UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
1600 E. LAMAR BLVD
ARLINGTON, TX 76011-4511

September 28, 2016

Mr. Rich Anderson, Site Vice President
Arkansas Nuclear One
Entergy Operations, Inc.
1448 SR 333
Russellville, AR 72802-0967

SUBJECT: ARKANSAS NUCLEAR ONE, UNIT 1 - NRC EXAMINATION REPORT 05000313/2016301

Dear Mr. Anderson:

On September 1, 2016, the U.S. Nuclear Regulatory Commission (NRC) completed an initial operator license examination at Arkansas Nuclear One, Unit 1. The enclosed report documents the examination results and licensing decisions. The preliminary examination results were discussed on August 26, 2016, with Mr. D. Perkins, Senior Operations Manager, and other members of your staff. A telephonic exit meeting was conducted on September 16, 2016, with Mr. Perkins, who was provided the NRC licensing decisions.

The examination included the evaluation of nine applicants for reactor operator licenses, four applicants for instant senior reactor operator licenses, and four applicants for upgrade senior reactor operator licenses. The license examiners determined that twelve of the seventeen applicants satisfied the requirements of 10 CFR Part 55, and the appropriate licenses have been issued. There were three post-examination comments submitted by your staff. Enclosure 1 contains details of this report and Enclosure 2 summarizes post-examination comment resolution.

No findings were identified during this examination.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice and Procedure," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA/

Vincent G. Gaddy, Chief
Operations Branch
Division of Reactor Safety

Docket No. 50-313
License No. DPR-51

Enclosures:
1. Examination Report 05000313/2016301
   w/Attachment: Supplemental Information
2. NRC Post-Examination Comment Resolution
3. Simulator Fidelity Report

cc w/encl: Electronic Distribution

system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA/

Vincent G. Gaddy, Chief
Operations Branch
Division of Reactor Safety

Docket No. 50-313
License No. DPR-51

Enclosures:
1. Examination Report 05000313/2016301
   w/Attachment: Supplemental Information
2. NRC Post-Examination Comment Resolution
3. Simulator Fidelity Report

cc w/encl: Electronic Distribution

Distribution:
See next page

ADAMS ACCESSION NUMBER: ML16273A055

☒ SUNSI Review By: TJFarina		ADAMS ☒ Yes ☐ No	☒ Publicly Available ☐ Non-Publicly Available		☒ Non-Sensitive ☐ Sensitive		Keyword: NRC-002
OFFICE	SOE:OB	SOE:OB	OE:OB	OE:OB	OE:OB	OE:OB	C:OB
NAME	TFarina	COsterholtz	MHayes	SHedger	MKennard	CSteely	VGaddy
SIGNATURE	*/RA/*	*/RA/*	*/RA/*	*/RA/*	*/RA/*	*/RA/*	*/RA/*
DATE	9/19/16	9/26/16	9/20/16	9/21/16	9/20/16	9/20/16	9/26/16
OFFICE	C:PBE	C:OB					
NAME	NOKeefe	VGaddy					
SIGNATURE	*/RA/*	*/RA/*					
DATE	9/28/16	9/28/16					

OFFICIAL RECORD COPY

Letter w/enclosures to Rich Anderson from Vincent G. Gaddy, dated September 28, 2016

SUBJECT: ARKANSAS NUCLEAR ONE, UNIT 1 - NRC EXAMINATION REPORT 05000313/2016301

Electronic distribution by RIV:
Regional Administrator (Kriss.Kennedy@nrc.gov)
Deputy Regional Administrator (Scott.Morris@nrc.gov)
DRP Director (Troy.Pruett@nrc.gov)
DRS Director (Anton.Vegel@nrc.gov)
DRS Deputy Director (Jeff.Clark@nrc.gov)
DRP Deputy Director (Ryan.Lantz@nrc.gov)
Senior Resident Inspector (Brian.Tindell@nrc.gov)
Resident Inspector (Margaret.Tobin@nrc.gov)
Resident Inspector (Andy.Barrett@nrc.gov)
Branch Chief, DRP/E (Neil.OKeefe@nrc.gov)
Senior Project Engineer, DRP/E (John.Dixon@nrc.gov)
Project Engineer, DRP/E (Brian.Correll@nrc.gov)
Project Engineer, DRP/E (Jackson.Choate@nrc.gov)
Administrative Assistant (Mary.Bennett@nrc.gov)
Public Affairs Officer (Victor.Dricks@nrc.gov)
Project Manager (Stephen.Koenick@nrc.gov)
Team Leader, DRS/IPAT (Thomas.Hipschman@nrc.gov)
Project Engineer, DRS/IPAT (Eduardo.Uribe@nrc.gov)
ACES (R4Enforcement.Resource@nrc.gov)
RITS Coordinator (Marisa.Herrera@nrc.gov)
Regional Counsel (Karla.Fuller@nrc.gov)
Technical Support Assistant (Loretta.Williams@nrc.gov)
Congressional Affairs Officer (Jenny.Weil@nrc.gov)
RIV Congressional Affairs Officer (Angel.Moreno@nrc.gov)
RIV/ETA: OEDO (Jeremy.Bowen@nrc.gov)
RIV RSLO (Bill.Maier@nrc.gov)

