 in their handout (please refer to the attached figure). We maintain the correct answer "A" is still correct considering the parameters as a snapshot in time. We are therefore requesting a change to the key to allow both "A" and "C" to be correct. This is in accordance with NUREG-1021, ES-403, D.1.c. We will, of course, revise this question to ensure it is suitable for future use. We will also be performing training needs analysis on this question.



FIGURE 1
Saturation and Adequate SCM



RCS Pressure	Adequate SCM
>1000 psig	$\geq 30^{\circ}\text{F}$
350 to 1000 psig	$\geq 50^{\circ}\text{F}$
<350 psig	$\geq 70^{\circ}\text{F}$

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(RO Final Written Examination Analysis continued)

#19

6/17 total candidates incorrect (35.2%)

One chose "A", and five chose "D". The correct answer is "C".

This question involves a dropped rod event which causes a plant runback to 40% of 902 MWe (the runback final power was not given). The parameters given show reactor power and turbine load at 30%, the student was asked which action was procedurally required. The correct answer "C" is to take manual control of the SG/RX master, an ICS station which will stop the runback when taken to manual. Candidate feedback during the exam de-brief on Friday, September 2, revealed that the reason the five candidates chose "D" (trip the reactor) was due to recent OE at Grand Gulf where the operating crew continued to operate the plant during a severe transient instead of tripping the unit. This OE was used by ANO's acting Site Vice President during recent meetings with plant staff where he reinforced the conservative position to trip the unit when plant control is not present. This action is procedurally supported by the entry conditions of 1202.001, Reactor Trip, where it is stated that a manual trip is required due to "...a system degradation that requires a manual reactor trip based on operator judgement." Please refer to the attached page of 1202.001. We are therefore requesting a change to the key to allow both "C" and "D" to be correct. This is in accordance with NUREG-1021, ES-403, D.1.c. Although ES-403, D.1.c gives an example where the question would be deleted we ascertain question 19 is different from the example since answer "C" does not overtly state "a manual trip is not required." We will, of course, revise this question to ensure it is suitable for future use. We will also be performing training needs analysis on this question.

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(RO Final Written Examination Analysis continued)

#27

9/17 total candidates incorrect (52.9%)

Seven chose "A", and two chose "B". The correct answer is "C".

This question involves essential Technical Specification knowledge: Shutdown Margin (SDM) is listed in the initial conditions as being less than 1.0% delta k/k. This is a 15 minute LCO action which is required to be committed to memory. No change to the key was made. The question is technically correct as written, with no construction problems. We will be performing training needs analysis on this question.

#44

9/17 total candidates incorrect (52.9%)

Two chose "A", one chose "B", and six chose "C". ". The correct answer is "D".

This question gives the conditions of a tube rupture, states an emergency cooldown is not required, asks what is the maximum cooldown rate, and what that rate is based on. The cooldown rate is limited by Tech Spec 3.4.3 to 100 °F/hr and the reason is to prevent cooldown induced stresses from causing a brittle fracture of the reactor vessel. The majority of examinees missing this question chose "C" which has the correct cooldown rate but has the bases for the Framatome cooldown rate guidance in 1102.010 for a normal (non-emergency) cooldown. No change to the key was made. The question is technically correct as written, with no construction problems. We will be performing training needs analysis on this question.

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(RO Final Written Examination Analysis continued)

#59

17/17 total candidates incorrect (100.0%)

Twelve chose "A", and five chose "C". The correct answer is "B".

This question is about an Inadequate Core Cooling (ICC) scenario testing the applicants' knowledge of Core Exit Thermocouples (CETs) during a core damaging event as well as actions to take when CET indications exceed specific thresholds on Figure 4 of 1202.013. The correct answer "B" states, "CETs are failing due to short circuits, trip all running RCPs." Choice "A" contains the correct action (trip all RCPs due to entering Region IV in an ICC event) and the reason "CETs are experiencing thermionic emission." Thermionic emission was chosen as a distracter since the ANO-1 system training manual on incore Self Powered Neutron Detectors (SPNDs) stated thermionic emission affected SPNDs but did not state this affected CETs (both are contained within the same insulating material).

