



NUCLEAR REGULATORY COMMISSION

[Docket No. 50-413; NRC-2026-1321]

Duke Energy Carolinas, LLC; Catawba Nuclear Station, Unit 1; Exemption

AGENCY: Nuclear Regulatory Commission.

ACTION: Notice; issuance.

SUMMARY: The U.S. Nuclear Regulatory Commission (NRC) is issuing an exemption in response to a request dated August 18, 2025, from Duke Energy Carolinas, LLC, to allow the use of AXIOM® fuel cladding at Catawba Nuclear Station, Unit 1. Current NRC regulations limit applicability to the use of fuel rod cladding with zircaloy or ZIRLO™.

DATES: The exemption was issued on March 10, 2026.

ADDRESSES: Please refer to Docket ID NRC-2026-1321 when contacting the NRC about the availability of information regarding this document. You may obtain publicly available information related to this document using any of the following methods:

- **Federal Rulemaking Website:** Go to <https://www.regulations.gov> and search for Docket ID NRC-2025-1321. Address questions about Docket IDs in Regulations.gov to Bridget Curran; telephone: 301-415-1003; email: Bridget.Curran@nrc.gov. For technical questions, contact the individual listed in the “For Further Information Contact” section of this document.

- **NRC’s Agencywide Documents Access and Management System (ADAMS):** You may obtain publicly available documents online in the ADAMS Public Documents collection at <https://www.nrc.gov/reading-rm/adams.html>. To begin the search, select “Begin ADAMS Public Search.” For problems with ADAMS, please contact the NRC’s Public Document Room (PDR) reference staff at 1-800-397-4209, at 301-415-4737, or by email to PDR.Resource@nrc.gov. The exemption request dated August 18, 2025, is available in ADAMS under Accession Nos. ML25230A072.

- **NRC's PDR:** The PDR, where you may examine and order copies of publicly available documents, is open by appointment. To make an appointment to visit the PDR, please send an email to PDR.Resource@nrc.gov or call 1-800-397-4209 or 301-415-4737, between 8 a.m. and 4 p.m. eastern time (ET), Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: John Klos, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; telephone: 301-415-5136; email: John.Klos@nrc.gov.

SUPPLEMENTARY INFORMATION: The text of the exemption is attached.

Dated: March 16, 2026.

For the Nuclear Regulatory Commission.

Lee Klos, Project Manager,
Plant Licensing Branch II-1,
Division of Operating Reactor Licensing,
Office of Nuclear Reactor Regulation.

Attachment – Exemption

NUCLEAR REGULATORY COMMISSION

Docket No. 50-413

Duke Energy Carolinas, LLC

Catawba Nuclear Station, Unit 1

Exemption

I. Background.

Duke Energy Carolinas, LLC (Duke Energy, the licensee), is the holder of Renewed Facility Operating License (RFOL) No. NPF-35 for Catawba Nuclear Station, Unit 1 (Catawba). The RFOL provides, among other things, that the facility is subject to all rules, regulations, and orders of the U.S. Nuclear Regulatory Commission (NRC, the Commission) now or hereafter in effect.

Catawba, Unit 1, consists of a pressurized-water reactor located at the licensee's site in York County, South Carolina.

II. Request/Action.

By application dated August 18, 2025 Agencywide Documents Access and Management System (ADAMS), Accession No. ML25230A072, the licensee, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.12, "Specific exemptions," requested an exemption from certain requirements of 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," to allow the use of AXIOM® fuel cladding at Catawba.

The regulations in 10 CFR 50.46 are currently limited in applicability to the use of fuel rods with zircaloy or ZIRLO™ cladding. The special circumstances associated with the exemption request are that application of the regulation in this circumstance is not necessary to achieve the underlying purpose of the rule.

