UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
475 ALLENDALE RD, STE 102
KING OF PRUSSIA, PENNSYLVANIA 19406-1415

January 27, 2026

Christopher H. Mudrick
Senior Vice President
and Chief Nuclear Officer
Constellation Energy Generation, LLC
President
Constellation Nuclear
200 Energy Way, KSA-3N
Kennett Square, PA 19348

SUBJECT: CHRISTOPHER M. CRANE CLEAN ENERGY CENTER – PLANT REFERENCE SIMULATOR INSPECTION REPORT 05000289/2025010

Dear Christopher Mudrick:

On December 16, 2025, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your Christopher M. Crane Clean Energy Center (CCEC). The enclosed inspection report documents the inspection results, which the inspectors discussed on July 10, 2025, and December 16, 2025, with Clint Six, Site Vice President, and other members of your staff.

On September 20, 2019, Three Mile Island Nuclear Station, Unit 1 (TMI-1) ceased permanent power operations and subsequently removed all fuel from the reactor, as detailed in the letter from Exelon to the NRC, “Certification of Permanent Removal of Fuel from the Reactor Vessel for Three Mile Island Nuclear Station, Unit 1” (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19269E480). Upon transition into a decommissioning status, maintenance and modifications on the simulator stopped and specific parts of the simulator were used for other applications. On November 4, 2024, Constellation submitted a letter to the NRC announcing your intent to restore TMI-1 to safe and reliable commercial power operation and renaming TMI-1 to the CCEC (ML24310A104).

The TMI-1 simulation facility was certified as a plant-reference simulator under the Simulator Facility Certification documented in “Three Mile Island Nuclear Station Certification of TMI-1 Simulation Facility,” dated June 28, 1990 (ML20055D207). This inspection was conducted to provide assurance that the simulation facility was restored back to its certified condition, after cessation of power operations for a period of time.

The inspectors performed sections of Inspection Procedure (IP) 41502, “Nuclear Power Plant Simulation Facilities.” The inspectors completed sections 02.02.b.1.(a) through (e), 02.02.b.2, 02.02.b.4.(a) through (d), and 02.02.b.5 of the IP. The inspectors partially completed 02.02.b.3 and plan to follow up on completion prior to the initial operator licensing examinations. The inspectors assessed the simulation facility performance, simulation facility program adequacy and implementation, and the simulator deficiency reporting system. The inspectors examined a sample of activities performed by your staff to ensure that the CCEC simulation facility was

being tested in accordance with ANSI/ANS-3.5-2009, “Nuclear Power Plant Simulators for Use in Operator Training and Examination.” Additionally, the inspectors reviewed the facility licensee’s established programs and processes related to continued assurance of simulator fidelity in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 55.46(d). The inspectors reviewed selected test procedures and programmatic procedures, reviewed simulator test records, observed activities, and interviewed personnel.

Based on the results of this inspection, no findings of significance were identified. In accordance with Inspection Manual Chapter (IMC) 0613, section 17.02, the enclosure to this report includes documentation of the scope of the inspection.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) 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 Website at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Should you have any questions concerning this letter, please contact us.

Sincerely,

SARAH ELKHIAMY

Digitally signed by SARAH ELKHIAMY
Date: 2026.01.27 08:20:21 -05'00'

Sarah H. Elkhiamy, Chief
Operations Branch
Division of Operating Reactor Safety

Docket No. 50-289
License No. DPR-50

Enclosure:
As stated

cc: Distribution via GovDelivery

SUBJECT: CHRISTOPHER M. CRANE CLEAN ENERGY CENTER – PLANT REFERENCE SIMULATOR INSPECTION REPORT 05000289/2025010 DATED JANUARY 27, 2026

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Region I

Docket Number:	05000289
License Number:	DPR-50
Report Number:	05000289/2025010
Licensee:	Constellation Energy Generation, LLC
Facility:	Christopher M. Crane Clean Energy Center
Location:	Middletown, PA
Inspection Dates:	July 7 – December 16, 2025
Inspectors:	James Kepley, Operations Engineer Brian Dyke, Senior Operations Engineer
Approved by:	Sarah H. Elkhiamy, Chief Operations Branch Division of Operating Reactor Safety

Enclosure

SUMMARY OF FINDINGS

Inspection Report (IR) 05000289/2025010; July 10, 2025, and December 16, 2025; Christopher M. Crane Clean Energy Center (CCEC) Simulator Inspection Report.

