Constellation

Christopher M. Crane Clean Energy Center

License Amendment Request: New Fuel Receipt

NRC Pre-Submittal Meeting
June 2, 2025

Introductions

- Constellation
  - In Person
    - Jim Barstow - Director, Corporate Licensing
    - Dennis Moore - Senior Manager, Corporate Licensing
    - Dan Kenny – Senior Manager, Crane Clean Energy Center Security
    - Christian Williams – Principal Regulatory Engineer, Corporate Licensing
    - Hannah Pell – Regulatory Specialist, Crane Clean Energy Center
  - Remote
    - Mike Kunzwiler – Director, Corporate Nuclear Security
    - John Massari – Senior Manager, Corporate Nuclear Fuels
    - Chris Demetriou – Manager, Corporate Nuclear Fuels
    - Rory Flynn – Manager, Corporate Emergency Preparedness
    - Jason Zorn – Associate General Counsel

Agenda

- Meeting Purpose and Goals
- Background
- Licensing Strategy
- Proposed Licensing Action
- License Condition 2.b.2
- Technical Specification 5.4.1
- Regulatory Bases and Justification
- Proposed Schedule
- Discussion/Questions

Meeting Purpose and Goals

- **Purpose** - Provide an overview of the Christopher M. Crane Clean Energy Center (Crane) Licensing Action to support receipt of new reactor fuel and startup source prior to approval of the Operating Reactor Licensing Bases (ORLB)
  - Present the proposed changes to License Condition 2.b.2 and Technical Specification (TS) 5.4.1
  - Provide the regulatory bases and technical justification for the requested action
  - Provide the proposed schedule for submittal, approval and implementation
- **Goal** - Obtain NRC feedback and insights on the bases and justification for the requested action

Background

- Unit 1 commenced commercial operation in 1974 and was granted initial License renewal in October 2009 to extend the Operating License to 2034
- On September 20, 2019, reactor was shut down due to market conditions
  - On June 20, 2017, 10 CFR 50.82 (a)(1)(i) Certification Letter was submitted to NRC
  - On September 29, 2019, 10 CFR 50.82 (a)(1)(ii) Certification Letter was submitted to NRC
    - All spent fuel is in dry cask storage
    - Fuel pool is drained with cover in place
  - Security Zone and Plan satisfy the requirements of 10 CFR 73.67, “Access Authorization and Access Control Requirements for the Physical Protection of Special Nuclear Material”
    - Security fence in place and monitored for the purposes of material control
  - Crane license conditions, TSs, and Defueled Safety Analysis Report (DSAR) amended to only what was necessary to support decommissioning and dry cask storage
  - Crane Renewed Facility License (RFL) continues to maintain the license authority to possess special nuclear material

Licensing Strategy

- On September 20, 2024, Constellation announced intention to restore Three Mile Island, Unit 1, (Crane) to commercial service and presented a regulatory path to reauthorization of power operations to NRC on October 25, 2024.
  - Constellation is submitting a License Amendment Request (LAR) to update the Renewed Facility License and Technical Specifications to support return to the operating reactor license bases (ORLB)
    - Submittal is targeted for July of 2025
    - Approval is required prior to placing fuel in the reactor vessel (2027)
  - A separate and apart LAR is required to modify the applicable License Condition and TS to support receipt, possession, and storage of new reactor fuel and startup source
    - This LAR is a limited term change to the decommissioning licensing bases
    - Approval is required prior to receipt of new fuel (2026)

Proposed Licensing Action

- **Reason for the request:**
  - Constellation intends to receive, possess, and store new reactor fuel at Crane prior to NRC approval of the ORLB

- **Requested Change:**
  - Constellation is requesting a License Amendment to revise existing License Condition 2.b.2 and add TS 5.4.1 applicable to storage of new reactor fuel and startup source.
    - Action is for receipt, possession, and storage only and is bounded by the 10 CFR 50.82(a)(1)(i) and (ii) Certifications
    - Intent is to store new fuel and startup source in the Fuel Pool

