



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION III  
2443 WARRENVILLE ROAD, SUITE 210  
LISLE, ILLINOIS 60532-4352

December 17, 2021

Mr. David Rhoades  
Senior VP, Exelon Generation Company, LLC  
President and CNO, Exelon Nuclear  
4300 Winfield Road  
Warrenville, IL 60555

SUBJECT: BYRON STATION, UNITS 1 AND 2—NRC INITIAL LICENSE EXAMINATION  
REPORT 05000454/2021301; 05000455/2021301

Dear Mr. Rhoades:

On October 28, 2021, the U.S. Nuclear Regulatory Commission (NRC) completed the initial operator licensing examination process for license applicants employed at your Byron Station, Units 1 and 2. The enclosed report documents the results of those examinations. Preliminary observations noted during the examination process were discussed on October 8, 2021, with Mr. Harris Welt, Plant Manager, and other members of your staff. An exit meeting was conducted by telephone on November 8, 2021, with Mr. John Kowalski, Site Vice President, other members of your staff, and Mr. Gregory Roach, Chief Operator Licensing Examiner, to review the final grading of the written examination for the license applicants. During the telephone conversation, NRC resolutions of the plant's post-examination comments, received by the NRC on October 28, 2021, were discussed.

The NRC examiners administered an initial license examination operating test during the weeks of September 27, 2021, and October 4, 2021. The written examination was administered by training department personnel on October 13, 2021. Six senior reactor operator and seven reactor operator applicants were administered license examinations. The results of the examinations were finalized on November 15, 2021. Twelve applicants passed all sections of their respective examinations. Five applicants were issued senior operator licenses and six applicants were issued operator licenses. One senior operator will receive his senior operator license when he has completed all experience requirements for which he was previously granted a deferral.

The administered written examination and operating test, as well as documents related to the development and review (outlines, review comments and resolution, etc.) of the examination will be withheld from public disclosure until October 28, 2023. However, since one applicant received a proposed license denial letter because of a written examination grade that was less than 80.0 percent, the applicant was provided a copy of the administered written examination. For examination security purposes, your staff should consider that written examination uncontrolled and exposed to the public.

This letter, its enclosure, and your response (if any) will be made available for public inspection and copying at <http://www.nrc.gov/reading-rm/adams.html> and at the NRC Public Document Room in accordance with Title 10 of the *Code of Federal Regulations*, Part 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,



Signed by Pelke, Patricia  
on 12/17/21

Patricia J. Pelke, Chief  
Operations Branch  
Division of Reactor Safety

Docket Nos. 50-454; 50-455  
License Nos. NPF-37; NPF-66

Enclosures:

1. OL Examination  
Report 05000454/2021301;  
05000455/2021301
2. Post-Examination Comments,  
Evaluation, and Resolutions
3. Simulator Fidelity Report

cc: Distribution via LISTSERV®  
B. Lewin, Senior Manager  
Site Training

Letter to D. Rhoades from Patricia J. Pelke dated December 17, 2021.

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U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket No: 50-454; 50-455

License No: NPF-37; NPF-66

Report No: 05000454/2021301; 05000455/2021301

Enterprise Identifier: L-2021-OLL-0025

Licensee: Exelon Generation Company, LLC

Facility: Byron Station, Units 1 and 2

Location: Byron, IL

Dates: September 27, 2021, through October 28, 2021

Examiners: G. Roach, Senior Operations Engineer, Chief Examiner  
L. Nist, Senior Reactor Operations Engineer, Examiner  
B. Tindell, Reactor Engineer, Examiner  
L. Rodriguez, Operations Engineer, Examiner

Approved by: P. Pelke, Chief  
Operations Branch  
Division of Reactor Safety

## **SUMMARY**

Examination Report 05000454/2021301; 05000455/2021301; 9/27/2021–10/28/2021; Exelon Generation Company, LLC; Byron Station; Units 1 and 2; Initial License Examination Report.