U.S. NUCLEAR REGULATORY COMMISSION

REGION IV

Docket:	05000313
License:	DPR-51
Report:	05000313/2016301
Licensee:	Entergy Operations, Inc.
Facility:	Arkansas Nuclear One, Unit 1
Location:	1448 SR 333 Russellville, AR 72802-0967
Dates:	August 22 through September 16, 2016
Inspectors:	T. Farina, Chief Examiner, Senior Operations Engineer C. Osterholtz, Senior Operations Engineer M. Hayes, Operations Engineer S. Hedger, Operations Engineer M. Kennard, Operations Engineer C. Steely, Operations Engineer
Approved By:	Vincent G. Gaddy Chief, Operations Branch Division of Reactor Safety

SUMMARY

ER 05000313/2016301; 08/22/2016 – 09/16/2016; Arkansas Nuclear One, Unit 1; Initial Operator Licensing Examination Report.

NRC examiners evaluated the competency of nine applicants for reactor operator licenses, four applicants for instant senior reactor operator licenses, and four applicants for upgrade senior reactor operator licenses at Arkansas Nuclear One, Unit 1.

The licensee developed the examinations using NUREG-1021, "Operator Licensing Examination Standards for Power Reactors," Revision 10. The written examination was administered by the licensee on September 1, 2016. NRC examiners administered the operating tests on August 22–27, 2016.

The examiners determined that twelve of the seventeen applicants satisfied the requirements of 10 CFR Part 55, and the appropriate licenses have been issued.

A. <u>NRC-Identified and Self-Revealing Findings</u>

None.

B. <u>Licensee-Identified Violations</u>

None.

REPORT DETAILS

4. OTHER ACTIVITIES (OA)

4OA5 Other Activities (Initial Operator License Examination)

.1 License Applications

a. Scope

NRC examiners reviewed all license applications submitted to ensure each applicant satisfied relevant license eligibility requirements. Examiners also audited three of the license applications in detail to confirm that they accurately reflected the subject applicant's qualifications. This audit focused on the applicant's experience and on-the-job training, including control manipulations that provided significant reactivity changes.

b. Findings

No findings were identified.

.2 Examination Development

a. Scope

NRC examiners reviewed integrated examination outlines and draft examinations submitted by the licensee against the requirements of NUREG-1021. The NRC examination team conducted an on-site validation of the operating tests.

b. Findings

NRC examiners provided outline, draft examination, and post-validation comments to the licensee. The licensee satisfactorily completed comment resolution prior to examination administration.

NRC examiners determined the written examinations and operating tests initially submitted by the licensee were within the range of acceptability expected for a proposed examination.

.3 Operator Knowledge and Performance

a. Scope

On September 1, 2016, the licensee proctored the administration of the written examinations to all 17 applicants. The licensee staff graded the written examinations, analyzed the results, and presented their analysis and post-examination comments to the NRC on September 6, 2016.

The NRC examination team administered the various portions of the operating tests to all applicants on August 22–27, 2016.

b. Findings

No findings were identified.

Twelve of 17 applicants passed the written examination and all parts of the operating test. Four applicants failed the written examination only, and one applicant failed both the written examination and administrative job performance measures (JPMs). The final written examinations and post-examination analysis and comments may be accessed in the ADAMS system under the accession numbers noted in the attachment.