III. Discussion.

The regulation in 10 CFR 50.46(a)(1)(i) states, in part, that:

each boiling or pressurized light-water nuclear power reactor fueled with uranium oxide pellets within cylindrical zircaloy or ZIRLO cladding must be provided with an emergency core cooling system (ECCS) that must be designed so that its calculated cooling performance following postulated loss-of-coolant accidents [LOCA] conforms to the criteria set forth in paragraph (b) of this section. ECCS cooling performance must be calculated in accordance with an acceptable evaluation model and must be calculated for a number of postulated loss-of-coolant accidents of different sizes, locations, and other properties sufficient to provide assurance that the most severe postulated loss-of-coolant accidents are calculated.

Since 10 CFR 50.46 specifically refers to fuel with zircaloy or ZIRLO™ cladding, its application to fuel clads with materials other than zircaloy or ZIRLO™ requires an exemption from this section of the regulations.

The exemption request from the licensee relates solely to the types of fuel cladding materials specified in these regulations. As written, the regulations specify the use of zircaloy or ZIRLO™ cladding. Thus, an exemption to 10 CFR 50.46 is necessary to use cladding materials (i.e., AXIOM®), other than zircaloy or ZIRLO™ cladding. The licensee's request does not propose to exempt Catawba from any other requirements of 10 CFR 50.46 regarding acceptance criteria, evaluation model features and documentation, reporting of changes or errors, etc.

Pursuant to 10 CFR 50.12, the NRC may, upon application by any interested person or upon its own initiative, grant exemptions from requirements of 10 CFR part 50 when: (1) the exemptions are authorized by law, will not present an undue risk to the public health and safety, and are consistent with the common defense and security, and (2) special circumstances are present. Under 10 CFR 50.12(a)(2), special circumstances are present when at least one of the following six conditions are met:

- (i) Application of the regulation in the particular circumstances conflicts with other rules or requirements of the Commission; or
- (ii) Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule; or
- (iii) Compliance would result in undue hardship or other costs that are significantly in

- excess of those contemplated when the regulation was adopted, or that are significantly in excess of those incurred by others similarly situated; or
- (iv) The exemption would result in benefit to the public health and safety that compensates for any decrease in safety that may result from the grant of the exemption; or
 - (v) The exemption would provide only temporary relief from the applicable regulation and the licensee or applicant has made good faith efforts to comply with the regulation; or
 - (vi) There is present any other material circumstance not considered when the regulation was adopted for which it would be in the public interest to grant an exemption.

The licensee's proposed exemption request which would permit application of the requirements of 10 CFR 50.46 to fuel rods clad with AXIOM® at Catawba identifies, in particular, that the special circumstance associated with this exemption request is that the application of the regulation in this circumstance is not necessary to achieve the underlying purpose of the rule.

The technical basis for the use of fuel cladding with AXIOM® in Pressurized Water Reactors (PWRs) is documented in Topical Report (TR) WCAP-18546NP-A, Revision 0, "Westinghouse AXIOM® Cladding for Use in Pressurized Water Reactor Fuel," March 2023 (ML23089A066). This TR describes Westinghouse's evaluation for the use of the AXIOM® alloy in PWR fuel assemblies as a replacement for ZIRLO™ and Optimized ZIRLO™. This TR discusses material properties of AXIOM®, as well as its behavior under normal operation, anticipated transients, and postulated accident conditions.

As identified in TR WCAP-18546NP-A, Revision 0, the AXIOM® alloy is a proprietary niobium-bearing variant of zirconium. This material also has tin, vanadium, and copper as alloying elements. Westinghouse stated that the AXIOM® alloy was developed to provide enhanced performance with respect to corrosion, hydrogen pickup,

growth, and creep. While demonstrating relevant differences in certain material properties and physical behavior, TR WCAP-18546NP-A, Revision 0, identifies that the basic physical properties of AXIOM® are similar to ZIRLO™.

In TR WCAP-18546NP-A, Revision 0, Section C, "Submittal of Topical Report," Sections 3.11, "Post Quench Ductility," 3.12, "Breakaway Oxidation," and 6.2.1.4, "Fuel Clad Wear," Westinghouse states the rationale for concluding that each of the acceptance criteria in 10 CFR 50.46 is applicable to fuel clad with AXIOM®.