Following exam administration, a discussion with an instructor who is also an Electrical Engineer revealed that thermionic emission will have an effect on thermocouples similar to that of a short. Thermocouples operate on the Seebeck effect. Two dissimilar metals (in this case chromel and alumel), one with a greater affinity for electrons result in a small voltage being generated where the wires are joined (junction). As temperature increases the average energy of the electrons increase resulting in a greater migration to the wire with the greater affinity. This results in a larger voltage at the junction. As the temperature further increases, the electron energies approach the work function energy of the conductor. Thermionic emission occurs when the electrons have sufficient energy to breach the work function and leave the conduction surface. This free movement of electrons neutralizes the potential previously generated at the thermocouple junction resulting in no or little voltage. This lowering of voltage at the hot junction will be indicated as a rapid lowering of the measured temperatures.

We maintain the correct answer "B" is still correct since melting of the CETs will still cause a short and a short will cause a CET to fail low. We are therefore requesting a change to the key to allow both "A" and "B" to be correct. This is in accordance with NUREG-1021, ES-403, D.1.c. We will, of course, revise this question to ensure it is suitable for future use. We will also be performing training needs analysis on this question.

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SRO Final Written Examination Analysis

The threshold for determination of questions to be analyzed was a percentage of 50% incorrect responses.

#76

5/8 total candidates missed (62.5%)

One chose "A" and four chose "D". The correct answer is "B".

This question is challenging. The question concerns a small break LOCA with a loss of subcooling margin (SCM). The question states the break has been isolated and gives conditions for SCM has been restored. The examinee must realize that the Reactor Trip EOP must be transitioned to in order to re-evaluate plant conditions to ensure no other events are in progress. This question is valid as written. No change to the key was made. The question is technically correct as written, with no construction problems. We will be performing training needs analysis on this question.

#84

4/8 total candidates missed (50.0%)

All four chose "A". The correct answer is "D".

This question tests the ability of the examinees to use the Technical Requirements Manual when given indications of a failed smoke detector. The successful examinees realized the smoke detector string would be non-functional and the suppression system which uses the smoke detector string as an initiator for automatic operation would also be non-functional. This question is valid as written. No change to the key was made. The question is technically correct as written, with no construction problems. We will be performing training needs analysis on this question.

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(SRO Final Written Examination Analysis continued)

#90

4/8 total candidates missed (50.0%)

All four chose "D". The correct answer is "B".

This question is based on actions in 1203.037 for abnormal ES bus voltage which is low but not low enough to automatically start the EDGs. The key to this question is the last condition given: no grid disturbances are occurring. If there are no grid disturbances, then the EDG can be started, paralleled with the grid, and then the ES bus separated from the grid with it's load on the EDG. The incorrect choice "D" has the EDG started, the ES bus feeder breaker opened, and then the EDG's output breaker closes to pick up the de-energized bus. This would be the correct action IF the grid was unstable. This question is valid as written. No change to the key was made. The question is technically correct as written, with no construction problems. We will be performing training needs analysis on this question.

#98

4/8 total candidates missed (50.0%)

One chose "C", three chose "D". The correct answer is "B".

This question involves a Site Area Emergency where an Emergency Medical Team must be dispatched to a high dose rate area to rescue a critically injured employee. The question asks what the maximum stay time is for the team members and who can authorize them to extend this time if they volunteer. The emergency dose limits are 10 Rem to save vital equipment and 25 Rem to save a life and the person who can authorize an extension is the Shift Manager. This question is valid as written. No change to the key was made. The question is technically correct as written, with no construction problems. We will be performing training needs analysis on this question.

#99

4/8 total candidates missed (50.0%)

Two chose "A", two chose "B". The correct answer is "D".

This question requires the examinee to recall that an exclusion area evacuation is required for a General Emergency. This question is valid as written. No change to the key was made. The question is technically correct as written, with no construction problems. We will be performing training needs analysis on this question.

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Applicant Examination Review

The applicant examination review produced several comments which are included in the preceding analysis for questions 1, 19, and 59.

Farina, Thomas

From: MARTIN, RANDAL K <----->
Sent: Wednesday, September 07, 2016 3:52 PM
To: Farina, Thomas
Cc: POSSAGE, ROBERT G
Subject: [External_Sender] Fwd: Information Request
Attachments: ASLP-RO-MCD04.pdf; ATT00001.htm

TJ,

See info below.