The announced initial operator licensing examination was conducted by regional Nuclear Regulatory Commission examiners in accordance with the guidance of NUREG-1021, "Operator Licensing Examination Standards for Power Reactors," Revision 11.

### Examination Summary

Twelve of thirteen applicants passed all sections of their respective examinations. Five applicants were issued senior operator licenses and six applicants were issued operator licenses. One senior operator will receive his senior operator license when he has completed all experience requirements for which he was previously granted a deferral. (Section 40A5.1)

## REPORT DETAILS

### 40A5 Other Activities

#### .1 Initial Licensing Examinations

##### a. Examination Scope

The U.S. Nuclear Regulatory Commission (NRC) examiners and members of the facility licensee's staff used the guidance prescribed in NUREG-1021, "Operator Licensing Examination Standards for Power Reactors," Revision 11, to develop, validate, administer, and grade the written examination and operating test. The written examination outlines and operating test outlines were prepared by the NRC staff. The facility licensee developed the written examination and the operating test. The NRC staff validated the proposed examination during the week of August 30, 2021, with assistance from members of the facility licensee's staff. During the onsite validation week, the examiners audited four license applications for accuracy. The NRC examiners, with the assistance of members of the facility licensee's staff, administered the operating test, consisting of job performance measures and dynamic simulator scenarios, during the period of September 27, 2021, through October 6, 2021. The facility licensee administered the written examination on October 13, 2021.

##### b. Findings

###### (1) Written Examination

The NRC staff determined that the written examination, developed by the facility licensee from the NRC prepared outlines, was within the range of acceptability expected for a proposed examination. Form ES-401-9, "Written Examination Review Worksheet," the written examination outlines (ES-401-2 and ES-401-3), and both the proposed and final written examinations will be available electronically in the NRC Public Document Room or from the Publicly Available Records component of NRC's Agencywide Documents Access and Management System (ADAMS) on October 28, 2023 (ADAMS Accession Numbers ML21055A847, ML21055A846, ML21055A845, and ML21055A851, respectively).

On October 28, 2021, the licensee submitted documentation noting that there were two post-examination comments for consideration by the NRC staff when grading the written examination. The post-examination comments are documented in Enclosure 2 of this report.

The NRC staff completed grading of the written examination on November 8, 2021, and conducted a review of each missed question to determine the accuracy and validity of the examination questions.

###### (2) Operating Test

The NRC examiners determined that the operating test, developed by the licensee from the facility prepared outlines, was within the range of acceptability expected for a proposed examination.

During validation of the operating test the week of August 30, 2021, a moderate number of issues were identified for three simulator scenarios. After the validation, modifications were made to ensure critical tasks were appropriate for the scenarios, the scenarios could be performed within a reasonable amount of time, and the applicable technical specifications were identified. Also, modifications were made to two JPMs to ensure critical steps were correctly identified and that the JPMs could be performed as expected within a reasonable amount of time. Minor modifications were made to several other job performance measures, and minor modifications were made to all of the dynamic simulator scenarios. All changes made to the operating test were made in accordance with NUREG-1021, "Operator Licensing Examination Standards for Power Reactors," and were documented on Form ES-301-7, "Operating Test Review Worksheet." The Form ES-301-7, the operating test outlines (ES-301-1, ES-301-2, and ES-D-1s), and both the proposed and final operating tests, will be available electronically in the NRC Public Document Room or from the Publicly Available Records component of NRC's ADAMS on October 28, 2023 (ADAMS Accession Numbers ML21055A847, ML21055A846, ML21055A845, and ML21055A851, respectively).

The NRC examiners completed grading of the operating test on November 8, 2021.

(3) Examination Results

Six applicants at the Senior Reactor Operator level and seven applicants at the Reactor Operator level were administered written examinations and operating tests.