This report covers an announced, infrequently performed inspection completed by regional inspectors.

A. NRC-Identified and Self Revealed Findings

No findings were identified.

B. Licensee-Identified Violations

No findings were identified.

REPORT DETAILS

4. Other Activities

Simulator Inspection (IP 41502)

a. Inspection Scope

The inspectors partially completed Inspection Procedure (IP) 41502, "Nuclear Power Plant Simulation Facilities." The inspectors examined a sample of activities performed by the facility licensee's staff to ensure that the CCEC simulation facility was being tested in accordance with the ANSI/ANS-3.5-2009 standard, "Nuclear Power Plant Simulators for Use in Operator Training and Examination." Additionally, the inspectors reviewed and assessed the facility licensee's established programs and processes related to continued assurance of simulator fidelity in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 55.46(d). The inspectors reviewed selected test procedures and programmatic procedures, reviewed simulator test records, observed activities, and interviewed personnel.

The facility licensee is committed to meet the requirements of ANSI/ANS-3.5-2009, as endorsed by Revision 4 of NRC Regulatory Guide 1.149, "Nuclear Power Plant Simulation Facilities for Use in Operator Training and License Examinations." This standard establishes the functional requirements for full scope nuclear power plant control room simulators used for operator training and examination. The ANSI/ANS-3.5 standard requirements for testing are specifically implemented in TQ-AA-306, "Simulator Management." The licensee is committed to meet these requirements when utilizing the simulation facility to conduct training activities, regardless of the operational state of the nuclear power unit. For the purposes of this inspection, the reference plant that the simulator is based on is the Three Mile Island Nuclear Station, Unit 1, as it existed on January 27, 2018, and the simulator configuration that existed prior to the final plant shutdown. The physical appearance of the main control room is documented in photos taken by the simulator coordinator at that time.

1. On-Site Simulation Facility Testing and Test Results

As detailed in the attached list of documents reviewed, the inspectors reviewed simulator test results and records for (a) three steady-state tests, (b) 11 transient tests, (c) three core performance tests, (d) three post-event tests, (e) two real-time and repeatability test, and (f) three trial scenario-based tests (SBTs).

In accordance with section 3.4.3.2 of the 2009 revision of the ANSI/ANS-3.5 standard, SBTs are only required to be performed for (1) NRC initial license examination scenarios, (2) licensed operator requalification annual examination scenarios, and (3) scenarios used for reactivity control manipulation experience. At the time of the inspection, none of the operations procedures were approved and the station had no licensed operators. Trial SBTs were performed using "training use only" copies of inactive procedures and using operations training instructors to ensure that the simulator could perform SBTs at a later date.

The inspectors also observed and reviewed the simulation facility performance during two simulator scenarios. These two scenarios were developed by the facility

licensee for licensed operator certification training for instructors. At the time of the inspection, the initial license training class in progress had not begun the simulator phase of their training.

The scope of the inspectors' review of the above items was informed by the requirements of 10 CFR 55.46(c)(1).

2. Simulation Facility Procedural Development

The inspectors reviewed a sample of the facility licensee's procedures related to the simulation facility conduct of testing, documentation of simulation facility issues requiring assessment and potential corrective actions, simulation facility modifications, and the use of the simulation facility for operator training and operator testing and evaluations. The inspectors ensured the procedures developed for the CCEC simulation facility correctly reflected ANSI/ANS-3.5-2009 requirements, where applicable, and were consistent with recognized practices as reflected in currently operating reactor plant reference simulators. The inspectors also reviewed a representative sample of CCEC's training department procedures where there was associated involvement with the simulation facility. Finally, the inspectors reviewed the facility licensee's procedures related to maintaining examination and test integrity consistent with the requirements of 10 CFR 55.49. This review was informed by the requirement of 10 CFR 55.46(d)(4).

3. Simulation Facility Programs for Assurance of Continued Simulator Fidelity

In addition to reviewing the specified procedural requirements that define the CCEC simulation facility programs for assurance of continued simulator fidelity, the inspectors compared the degree of similarity between the simulator and the reference plant control room. The inspectors also reviewed the facility licensee's simulator work request (SWR) program, including open and closed deficiencies. Finally, the inspectors reviewed facility licensee records related to the determination of whether simulator discrepancies resulted in an impact on operator training and the determination of the impact of identified simulator discrepancies on the pass/fail criteria of associated test results.