License Condition 2.b.2

Current:	Proposed:
Constellation Energy Generation, LLC pursuant to the Act and 10 CFR Parts 30, 40 and 70 to possess at any time any byproduct, source and special nuclear material used previously as reactor fuel, sealed neutron sources used previously for reactor startup, as fission detectors, and sealed sources for reactor instrumentation and to possess and use at any time any byproduct, source and special nuclear material as sealed sources for radiation monitoring equipment calibration in amounts as required;	*Constellation Energy Generation, LLC pursuant to the Act and 10 CFR Parts 30, 40 and 70 to receive and possess at any time any byproduct, source and special nuclear material ~~used previously~~ as reactor fuel, sealed neutron sources ~~used previously~~ for reactor startup, as fission detectors, and sealed sources for reactor instrumentation and to possess and use at any time any byproduct, source and special nuclear material as sealed sources for radiation monitoring equipment calibration in amounts as required;*

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Technical Specification 5.4.1

Current:

- Crane Maintains ISFSI Only TS
- TS 5.4.1 for New Fuel Storage Requirements previously deleted by Amendment 297

Proposed:

- TS 5.4.1 (Appendix A of this presentation) is being restored to the language approved by Amendment 170 as reflected in the last approved version of the Operating TS (Amendment 294)
- TS 5.4.1 establishes required design features for the fuel pool and fuel storage vault such that a criticality accident is not credible
- Two (2) minor editorial changes from amendment 170 (last approved for this TS):
  - TS 5.4.1 b. and c. will be revised to move the statement (as approved by amendment 170) *'New fuel may also be stored in shipping containers'* from 5.4.1.c to 5.4.1.b
  - '*600 ppmb*' will be revised to '*600 ppm*' to eliminate redundancy and avoid confusion

Regulatory Basis and Justification

- **10 CFR 50.68 – Criticality requirements**
  - Appendix B of this presentation
- **10 CFR 73.67– Security requirements for Special Nuclear Material**
  - Appendix C of this presentation
- **10 CFR 50.47 / Appendix E to Part 50 – Emergency Plan requirements**
  - Appendix D of this presentation

Regulatory Basis and Justification (cont.)

- **10 CFR 50.68 - Criticality requirements**
  - Criticality requirements are applicable based on the quantity and type of nuclear material being stored
  - Per 10 CFR 50.68 the following are required:
    - Plant procedures for handling and storage
    - K-effective[1] requirements for storage
    - Radiation monitoring in the handling and storage areas
    - Maximum Uranium enrichment <5%
  - Procedures for handling and storage of new reactor fuel and startup source will be implemented and maintained in accordance with the requirements of the Crane Quality Assurance program
  - Criticality analysis of record demonstrates compliance with 10 CFR 50.68
  - TS 5.4.1 describes the design attributes which support the Criticality analysis of record

1. "k-effective" is the estimated ratio of neutron production to neutron absorption and leakage in nuclear fuel

Regulatory Basis and Justification (cont.)

- **No Significant Hazards Determination – Criteria and Basis**
  - *The proposed changes do not involve a significant increase in the probability or consequences of an accident previously evaluated.*
    - As demonstrated in the Criticality Analysis of record, a criticality accident is not a credible event based on the design features described in proposed TS 5.4.1.
    - Existing storage and protection requirements for nuclear fuel are maintained.
  - *The proposed changes do not create the possibility of a new or different kind of accident from any previously evaluated.*
    - The receipt of new fuel requires compliance with 10 CFR 50.68, "Criticality accident requirements."
    - As demonstrated in the Criticality Analysis of record, a criticality accident is not a credible event based on the design features described in proposed TS 5.4.1.
  - *The proposed changes do not involve a significant reduction in the margin of safety.*
    - As demonstrated in the Criticality Analysis of record, a criticality accident is not a credible event based on the design features described in proposed TS 5.4.1.
    - Existing storage and protection requirements for nuclear fuel are maintained.
    - The proposed changes will not relax any criteria used to establish safety limits, will not relax any safety system settings, and will not relax the bases for any limiting conditions of operation.