Twelve applicants passed all portions of their examinations. Eleven applicants were issued their respective operating licenses on November 15, 2021. One applicant received a deferral for eligibility prior to exam administration and will be issued his Senior Reactor Operator license when all eligibility requirements have been completed.

.2 Examination Security

a. Scope

The NRC examiners reviewed and observed the licensee's implementation of examination security requirements during the examination validation and administration to assure compliance with Title 10 of the *Code of Federal Regulations*, Part 55.49, "Integrity of Examinations and Tests." The examiners used the guidelines provided in NUREG-1021, "Operator Licensing Examination Standards for Power Reactors," to determine acceptability of the licensee's examination security activities.

b. Findings

None.

4OA6 Management Meetings

.1 Debrief

The chief examiner presented the examination team's preliminary observations and findings on October 8, 2021, to Mr. Harris Welt, Plant Manager, and other members of the Byron Station staff.

.2 Exit Meeting

The chief examiner conducted an exit meeting on November 8, 2021, with Mr. John Kowalski, Site Vice President, and other members of the Byron Station staff, by MS Teams. The chief examiner asked the facility licensee to confirm that all proprietary information had been returned. The facility licensee confirmed that all proprietary information had been returned.

ATTACHMENT: SUPPLEMENTAL INFORMATION



## **SUPPLEMENTAL INFORMATION**

### **KEY POINTS OF CONTACT**

#### Licensee

John Kowalski, Site Vice President  
Harris Welt, Plant Manager  
Chris Cote, Director Site Operations  
Brian Gapinski, Shift Operations Superintendent  
Keri Benning, Senior Manager Operations Services  
Andrew Kolste, Director Organizational Performance and Regulatory Assurance  
Bill Hines, Manager Operations Training  
Brian Lewin, Senior Manager Site Training  
Barry Mingus, Exam Author Team member  
Ben Reyes, Exam Author Team member  
Peter Leonhardt, Exam Site Representative  
Mike Justice, Director Site Maintenance  
Scott Leach, Manager Radiation Protection Operations

#### U.S. Nuclear Regulatory Commission

D. Betancourt, Senior Resident Inspector  
C. Hunt, Resident Inspector  
G. Roach, Senior Operations Engineer, Chief Examiner

### **ITEMS OPENED, CLOSED, AND DISCUSSED**

#### Opened, Closed, and Discussed

None

### **LIST OF ACRONYMS USED**

ADAMS	Agencywide Documents Access and Management System
NRC	U.S. Nuclear Regulatory Commission

## POST-EXAMINATION COMMENTS, EVALUATION, AND RESOLUTIONS

### NRC Resolution to the Byron Station Post-Examination Comments

#### RO Question 12

- Unit 1 experienced a reactor trip from full power.
- One minute later, a loss of offsite power occurred.

Currently (90 minutes after the loss of offsite power):

- The crew is implementing 1BEP ES-0.2, NATURAL CIRCULATION COOLDOWN.
- RCS pressure is 885 PSIG.
- ALL SG pressures are 763 PSIG.
- CETCs indicate 532°F.
- RCS cold leg temperatures indicate 515.5°F.

SATURATED conditions are indicated in the 1.  
In response, operators will 2.

- A.     1. reactor vessel plenum  
          2. actuate safety injection
  
- B.     1. SG tubes  
          2. limit the RCS cooldown rate to 11°F/hour
  
- C.     1. reactor vessel plenum  
          2. limit the RCS cooldown rate to 11°F/hour
  
- D.     1. SG tubes  
          2. actuate safety injection

Answer:               A  

#### **References provided to NRC:**

- Steam Tables
- 1BEP ES-0.2, "Natural Circulation Cooldown Unit 1," Rev. 302

#### **Applicant Comment:**

This question asks the examinee to distinguish between saturation conditions in the reactor vessel plenum and the SG tubes based on provided CETC temperature, RCS cold leg temperature, RCS pressure, and SG pressure indications with the reactor in natural circulation following a reactor trip. However, the indications provided can be interpreted in such a way that suggests saturation conditions in both the reactor vessel plenum and the SG tubes.