The inspectors compared the SWRs identified by the facility licensee against the simulator test records and results to assess the effectiveness of the facility licensee's program for identification and prioritization of issues, reporting, evaluation, schedule for implementing timely corrective actions, and corrective actions. The inspectors assessed whether the facility licensee was effectively identifying any simulator discrepancies that could result in negative training of operators. The inspectors verified whether the facility licensee adequately captured simulator problems and deficiencies; and that corrective actions were performed, tracked, trended, and completed in a timely fashion commensurate with the safety significance of the item. The inspectors review included confirming that the corrective actions taken did not introduce new errors into the simulation facility modeling and response (reference IP 41502 section 02.02.a.2 and 02.02.b.5).

For the purposes of this inspection, the reference plant that the simulator is based on is the Three Mile Island Nuclear Station, Unit 1, as it existed on January 27, 2018, and the simulator configuration that existed prior to the final plant shutdown. The

physical appearance of the main control room is documented in photos taken by the simulator coordinator at that time. Due to this limitation, all inspection criteria could not be fully accomplished. Following on-site inspection activities, the licensee has developed a new procedure, TQ-TM306-1001, "Crane Restart Simulator Training and Management," to establish consistent processes to account for the unique situations at the CCEC simulator until CCEC has been restarted, and to provide methods to ensure compliance with the applicable regulations. The inspectors subsequently reviewed the new procedure and determined that it is adequate to ensure proper simulator configuration control.

The inspectors also evaluated documented simulator differences and recent modifications impacting the simulator and the reference plant control room (reference IP 41502 section 02.02.b.3).

The scope of the inspectors' review of the above items was informed by the requirements of 10 CFR 55.46(d).

4. Summary of IP 41502 Completion

The inspectors completed the following IP 41502 inspection requirements: 02.02.b.1.(a) through (e), 02.02.b.2, 02.02.b.4.(a) through (d), and 02.02.b.5; and partially performed 02.02.b.3.

b. Observations and Findings

No findings were identified.

c. Assessment

1. On-Site Simulation Facility Testing and Test Results

(a) Steady-State Test Results

Steady state testing was reviewed for the 100 percent, 75 percent, and 48.8 percent power levels under Constellation Simulator Test Procedure, SSP-02, spanning at least 50 percent of the operating range for which reference unit data was available, as well as the SSP-02 data performed on January 9, 2017, prior to plant shutdown. The inspectors reviewed the licensee's testing and determined that it adequately addressed the requirements of ANSI/ANS-3.5-2009 section 4.1.3.1. No discrepancies were identified.

(b) Transient Test Results

The inspectors reviewed all 11 of the licensee's transient tests obtained on the simulator compared to the design data requirements of ANSI/ANS-3.5-2009 Appendix B.3. No discrepancies were identified.

(c) Core Performance Testing Results

The facility licensee used the most recent reactor core load, prior to plant shutdown (cycle 22), to perform the core performance testing on May 7, 2025,

and which was documented in Constellation Simulator Management Procedure, TQ-AA-306. The inspectors reviewed the licensee's testing data, as well as similar testing performed in March of 2018 and determined that it adequately addressed the requirements of ANSI/ANS-3.5-2009 section 3.4.3.3. No discrepancies were identified.

(d) Post-Event Testing Results

Three post-event tests were conducted and reviewed by the inspectors: OES30 – DTCS Load Set failure to zero, Sept 19, 2010; OES32 – Reactor Trip Due to Trip of RC-P-1C; and OES35 – Dropped Rod with Plant Runback. The inspectors reviewed the data and determined that the post-event tests demonstrated the capability of the simulator to adequately reproduce the events, as required in ANSI/ANS-3.5-2009 section 4.4.3.4. No discrepancies were identified.

(e) Real-Time and Repeatability Test Results

The inspectors reviewed CCEC's simulator test procedures TQ-AA-306 – Simulator Management and TQ-TM-306-0101 – CCEC Simulator Operation, and three associated tests RTT-01, RTT-02, and RTT-03 and determined that they met the requirements of ANSI/ANS-3.5-2009 section 4.1.1. No discrepancies were identified.