As documented in its safety evaluation on TR WCAP-18546NP-A, Revision 0, Section A, the NRC staff concluded that the criteria of 10 CFR 50.46 are acceptable for the application of AXIOM® cladding. The TR's Section A also states the technical basis for the NRC staff's conclusions in support of the AXIOM® alloy is the testing and analysis that Westinghouse had performed. Despite finding application of 10 CFR 50.46 to AXIOM® acceptable from a technical perspective, current regulations in 10 CFR 50.46 are limited in applicability to the use of fuel rods with zircaloy or ZIRLO™ cladding; therefore, an exemption for use of a new cladding material (such as AXIOM®), is required.

A. The Exemption is Authorized by Law.

The NRC has the authority under 10 CFR 50.12 to grant exemptions from the requirements of 10 CFR Part 50 if the justification demonstrates it is authorized by law. The AXIOM® fuel that will be irradiated at Catawba is clad with a zirconium-based alloy that is not expressly within the scope of 10 CFR 50.46. However, the NRC staff considers all other aspects of these regulations (e.g., acceptance criteria, prescribed methods, reporting requirements) applicable to the AXIOM® cladding material, and the licensee states that it will ensure that these regulations are satisfied for operation with fuel clad with AXIOM®. The NRC staff has determined that granting the exemption from 10 CFR 50.46 related to AXIOM®, which is neither zircaloy nor ZIRLO™, will not result in a violation of the Atomic Energy Act of 1954, as amended, or the NRC's regulations. Therefore, the exemption is authorized by law.

B. The Exemption Presents no Undue Risk to Public Health and Safety.

In its submittal dated August 18, 2025, the licensee stated,

The reload evaluations will ensure that acceptance criteria are met for future reload cores after the transition to fuel rods clad with AXIOM material. Fuel assemblies using AXIOM fuel rod cladding will be evaluated using NRC-approved analytical methods and plant-specific models to address the changes in the cladding material properties. The safety analyses for CNS U1 and MNS are supported by the applicable site-specific TSs [Technical Specifications]. Reload cores are required to be operated in accordance with the operating limits specified in the TSs. Thus, the granting of this exemption request will not pose an undue risk to public health and safety.

The NRC staff's previous review of TR WCAP-18546NP-A, Revision 0, which concerns the properties of the AXIOM[®] alloy, provides assurance that predicted chemical, thermal, and mechanical characteristics of AXIOM[®]-alloy cladding are acceptable under normal operation, anticipated transients, and postulated accidents. The NRC staff finds that by utilizing the methods and properties stated in TR WCAP-18546NP-A, Revision 0, Section A, the licensee meets the acceptance criteria and analytical methods in 10 CFR 50.46, and thus, ensures acceptable safety margins for fuel clad with AXIOM[®] that are consistent with those the Commission has established for zircaloy and ZIRLO[™]. Catawba's cores involving AXIOM[®] cladding will continue to be subject to the operating limits specified in the technical specifications and core operating limits report. The licensee will manage core reloads of fuel with AXIOM[®] cladding using NRC-approved analytical methods and plant TS. Thus, granting this exemption request will not pose undue risk to public health and safety.

C. The Exemption is Consistent with the Common Defense and Security.

The exemption will allow the licensee to use an enhanced fuel rod cladding material relative to the zircaloy material for which the requirements of 10 CFR 50.46 were originally established. The NRC staff concluded in TR WCAP-18546NP-A,

Revision 0, Section A, that the use of AXIOM® fuel rod cladding at Catawba will not significantly affect plant operations and is, therefore, consistent with the common defense and security. Special nuclear material in these fuel assemblies will be controlled using NRC-approved analytical methods, plant-specific models, and approved station procedures. Therefore, the exemption does not involve security requirements and does not create a security risk. Therefore, the exemption is consistent with the common defense and security.

D. Special Circumstances.

Special circumstances, in accordance with 10 CFR 50.12(a)(2)(ii), are present whenever application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule. The underlying purpose of 10 CFR 50.46 is to establish acceptance criteria for ECCS performance.