The examination team noted six generic weaknesses associated with applicant performance on the administrative JPM, simulator JPM, in-plant JPM, and dynamic scenario sections of the operating tests. Specifically:

1. Three applicants demonstrated a weakness in lowering the pressurizer quench tank down to a specific level by transferring water to the clean waste receiving tank. The applicants all secured the associated transfer pump at the desired level; however, they delayed isolating the two quench tank drain valves, causing quench tank level to continue lowering to the low level alarm setpoint due to a difference in elevations between the two tanks and a 4.7 psig Nitrogen over-pressure in the quench tank.

2. Seven applicants demonstrated a weakness implementing the station's work hour fitness-for-duty guidance. Given a work history of five operators, many applicants incorrectly stated that one of the operators failed to satisfy the requirement to have a minimum 34-hour break in a 9-day period and was, therefore, ineligible to stand an emergent watch. In actuality, the applicant had one full day off in between two day-shift watches, which equated to at least a 35-hour break, satisfying the 34-hour requirement.

3. When purging the main generator with CO2 following a station blackout, several operators failed to use the designated rack of 15 CO2 bottles, which is labeled "Reserved for Unit 1 EOP [Emergency Operating Procedure] Requirements," and instead used an identical rack of 15 CO2 bottles which is intended for normal daily use, not EOPs. Procedure 1106.002, Section 15.0, Generator Hydrogen System, fails to specify which bank should be used, constituting a missed opportunity to prevent operator error.

4. Three out of four crews unnecessarily tripped the reactor on a continuous rod withdrawal malfunction, which could have been mitigated by proper implementation of Alarm Response Procedure ACA 1203.003, Section 9, Control Rod Drive Malfunction Actions. Two of the crews failed to properly implement the "MAJI" sequence of operator actions, which directs the crew to verify the diamond panel in MANUAL, set the GROUP-AUXIL switch to AUXIL, set SPEED SELECTOR switch to JOG, and place manual command switch in

INSERT for three seconds. These two crews failed to stop rod motion, and manually tripped the reactor. One crew properly stopped all rod motion, but misinterpreted plant indications to mean that rod motion was continuing and tripped the reactor as well.

5. Several crews demonstrated a weak understanding of generator hydrogen temperature control valve CV-4018 controller operation. This controller is reverse acting, meaning that it generates a 0 percent signal to open the valve and a 100 percent signal to fully close the valve. Some believed that a 100 percent signal indicated open, and several applicants misunderstood this controller to indicate actual position, when it only indicates demanded position. Actual valve position can only be verified locally. One crew tripped the turbine instead of taking manual control of the controller, which would have mitigated the malfunction.

6. Three crews demonstrated weaknesses implementing the steam generator tube rupture procedure. Errors included tripping the reactor out of sequence, initiating emergency feedwater instead of auxiliary feedwater, unnecessary delays establishing a plant cooldown, and a failure to control steam header pressure to prevent unnecessary cycling of the bad steam generator atmospheric dump valve.

Copies of all individual examination reports were sent to the facility training manager for evaluation and determination of appropriate remedial training.

.4 Simulation Facility Performance

a. Scope

The NRC examiners observed simulator performance with regard to plant fidelity during examination validation and administration.

b. Findings

No findings were identified. However, two simulator-related issues occurred during examination administration that warrant discussion.

1. The simulator control software includes an administrative trainee action monitor program which logs simulator switch manipulations during the course of a scenario. During nine scenarios, this log was flooded due to noisy analog inputs on control boards C03/C04, causing it to exceed its capacity. The trainee action monitor log can accommodate a maximum of 1,000 entries in a scenario, but the noisy analog inputs caused multiple log entries per second which filled the log to capacity prior to scenario completion. This program had no impact on simulator performance or fidelity, but it resulted in an incomplete record of applicant actions for the scenarios which were affected. The licensee initiated simulator deficiency report DR16-0120 to address the issue.

2. During one administration of JPM S-6, “Transfer Buses from the Unit Aux Transformer to a Startup Transformer,” an applicant was required to open breaker H-14 on 6900V bus H1 to correct a condition where the bus was aligned to two power sources simultaneously. The applicant correctly identified that breaker H-14 failed to open automatically after the H-15 Synchronize switch was taken to off, and attempted to manually open breaker H-14 twice. Both attempts appeared to be a full turn of the handswitch, but the breaker remained closed on the control board. Therefore the applicant correctly implemented step 8.4.6.A.1 of Procedure OP-1107.001, and manually reopened breaker H-15 from the startup transformer #1 to ensure that bus H1 remained energized from only one source.