Assuming that heat loss as water travels from the reactor vessel plenum to the steam generator is negligible, the temperature of water leaving the RCS plenum is the same temperature as the water entering the steam generator tubes. With the assumption that the RCS pressure is homogenous throughout the RCS system, the pressure in the plenum and the pressure at

## POST-EXAMINATION COMMENTS, EVALUATION, AND RESOLUTIONS

the SG inlet is the same. By this logic, the water within the plenum and the water entering the Steam Generator will have the same saturation state. As the question does not specify where in the steam generator tubes saturation may be occurring, there is no discrimination to answer the question whether the reactor vessel plenum or steam generator tubes are at saturation.

With no discriminator in the stem of the question asking where in the steam generator tubes saturation may be occurring and the plenum temperature being inexact with regards to saturation pressure of the RCS, the question is open for interpretation and math rounding inaccuracies. This ambiguity allows for both, either, or no answer being correct, and as such should be deleted from the examination.

### **Facility Position on Applicant Comment:**

The licensee does not agree with the applicants' comment. The applicant may be correct in assuming that the temperature of the cold leg is the same as the temperature of the water exiting the steam generator and the temperature of the hot leg, as indicated by the CETCs, is the same as the water entering the steam generator and therefore it is possible that the tubes may be at saturation. However, the core of the question is asking whether the plenum was at saturation and, per 1BEP ES-0.2, what is proper course of action. Per the procedure Operator Action Summary Page, the proper course of action if the plenum is not adequately subcooled, at saturation, would be to actuate a Safety Injection. The question is still technically correct and provides adequate information to make the correct determination to support the identified correct answer.

### **NRC Evaluation/Resolution:**

Based on the information provided in the question stem that core exit thermocouples (CETCs) are 532°F, and RCS pressure is 885 PSIG (i.e., 900 PSIA), the Steam Tables indicate saturated conditions exist in the reactor vessel plenum. The cold leg (i.e., RCS water leaving the steam generator tubes) is at 515.5°F, which the Steam Tables indicate is subcooled for the given RCS pressure. Additional information provided by the facility licensee indicates it is possible that saturated conditions may also exist at some point in the steam generator tubes (i.e., where the RCS water enters the steam generator tubes), assuming there is no heat lost as water exits the core and transits to the inlet of the steam generator tubes. Therefore, the NRC staff concludes it is possible for saturated conditions to potentially exist at the inlet of the steam generator tubes, and that as the RCS water flows through the tubes and heat is removed from it, it reaches subcooled conditions. Therefore, the NRC staff concludes that it would be reasonable for an applicant to conclude that saturated conditions exist at some point in the steam generator tubes and in the reactor vessel plenum.

The stem also states that “[t]he crew is implementing 1BEP ES-0.2, NATURAL CIRCULATION COOLDOWN,” and in 1BEP ES-0.2, “Operator Action Summary” Page, there is direction to actuate Safety Injection (SI) if RCS subcooling is not acceptable per ICONIC Display or Attachment A. Attachment A determines RCS subcooling by using RCS wide range pressure, the temperature associated with the pressure per the appropriate figure in the procedure, and the average of the ten highest CETCs. The ICONIC Display uses CETCs, pressure indications, and containment radiation levels to determine subcooling. CETCs measure fluid temperature of the reactor vessel plenum, and therefore, CETCs at 532°F indicates plenum saturation. Indication of saturated conditions in the SG tubes is not an input that is used to determine whether the crew must actuate SI. Therefore, the NRC staff concludes that Answer Option D is not correct.