Regulatory Bases and Justification (cont.)

- **No Significant Hazards Determination – Conclusion**
  - The proposed amendment does not involve:
    - A significant hazards consideration, as discussed in previous slide
    - A significant change in the types or significant increase in the amounts of any effluent that may be released offsite as storage of new fuel does not introduce effluents
    - Unirradiated fuel does not result in a significant increase in individual or cumulative occupational radiation exposure.
  - Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment is required.

Regulatory Bases and Justification (cont.)

- **10 CFR 50.47 and Appendix E to Part 50 – Emergency Plan requirements**
  - Crane presently maintains an ISFSI Only Emergency Plan
  - Approved operational Emergency Plans are only required to be in place prior to loading fuel into the reactor
  - As this licensing action is to only allow receipt of new fuel and a startup source, which will not be loaded into the reactor, a change to the Emergency Plan is not required by regulations

Regulatory Bases and Justification (cont.)

- **10 CFR 73 – Security Requirements**
  - Crane maintains, as a licensee-controlled program, the Material Protection Plan for Special Nuclear Material
  - Crane complies with the requirements of 10 CFR 73.67
  - Based on compliance with 10 CFR 73.67, the requirements of 10 CFR 73.55(a)(4) and 10 CFR 73.56(a)(3) are not required.
    - Vogtle Exemption, 86 Fed. Reg. 67734 (Nov 29, 2021), as precedence:
      - *"[…] unirradiated reactor fuel poses no significant risk to public health and safety and protecting it in accordance with § 73.67 would not be inimical to the common defense and security."*
      - *"[…] requiring SNC to implement the requirements of §§ 73.55 and 73.56 to protect unirradiated reactor fuel and other non-fuel SNM that is already being adequately protected in accordance with the requirements of § 73.67 is an unnecessary burden on SNC."*
  - The only security related change required for receipt of new fuel and a startup source is to update the licensee-controlled, Material Protection Plan for Special Nuclear Material to account for the receipt, protection, and storage of new fuel and startup source

Proposed Schedule

- NRC Pre-Submittal Meeting – June 2, 2025
- Target Submit Date – June 27, 2025
- Requested Approval Date – July 31, 2026 (Standard 1 year review)
- Implementation Date – August 29, 2026 (Approval plus 30-day implementation)

Discussion/Questions

Appendices

Appendix A: Proposed Technical Specification 5.4.1

5.4.1 NEW FUEL STORAGE

a. New fuel will normally be stored in the new fuel storage vault or spent fuel pools.

For the new fuel storage vault, the fuel assemblies are stored in racks in parallel rows, having a nominal center to center distance of 21-1/8 inches in both directions. The spacing in the new fuel storage vault is sufficient to maintain Keff less than 0.95 based on storage of fuel assemblies in clean unborated water or less than 0.98 based on storage in an optimum hypothetical low density moderator (fog or foam) for fuel assemblies with a nominal enrichment of 5.0 weight percent U235. When fuel is being stored in the new fuel storage vault, twelve (12) storage locations (aligned in two rows of six locations each; transverse row numbers four and eight) must be left vacant of fissile or moderating material to provide sufficient neutron leakage to satisfy the NRC maximum allowable reactivity value under the optimum low moderator density condition.

For Spent Fuel Pool "A", the fuel assemblies are stored in racks in parallel rows, having a nominal center to center distance of 11.1 inches in both directions for the Region I racks and 9.2 inches in both directions for the Region II racks. The spacing in the Spent Fuel Pool "A" storage locations for both Region I and II is adequate to maintain Keff less than 0.95. Region I will store fuel with a maximum 5.0 percent initial enrichment. Region II will store new fuel with low enrichment. When fuel is being moved in or over the Spent Fuel Storage Pool "A" and fuel is being stored in the pool, a boron concentration of at least 600 ppm must be maintained to meet the NRC maximum allowable reactivity value under the postulated accident condition.