   Post-scenario, the examiner reviewed available simulator data with the licensee to determine what actions were captured by the machine. The trainee action monitor log records all manipulations which are performed on the simulator. The trainee action monitor log clearly showed that component C10 152-14/CS (breaker H-14 control switch) was taken to Trip multiple times and returned to normal. The simulator did not pick up this action, however, and continued to display the breaker as closed. The licensee believes that the issue may be related to a difference in scan operating speeds between the simulator operating system (10 Hz) and the simulator subroutine that controls large breaker logic (2 Hz). The licensee initiated simulator deficiency reports DR16-0122 and DR16-0123 to address the issue.

.5 Examination Security

a. Scope

The NRC examiners reviewed examination security for examination development during both the on-site preparation week and examination administration week for compliance with 10 CFR 55.49 and NUREG-1021. Plans for simulator security and applicant control were reviewed and discussed with licensee personnel.

b. Findings

No findings were identified.

4OA6 Meetings, Including Exit

Exit Meeting Summary

The chief examiner presented the preliminary examination results to Mr. D. Perkins, Senior Operations Manager, and other members of the staff on August 26, 2016. A telephonic exit was conducted on September 16, 2016, between Mr. T. Farina, Chief Examiner, and Mr. Perkins.

The licensee did not identify any information or materials used during the examination as proprietary.

ATTACHMENT: SUPPLEMENTAL INFORMATION

<u>**SUPPLEMENTAL INFORMATION**</u>

KEY POINTS OF CONTACT

<u>Licensee Personnel</u>

R. Martin, Operations Training Superintendent
B. Possage, Examination Writer
J. Cork, Examination Writer

<u>NRC Personnel</u>

B. Tindell, Senior Resident Inspector

ADAMS DOCUMENTS REFERENCED

Accession No. ML16259A363 - FINAL WRITTEN EXAMS
Accession No. ML16259A379 - FINAL OPERATING TEST
Accession No. ML16259A348 – POST-EXAMINATION ANALYSIS-COMMENTS

Note: The final written examination and operating test are withheld from public release until September 1, 2018.

NRC Resolution to the Arkansas Nuclear One Unit 1 Post-Examination Comments

A complete text of the licensee's post-examination analysis and comments can be found in ADAMS under Accession Number ML16259A348.

RO QUESTION # 1

- ESAS actuated on low RCS pressure.
- RCS Tave 560 °F and stable
- Pressurizer level 320" and stable
- RCS pressure 1350 psig and rising rapidly
- RB sump level 55% and rising
- Fuel failure of 1 % is indicated

Considering the above conditions, which of the following methods, and reason behind the method, will be used to mitigate the RCS pressure transient in accordance with RT-14?

A. Cycle ERV as required, this prevents challenges to the PZR safeties.
B. Raise PZR spray flow, this condenses steam in PZR vapor space.
C. Throttle HPI flow, this reduces input of mass into RCS to match RCS leakage.
D. Raise letdown flow, this lowers RCS mass and thus reduces pressure.

Answer: A.

LICENSEE COMMENT: 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 debrief 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.

NRC RESOLUTION: The NRC has determined to delete this question from the exam. This question has missing information in the stem that is needed to answer the question. The conditions given in the stem are representative of a steam space leak (TMI event). EOP Repetitive Task 14 (RT-14), "Control RCS Pressure", is used to combat these conditions. The stem indicates reactor coolant system pressure rapidly increasing as the pressurizer goes solid, with some fuel failure, implying a bubble in the vessel - also consistent with TMI events. Break flow is assumed to be the method of cooling the core under the given conditions.

Step 3.B of procedure RT-14 directs that High Pressure Injection (HPI) may be throttled once subcooling margin (SCM) is restored (this is the licensee's requested additional correct answer, "C"). The EOP basis document for this step, GEOG Bases Section V.B, RCS Pressure Control, Step 3.3 specifies that use of this guidance also requires adherence to GEOG Bases Section VI Rule 2.0, "HPI Throttling/Termination Rule". This Rule states that "HPI flow may not be throttled unless SCM exists," and further notes that "HPI may not be throttled, even with SCM, if HPI cooling is in progress until core exit thermocouple temperatures are decreasing, except to prevent violating the RV P-T limit." Therefore, it is necessary to know both the status of SCM and CET temperature trend in order to make the determination to throttle HPI flow. However, only Tave is given in the stem; without CET temperature or its trend given, the applicant cannot make this determination. Tave would not accurately track CET temperature with a bubble in the vessel, RCPs secured, and fuel damage. Further, per the licensee, the determination of SCM using EOP 1202.013 Figure 1, "Saturation and Adequate SCM", requires the use of CET temperature on the RCS Pressure – Temperature plot, not Tave. For these reasons, inadequate information is given in the stem to determine any correct answer, and the question is therefore deleted from the exam.