## POST-EXAMINATION COMMENTS, EVALUATION, AND RESOLUTIONS

There is direction in 1BEP ES-0.2, Step 7.c Response Not Obtained (RNO) to limit the cooldown rate in the RCS cold legs to 11°F per hour if hot leg temperature in any inactive RCS loop(s) is not lowering at the same rate as active loops (the note on Page 7 of 35 states, “[a]n inactive loop exists if either the capability to feed the respective SG or the capability to release steam from the respective SG is lost”). There is no direction in this procedure to “limit the RCS cooldown rate to 11°F/hour” based on indication of saturated conditions in either the SG tubes or the reactor vessel plenum. Therefore, the NRC staff concludes that Answer Options “B” and “C” cannot be correct because it is not correct to limit the RCS cooldown rate to 11°F/hour in response to saturated conditions in either the reactor vessel plenum or the SG tubes.

Therefore, the NRC staff concludes that Answer Option A is the only correct answer, and no changes to the answer key are required.

## POST-EXAMINATION COMMENTS, EVALUATION, AND RESOLUTIONS

### RO Question 68

Unit 1 is at 100% power, normally aligned.

- The RO is performing channel checks for the Shiftly and Daily Operating Surveillance.
- Currently, the RO is evaluating a multiple channel parameter with a meter scale of 0-200 psig.

What is the MAXIMUM allowed channel deviation (lowest to highest channel) for a generally acceptable channel check?

- A. 6 psig
- B. 12 psig
- C. 18 psig
- D. 25 psig

Answer:     B    

#### **References provided to NRC:**

- 1BOSR 0.1-1,2,3, "Unit One Mode 1, 2 & 3 Shiftly and Daily Operating Surveillance," Revision 75
- 0BOSR 0.1-0, "Unit Common All Modes/All Times Shiftly and Daily Operating Surveillance," Revision 72

#### **Applicant Comment:**

The stem of the question states that the RO is performing channel checks for the Shiftly and Daily Operating Surveillance. As there is no surveillance specified, this means the RO is performing channel checks per 1 BOSR 0.1-1,2,3 (Unit 1 Mode One, Two and Three Shiftly and Daily Operating Surveillance) 2BOSR 0.1-1,2,3 (Unit 2 Mode One, Two and Three Shiftly and Daily Operating Surveillance), or 0BOSR 0.1-0 (Unit Common All Modes/All Times Shiftly and Daily Operating Surveillance).

In accordance with 1/2BOSR 0.1-1,2,3 Limitation and Actions E.8.a, an "acceptable Channel Check is typically +/- 3% (unless otherwise stated) from the average of the readings. In other words, 6% deviation from high to low is generally acceptable to satisfy the Channel Check". In accordance with 0BOSR 0.1-0 Limitation and Action E.2.d, "Tolerances for any channel check performed should use the analog indicator for 3% deviation of scale limitation".

The definition in Technical Specifications of Channel Check does not delineate a quantitative scale in which to compare but rather specifically states, "a channel check shall be the qualitative assessment, by observation, of channel behavior during operation".

As both 1/2BOSR 0.1-1,2,3 and 0BOSR 0.1-0 are Shiftly and Daily Operating Surveillances, both channel check criteria would be acceptable answers when no specific discriminator in the stem of the question exists. By this logic, answer "A" of 6 psig is correct based on the criteria of 0BOSR 0.1-0 where 3% of a 0 to 200 psig scale is 6 psig. This also makes answer "B" of 12 psig correct based on the criteria of 1/2BOSR 0.1-1,2,3 where +/-3% of a 0 to 200 psig scale is 12 psig. Based on this logic and interpretation, this makes both answers "A" and "B" correct where neither answer nullifies the other correct answer, nor does the logic or criteria utilized to determine these answers make the distractors "C" nor "D" correct.

## POST-EXAMINATION COMMENTS, EVALUATION, AND RESOLUTIONS

### Facility Position on Applicant Comment:

The licensee agrees with the applicants' comments. The 0BOSR 0.1 and 1BOSR 0.1-1,2,3 specify different parameters for acceptable channel checks, and since they are not performed on the same equipment, the parameters are not mutually exclusive. Since it was not delineated in the question which procedure was being implemented, either "A" or "B" would be correct and either one should be accepted.