Randal

Sent from my iPhone

Begin forwarded message:

From: "POSSAGE, ROBERT G" <----->
Date: September 7, 2016 at 4:49:16 PM EDT
Cc: "MARTIN, RANDAL K" <----->
Subject: RE: Information Request

1. CETs are used for calculating SCM.
2. The display on C19 (ICCMDS) gets its temperature from the CETs. The ATOG screen that is often up tracks Th and Tc to look for heat transfer upsets and it is plotted against a saturation curve and an adequate SCM curve. The Plant Data Server (PDS) and SPDS have the ATOG screens but there is no direct readout of SCM on the ATOG screen. There is also a ANO 1 SPDS Safety Function Display that uses CETs to calculate SCM. TI-1150A/B on C04 indicates SCM directly and uses CETs for an input. The Plant Computer is located to the right of the Turbine controls.
3. I can't find a value. Everything I find gives an indicating band like you stated 50 – 2300 F.
4. See attached file

From: Farina, Thomas [-----]
Sent: Wednesday, September 07, 2016 2:14 PM
To: POSSAGE, ROBERT G; CORK, JOHN W; MARTIN, RANDAL K
Cc: Clayton, Kelly
Subject: Information Request

EXTERNAL SENDER. DO NOT click links if sender is unknown. DO NOT provide your user ID or password.

ANO,
Please provide the following additional information to facilitate review of your post-exam comments.

1. For 1202.013 Figure 1, "Saturation and Adequate SCM", what measure of RCS temperature is an operator required to use to determine SCM: CET temp, Tave, Thot, or something else?
2. Similarly, on the large LCD display mounted in the overhead to the left of the CRS desk in the control room, SCM is displayed from the plant computer. What measure of RCS temperature does this parameter use to calculate SCM?

And so that I have all my questions in one place, per previous emails please provide the following:

3. Per design, at what temperature are ANO1's CETs expected to start failing?
4. Please provide the initial license training material that describes CET failure mechanism and behavior in accident conditions.

Thanks,
-TJ

Thomas Farina
Sr. Operations Engineer
USNRC Region IV
Division of Reactor Safety, Operations Branch

Farina, Thomas

From: MARTIN, RANDAL K <----->
Sent: Thursday, September 08, 2016 6:50 AM Farina,
To: Thomas
Cc: POSSAGE, ROBERT G
Subject: [External_Sender] RE: Exam Security Agreement

TJ,

Another aspect of the question #59 that came to mind during this review is the level of knowledge on the thermocouple failure and to what level of detail the operators should know from memory. When the operators were asked about this during the post exam debrief, they recalled the impact of thermionic emission within the incore instrument string which contains the CET thermocouple. Based on that information and the discussion with John Cork who remembers struggling how to meet both parts of the KA statement, that I believe introduced a level of difficulty into #59 that is possibly beyond what is necessary for the licensed operator to recall from memory. The proposal to accept the two answers (A and B) that contain the correct response to part B of the KA is what we are presenting as the more essential piece of the question and that the question does test the level of knowledge for the operator in the control room.

Thank you for the consideration of the three questions we have proposed for changes and let me know if you or the review team needs any additional information.

Randal

ES-401 page 6 of 50

2. Select and Develop Questions

a. Prepare the site-specific written operator licensing examination using a combination of existing, modified, and new questions that match the specific K/A statements in the previously approved examination outline (refer to Section D.1 and ES-201) and the criteria summarized below. Ensure that the questions selected for Tier 3 maintain their focus on plant-wide generic knowledge and abilities and do not become an extension of Tier 2, "Plant Systems."

When selecting or writing questions for K/As that test coupled knowledge or abilities (e.g., the A.2 K/A statements in Tiers 1 and 2 and a number of generic K/A statements, such as 2.4.1, in Tier 3), try to test both aspects of the K/A statement.

If that is not possible without expending an inordinate amount of resources, limit the scope of the question to that aspect of the K/A statement requiring the highest cognitive level (e.g., the (b) portion of the A.2 K/A statements) or substitute another randomly selected K/A.

Any time it becomes necessary to deviate from the previously approved examination outline, discuss the proposed deviations with the NRC's chief examiner and obtain concurrence. Also explain on Form ES-401-4 why the original proposal could not be implemented and why the proposed replacement is considered an acceptable substitute.

ES-401-9

4. Check the appropriate box if a job content error is identified:

- "Job Link": The question is not linked to the job requirements (i.e., the question has a valid K/A but, as written, is not operational in content).
- "Minutia": The question requires the recall of knowledge that is too specific for the closed reference test mode (i.e., it is not required to be known from memory).

From: Farina, Thomas [-----]
Sent: Wednesday, September 07, 2016 4:57 PM
To: POSSAGE, ROBERT G
Cc: MARTIN, RANDAL K
Subject: RE: Exam Security Agreement