RO QUESTION # 19

A dropped rod event has occurred (one CRA in Group 7) and the following conditions exist:
- Reactor power = 30% and decreasing.
- Turbine output = 320 MWe and decreasing.
- Annunciator (K07-C3) HIGH LOAD LIMIT is in fast flash.
- Turbine runback is in progress.

What operator action is procedurally required?

A. Allow the runback to terminate normally.
B. Take manual control of the turbine and raise load.
C. Take manual control of SG/RX master.
D. Trip the reactor.

Answer: C.

LICENSEE COMMENT: 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.

NRC RESOLUTION: The licensee requests to accept two correct answers, one where the reactor is tripped (Distracter 'D') and one where it is not tripped by taking manual control of the condition and stabilizing the plant (correct answer 'C'). These are opposing choices, and if both were true then the question would be required to be deleted based on NUREG-1021 guidance for directly opposing selections (Section D.1.c). This is not necessary for question 19 however, because the stem clearly states that the annunciator K07-C3 "HIGH LOAD LIMIT" is alarming. In the case of a dropped rod with a failure of turbine runback to terminate at 40% reactor power, explicit procedural direction exists in annunciator response procedure 1203.012F, K07-C3, "HI LOAD LIMIT IN EFFECT," to mitigate the malfunction without a reactor trip. Specifically, if the high load limit is caused by an ICS failure or ICS input signal failure, the operator is required to take manual control of the affected ICS station (in this case, SG/RX Master):

1. Verify Integrated Control System (ICS) is in track and running back to the maximum load limit setpoint.
2. If high load limit is clearly caused by an ICS failure … then take manual control of the affected ICS station and return the plant to steady state condition.

The licensee states that per the entry conditions of 1202.001, Reactor Trip, a manual reactor trip is required for "a system degradation that requires manual reactor trip based on operator judgment." Recognizing that unplanned reactor trips have a direct impact on core damage frequency (CDF, SECY-99-007), the NRC maintains the "Unplanned Scrams per 7000 critical hours" performance indicator to monitor plant performance in this area. A subjective operator decision to trip the reactor without first attempting to take manual control of the SG/RX Master ICS station would therefore not be a conservative decision, would unnecessarily introduce additional transient risk, and would be contrary to the specific required procedural guidance of 1203.012F, K07-3 for a condition well within the capability of the operator to recognize and correct. Therefore, the NRC has determined to retain question 19 with no changes.

RO QUESTION # 59

Given:
- An overheating event has been in progress.
- 1202.005, Inadequate Core Cooling, is in use.
- Core Exit Thermocouples= 1460 degrees F (average) and rising.
- RCS pressure = 2350 psig
- All actions have been performed for the current Region.

Critical parameters have been updated by the ATC:
- Core Exit Thermocouples= 1520 degrees F (average) and rising.
- RCS pressure = 2400 psig

CBOT reports multiple CETs are alarming on the plant computer with the status "INVALID" or "FAIL_LO".

What is occurring and what procedural action is required for the above conditions?

A. CETs are experiencing thermionic emission, trip all running RCPs.
B. CETS are failing due to short circuits, trip all running RCPs.
C. CETs are experiencing thermionic emission, use ADVs to reduce SG T-sat to ~100°F below current value.
D. CETS are failing due to short circuits, use ADVs to reduce SG T-sat to ~100°F below current value.

Answer: B.

LICENSEE COMMENT: 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.