### NRC Evaluation/Resolution:

The NRC staff reviewed 0BOSR 0.1-0, "Unit Common All Modes/All Times Shiftly and Daily Operating Surveillance," Revision 72, and Section E, "Limitations and Actions," 2.d states (bold text added for emphasis), "Tolerances for any channel check performed should use the Analog indicator for **3%** deviation of scale limitation." This criterion differs from that provided in 1BOSR 0.1-1,2,3, "Unit One Mode 1, 2 & 3 Shiftly and Daily Operating Surveillance," Revision 75, Section E, "Limitations and Actions," 8.a, which states, in part (bold text added for emphasis), "Tolerances should be based on expected operating range pertaining to plant status. Acceptable Channel Check is typically  **$\pm 3%$**  (unless otherwise stated) from the average of the readings. In other words, **6% deviation from high to low** is generally acceptable to satisfy the Channel Check." Accordingly, there is a difference in the acceptance criteria for channel checks in these two surveillance procedures.

Additional information provided by the facility licensee indicates that the Unit 1 Assist Operator, which is a position on shift that is filled by an RO, typically performs 0BOSR 0.1-0. Given the stem states that "Unit 1 is at 100% power," and "[t]he RO is performing channel checks for the Shiftly and Daily Operating Surveillance," the NRC staff concluded that it is reasonable that the RO referenced in the stem could be performing either 0BOSR 0.1-0 or 1BOSR 0.1-1,2,3. The question stem also does not provide enough information for the applicant to determine which of these two procedures the RO is using. Therefore, the NRC staff also concluded it would be reasonable for the applicant to recall either the channel check acceptance criteria for 0BOSR 0.1-0 or 1BOSR 0.1-1,2,3 to answer the question. If the applicant applies the criteria of 0BOSR 0.1-0, then "A" is the correct answer. If the applicant applies the criteria of 1BOSR 0.1-1,2,3 to answer the question, then "B" is the correct answer.

Therefore, the NRC staff concluded that both Answer Options "A" and "B" are correct. Additionally, the facility licensee acknowledged that the channel check acceptance criteria in both procedures should be the same. It is recommended that the facility licensee take appropriate actions in accordance with its Corrective Action Program to resolve the deviation between the two procedures, and that this question be revised to specify the procedure that is in use (e.g., 1BOSR 0.1-1,2,3) in the question stem prior to use in a future examination.

## SIMULATOR FIDELITY REPORT

Facility Licensee: Byron Station, Units 1 and 2

Facility Docket No: 50-454; 50-455

Operating Tests Administered: September 27 – October 6, 2021

The following documents observations made by the U.S. Nuclear Regulatory Commission examination team during the initial operator license examination. These observations do not constitute audit or inspection findings and are not, without further verification and review, indicative of non-compliance with Title 10 of the *Code of Federal Regulations*, Part 55.45(b). These observations do not affect U.S. Nuclear Regulatory Commission certification or approval of the simulation facility other than to provide information which may be used in future evaluations. No licensee action is required in response to these observations.

During the conduct of the simulator portion of the operating tests, the following items were observed:

ITEM	DESCRIPTION
SWR 137381	During the second run of Scenario 3, on Wednesday, September 29, during performance of Attachment B of 1BEP-0, the Main Generator Exciter could not be turned off. The applicant saw that the Main Generator excitation light was lit, and so attempted to turn it off. However, it would not de-energize.
SWR 137223	During performance of a JPM, simulator panel annunciator alarms were silenced by the applicant. Prior to performance of the next JPM, the alarms needed to be audible to provide an important cue. However, when the next applicant attempted to perform the JPM, the alarms were still silenced as the silence pushbutton was stuck in the depressed position.