For Spent Fuel Pool "B", the fuel assemblies are stored in racks in parallel rows, having nominal center to center distance of 13-5/8 inches in both directions. This spacing is sufficient to maintain a Keff less than 0.95 based on fuel assemblies with a maximum enrichment of 4.37 weight percent U235. When fuel is being moved in or over the Spent Fuel Storage Pool "B" and fuel is being stored in the pool, a boron concentration of at least 600 ppm must be maintained meet the NRC maximum allowable reactivity value under the postulated accident condition.

b. New fuel may also be stored in shipping containers.

Appendix B: 10 CFR 50.68 Criticality Requirements

10 CFR 50.68 Criticality accident requirements

"(b)(1) Plant procedures shall prohibit the handling and storage at any one time of more fuel assemblies than have been determined to be safely subcritical under the most adverse moderation conditions feasible by unborated water.

(2) The estimated ratio of neutron production to neutron absorption and leakage (k-effective) of the fresh fuel in the fresh fuel storage racks shall be calculated assuming the racks are loaded with fuel of the maximum fuel assembly reactivity and flooded with unborated water and must not exceed 0.95, at a 95 percent probability, 95 percent confidence level. This evaluation need not be performed if administrative controls and/or design features prevent such flooding or if fresh fuel storage racks are not used.

(3) If optimum moderation of fresh fuel in the fresh fuel storage racks occurs when the racks are assumed to be loaded with fuel of the maximum fuel assembly reactivity and filled with low-density hydrogenous fluid, the k-effective corresponding to this optimum moderation must not exceed 0.98, at a 95 percent probability, 95 percent confidence level. This evaluation need not be performed if administrative controls and/or design features prevent such moderation or if fresh fuel storage racks are not used."

Appendix C: 10 CFR 50.47 and Appendix E to Part 50 – Emergency Plan Requirements

10 CFR 50.47 Emergency plans (talk about exemption/schedule for restoration and regulations)

"(d) Notwithstanding the requirements of paragraphs (a) and (b) of this section, and except as specified by this paragraph, no NRC or FEMA review, findings, or determinations concerning the state of offsite emergency preparedness or the adequacy of and capability to implement State and local or utility offsite emergency plans are required prior to issuance of an operating license authorizing only fuel loading or low power testing and training"

Appendix E to Part 50 - Emergency Planning and Preparedness for Production and Utilization Facilities

"4. Notwithstanding the above paragraphs, in the case of an operating license authorizing only fuel loading and/or low power operations up to 5 percent of rated power, no NRC or FEMA review, findings, or determinations concerning the state of offsite emergency preparedness or the adequacy of and the capability to implement State and local offsite emergency plans, as defined in this Appendix, are required prior to the issuance of such a license."

Appendix D: 10 CFR 73 – Security Requirements for Special Nuclear Material

10 CFR 73.55 Requirements for physical protection of licensed activities in nuclear power reactors against radiological sabotage.

(a)(4) Applicants for an operating license under the provisions of part 50 of this chapter or holders of a combined license under the provisions of part 52 of this chapter, shall implement the requirements of this section before fuel is allowed onsite (protected area).

10 CFR 73.56 Personnel access authorization requirements for nuclear power plants.

(a)(3) Each applicant for an operating license under the provisions of part 50 of this chapter, and each holder of a combined license under the provisions of part 52 of this chapter, shall implement the requirements of this section before fuel is allowed on site (protected area).

10 CFR 73.67: Licensee fixed site and in-transit requirements for the physical protection of special nuclear material of moderate and low strategic significance.

"(b) General performance objectives and requirements.

1) Each licensee who possesses, uses or transports special nuclear material of moderate or low strategic significance shall establish and maintain a physical protection system that will achieve the following objectives:

(i) Minimize the possibilities for unauthorized removal of special nuclear material consistent with the potential consequences of such actions; and

(ii) Facilitate the location and recovery of missing special nuclear material."