[Follow-on Comment]:

Another aspect of the question #59 … 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 [the exam writer] … 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. [Part B is the ability to use procedures to correct, control or mitigate the consequences of core damage on the in-core temperature monitoring system]

NRC RESOLUTION: The licensee’s proposed basis for accepting “A” as an additional correct answer relies on the opinion of an ANO training department instructor, but does not include any formal technical background documentation to support this basis. The licensee could not provide any design documentation or formal technical analysis to demonstrate that the ANO-1 CETs would experience thermionic emission under accident conditions, and ANO training materials do not discuss this as a failure mode of the CETs. The NRC independently reviewed ANO training materials, as well as NUREG/CR-3386, “DETECTION OF INADEQUATE CORE COOLING WITH CORE EXIT THERMOCOUPLES: LOFT PWR EXPERIENCE,” published in November of 1983. This study doesn’t mention thermionic emission as a failure mechanism of CETs during accident conditions. Lacking supporting evidence, there is no basis to consider thermionic emission a known major contributor to the failure mechanism of the CETs, and therefore insufficient justification for accepting “A” as an additional correct answer on technical grounds.

The licensee secondarily proposed that only part 2 of the question (procedural action required for entering Region 4 of Inadequate Core Cooling: the cause of CET damage) is expected operator knowledge, and proposed accepting both “A” and “B” as correct answers based on the second part of the question alone. This justification, if accepted, would more appropriately result in a deletion of the question from the examination because it would constitute only a 2-choice question. However, both parts of the question as-written test to the K/A directly, specifically the effect of core damage conditions on in-core temperature monitoring systems, differentiating between the failure modes of two different ANO-1 in-core instruments: CETs vs. SPNDs. In addition to the selected K/A, “Failure modes of thermocouples” is required operator knowledge listed in the Component section of the K/A catalog, NUREG-1122, Revision 2, page 5-3, K/A K1.14. This K/A has an RO importance rating of 2.8, implying its acceptability for examination inclusion when combined with ANO-specific operational material, which the second part satisfies. While every applicant incorrectly chose the SPND failure mode instead of the CET failure mode, this is an indication of a highly plausible distractor rather than a non-applicable knowledge check. For the above reasons, the NRC has determined to retain question 59 with no changes.

Simulator Fidelity Report

Facility Licensee: Arkansas Nuclear One, Unit 1

Facility Docket No.: 50-313

Operating Tests Administered on: August 22 to 27, 2016

This form is to be used only to report observations. These observations do not constitute audit or inspection findings and, without further verification and review in accordance with IP 71111.11, are not indicative of noncompliance with 10 CFR 55.46. No licensee action is required in response to these observations.

While conducting the simulator portion of the operating tests, examiners observed the following items:

Item	**Description**
Trainee Action Monitor Log Over-Capacity due to Noisy Inputs.	The simulator control software includes an administrative trainee action monitor (TAM) program which logs simulator switch manipulations during the course of a scenario. During nine scenarios, this log was flooded due to noisy analog inputs on control boards C03/C04, causing it to exceed its capacity. The TAM log can accommodate a maximum of 1000 entries in a scenario, but the noisy analog inputs caused multiple log entries per second which filled the log to capacity prior to scenario completion. This program had no impact on simulator performance or fidelity, but it resulted in an incomplete record of applicant actions for the scenarios which were affected. The licensee initiated simulator deficiency report DR16-0120 to address the issue.
Simulator Failed to Recognize Breaker Manipulation.	During one administration of JPM S-6, "Transfer Buses from the Unit Aux Transformer to a Startup Transformer," an applicant was required to open breaker H-14 on 6900V bus H1 to correct a condition where the bus was aligned to two power sources simultaneously. The applicant correctly identified that breaker H-14 failed to open automatically after the H-15 Synchronize switch was taken to off, and attempted to manually open breaker H-14 twice. Both attempts appeared to be a full turn of the handswitch, but the breaker remained closed on the control board. Therefore the applicant correctly implemented step 8.4.6.A.1 of procedure OP-1107.001, and manually reopened breaker H-15 from the Startup Transformer #1 to ensure that bus H1 remained energized from only one source. Post-scenario, the examiner reviewed available simulator data with the licensee to determine what actions were captured by the machine. The Trainee Action Monitor (TAM) log records all manipulations which are performed on the simulator. The TAM log clearly showed that component C10 152-14/CS (breaker H-14 control switch) was taken to Trip multiple times, and returned to normal. The simulator did not pick up this action

	however, and continued to display the breaker as closed. The licensee believes that the issue may be related to a difference in scan operating speeds between the simulator operating system (10 Hz) and the simulator subroutine that controls large breaker logic (2 Hz). The licensee initiated simulator deficiency reports DR16-0122 and DR16-0123 to address the issue.