(f) Scenario-Based Testing Results

The inspectors reviewed facility licensee procedure, Simulator Scenario Based Testing (SBT) Guideline, and determined that it met the requirements of ANSI/ANS-3.5-2009 section 3.4.3.2.

In accordance with section 3.4.3.2 of the 2009 revision of the ANSI/ANS-3.5 standard, SBT is only required to be performed for (1) NRC initial license examination scenarios, (2) licensed operator requalification annual examination scenarios, and (3) scenarios used for reactivity control manipulation experience. The licensee was not required at the time of inspection to perform SBTs, however; they did perform three SBTs to ensure that the simulator could perform the testing when required. The inspectors reviewed CCEC completed test procedures TQ-TM-106-LRU-S006, TQ-TM-106-LRU-S028, and TQ-TM-106-LRU-S060 and identified no discrepancies.

(g) Scenario Results

The inspectors observed the simulation facility performance during two simulator scenarios. These two scenarios were developed by the facility licensee for licensed operator requalification training. The inspectors determined the simulator adequately addressed the requirements of ANSI/ANS-3.5-2009.

2. Simulation Facility Procedural Development

The inspectors reviewed the following facility licensee's simulator testing procedures: TQ-AA-306, Simulator Management; TQ-TM-306-0101, CCEC Simulator Operation; TQ-TM-306-1001, Crane Restart Simulator Training and Management.

The procedures laid out testing methodologies and schedules for all required tests and appropriately included the necessary acceptance criteria. The inspectors determined the procedures adequately addressed the requirements of ANSI/ANS-3.5-2009. No discrepancies were identified.

3. Simulation Facility Programs for Assurance of Continued Simulator Fidelity

The inspectors reviewed the following facility licensee's simulator configuration control and maintenance procedures: PNT-018, Simulator Configuration Control, and PNT-019, Simulator Change Request Implementation.

The inspectors also reviewed a list of open and closed deficiency reports generated by the licensee to determine the types of issues that were being identified and included. The inspectors also reviewed a sample of the records to determine the impact on operator training and the effect on the previously completed ANSI/ANS-3.5-2009 required testing. The inspectors found that the licensee had a very low threshold for submitting deficiency requests. When the deficiency could not be corrected, the staff then submitted the issue for a training needs analysis.

The inspectors then reviewed the licensee's database of outstanding SWRs to ensure that they were being tracked adequately for resolution. The licensee maintained a database of all SWRs created. The database included the SWR identification number, a brief description of the issue, and a priority for issue restoration. As it was, the inspectors found the database an effective tool to track deficiency reports and the Simulator Review Board was effectively evaluating simulator deficiencies.

Finally, the inspectors performed a review of the simulator control room environment, photos of the main control room as it existed prior to plant shutdown, and the reference plant control room to verify the simulator replicated the control room in accordance with ANSI/ANS-3.5-2009 section 3.2.1.3 and that noticeable differences were corrected or that a training needs analysis had been conducted in accordance with the criteria provided in section 4.2.1.4. The inspectors noted that the simulator was much further along in restoration compared to the main control room and as such could not complete this area of the inspection, and that the established simulator management procedures did not adequately address how the configuration management would be maintained. As a result, the facility created a new procedure, TQ-A-306-1001, "Crane Restart Simulator Training and Management," to establish consistent processes to account for the unique situations at the CCEC simulator until CCEC has been restarted, and to provide methods to ensure compliance with the regulations.

The inspectors determined that simulator differences were appropriately documented and assessed to the extent possible in accordance with ANSI/ANS-3.5-2009 section 3.2.1.3. Follow-up reviews will be performed prior to the initial licensed operator examinations

4A06 Meetings, Including Exit

Exit Meeting

On July 10, 2024, the inspectors presented the preliminary inspection results to Clint Six, Site Vice President, and other members of the licensee staff. On December 16, 2025, the inspectors presented the final inspection results to Clint Six, Site Vice President, and other members of the licensee staff. The inspectors stated that no proprietary information would be included in the inspection report.

ATTACHMENT: SUPPLEMENTARY INFORMATION

SUPPLEMENTARY INFORMATION

KEY POINTS OF CONTACT

Licensee Personnel

Clint Six, Crane Clean Energy Center Site Vice President
Ryan Harris, Training Director
Robert Cameron, Operations Training Manager
Evan Stone, Simulator Coordinator

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

None

LIST OF DOCUMENTS REVIEWED

Simulator Work Requests

SWR 001676, EFW System Tuning
SWR 00133949, Control Room Meter Mods
SWR 00134138, Mismatch between Pressurizer Level Channels
SWR 00134750, Small Steam Leak Response
SWR 00134751, End of Cycle Power Manuever
SWR 00139327, Cooling Tower B Replacement
SWR 00139329, Main Generator Voltage Regulator Replacement
SWR 00139564; Add Malfunction for Partial Runback
SWR 00139676, Replace Missing Simulated D RPS Trip Module
SWR 00139702, Rod Group 6 Reactivity Worth did not meet acceptance Criteria
SWR 00139725, Initial RCS Pressure Spike on Reactor-Turbine Trip
SWR 00139737, Simulator Crash after Insertion of Lage Break Leak
SWR 00139752, EC 643997 AVR Replacement
SWR 00139769, RC pump Vibration malfunctions don't match C&E

Plant Condition Reports

CR 4869340, Gap Identified during Simulator Self-Assessment
CR 4878289, Simulator Post Event Review for ANO-1 FW Transient

Procedures:

TQ-AA-306, Simulator Management
TQ-TM-306-0101, CCEC Simulator Operation
TQ-TM-306-1001, Crane Restart Simulator Training and Management

Simulator ANSI/ANS-3.5-2009 Appendix B Transient Tests:

Crane Simulator Test Procedure, OT01 - Manual Reactor Trip
Crane Simulator Test Procedure, OT02 – Loss of all Feedwater
Crane Simulator Test Procedure, OT03 – Closure of all Main Steam Isolation Valves
Crane Simulator Test Procedure, OT04 – Loss of Forced Flow

Crane Simulator Test Procedure, OT05 – Loss of One RCP
Crane Simulator Test Procedure, OT06 – Main Turbine Trip form Reduced Power
Crane Simulator Test Procedure, OT07 – Maximum Power Ramp
Crane Simulator Test Procedure, OT08 - RB Normal Sump Level
Crane Simulator Test Procedure, OT09 – Main Steam Lesk Inside Reactor Building
Crane Simulator Test Procedure, OT10 – RCS Safety Valve Failure
Crane Simulator Test Procedure, OT11 – Maximum Design Load Rejection

Simulator ANSI/ANS-3.5-2009 Scenario Based Tests:

Crane Simulator Test Procedure, TQ-TM-106-LRU-S006
Crane Simulator Test Procedure, TQ-TM-106-LRU-S028
Crane Simulator Test Procedure, TQ-TM-106-LRU-S060

Simulator ANSI/ANS-3.5-2009 Post-Event Tests:

Crane Simulator Test Procedure, OES-30 – DTCS Load Set Failure
Crane Simulator Test Procedure, OES-32 – RCP 1C Trip and Reactor Trip
Crane Simulator Test Procedure, OES-35 – Dropped Rod with Plant Runback

Simulator ANSI/ANS-3.5-2009 Steady State Tests:

Crane Simulator Test Procedure, SSP02 – Simulator to Reference Unit Comparison; 100%, 75%, 48.8%

Simulator ANSI/ANS-3.5-2009 Real Time and Repeatability Test:

RRT01, Simulator Real Time Test, performed June 9, 2025
RRT02, Simulator Repeatability Time Test, performed June 9, 2025
RRT03, Simulator Limits Status Alarm Test, performed June 26, 2025

Simulator ANSI/ANS-3.5-2009 Core Performance Tests:

TQ-AA-306-F-10, PWR Temperature Coefficient of Reactivity, performed May 6, 2025
TQ-AA-306-F-11, PWR Rod Worth Coefficient of Reactivity, performed May 6, 2025
TQ-AA-306-F-12, PWR Boron Coefficient of Reactivity, performed May 21, 2025
TQ-AA-306-F-13, PWR Xenon Worths, performed April 30, 2025
TQ-AA-306-F-14, PWR TMI Differential Boron Coefficient of Reactivity, performed May 6, 2025
TQ-AA-306-F-15, PWR TMI Fuel and Power Doppler Coefficient of Reactivity, performed May 6, 2025
TQ-AA-306-F-17, PWR Approach to Criticality Using Control Rods, performed May 6, 2025