The regulations in 10 CFR 50.46 do not explicitly apply to fuel clad with AXIOM®. However, the underlying purpose of 10 CFR 50.46 is to provide requirements capable of ensuring adequate core cooling during and after the most limiting postulated LOCA. As discussed above, Westinghouse has demonstrated in an NRC-approved TR (i.e. TR WCAP-18546NP-A) that application of the acceptance criteria and analytical methods required in 10 CFR 50.46 to fuel cladding with AXIOM® is acceptable. For the maximum local oxidation limit in 10 CFR 50.46(b)(2), Westinghouse meets the 17 percent limit in the rule for cladding without any hydrogen but further justified the use of an alternative limit that the NRC finds acceptable for maintaining post quench ductility during a postulated LOCA. The licensee stated that the Catawba LOCA analysis for the fuel assemblies with AXIOM® cladding was performed using the Full Spectrum LOCA evaluation model and adheres to the limitations of the associated topical reports. Therefore, strict application of the material-specific requirements for fuel cladding in 10 CFR 50.46 is not necessary to achieve the underlying purpose of ensuring adequate core cooling in this instance. Furthermore, granting an exemption to allow application of

the balance of these regulations for fuel cladding with AXIOM® at Catawba, Unit 1, would be consistent with the underlying regulatory purpose.

E. Environmental Considerations.

The exemption requested by the licensee includes changes to requirements with respect to installation or use of a facility component located within the restricted area. The NRC staff determined that the exemption meets the eligibility criteria for the categorical exclusion set forth in 10 CFR 51.22(c)(9) because the granting of this exemption involves: (i) no significant hazards consideration, (ii) no significant change in the types or a significant increase in the amounts of any effluents that may be released offsite, and (iii) no significant increase in individual or cumulative occupational radiation exposure. Therefore, in accordance with 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the NRC's consideration of this exemption request. The basis for the NRC staff's determination of each of the requirements in 10 CFR 51.22(c)(9) is discussed below.

Requirements in 10 CFR 51.22(c)(9)(i) – There is no significant hazards consideration.

The NRC staff evaluated the issue of no significant hazards consideration using the standards described in 10 CFR 50.92(c), as presented below:

1. Does the proposed exemption involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No.

The proposed exemption to allow the use of AXIOM® fuel rod cladding does not involve a significant increase in the probability or consequences of an accident previously evaluated.

For the set of previously evaluated accidents, their probability is governed by the failure or malfunction of equipment or components other than the fuel rod cladding. The fuel rod cladding itself is not an accident initiator and does not affect the accident probability. Therefore, the change in fuel rod cladding material does not affect the probability of previously evaluated accidents. The proposed exemption does not involve a significant

increase in the consequences of previously evaluated accidents. This conclusion is demonstrated by the analysis submitted by the licensee in support of the proposed use of AXIOM® cladding that the NRC staff has reviewed in support of the proposed license amendment. The licensee's analysis shows that fuel clad with AXIOM® material performs comparably to fuel cladding materials that have been used previously. This satisfies the acceptance criteria in 10 CFR 50.46(b) for the LOCA event.

Therefore, the proposed exemption does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed exemption create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No.

The use of AXIOM® fuel rod cladding does not create the possibility of a new or different kind of accident from any previously evaluated. The fuel rod cladding is not an accident initiator. The use of AXIOM® cladding has been assessed by the licensee and vendor, and it has been found to exhibit comparable or enhanced behavior relative to the zircaloy and ZIRLO™ cladding material specifically identified in 10 CFR 50.46. The NRC staff has previously reviewed this information in its safety evaluation approving TR WCAP-18546NP-A. Use of Westinghouse fuel with AXIOM® cladding in the Catawba, Unit 1, reactor cores is compatible with the plant design and does not introduce any new safety functions for plant structures, systems, or components. Furthermore, the introduction of AXIOM® cladding does not affect any accident mitigation systems and does not introduce any new accident initiation methods.

Therefore, the proposed exemption do not create the possibility of a new or different kind of accident from any previously evaluated.

3. Does the proposed exemption involve a significant reduction in a margin of safety?

Response: No.

The proposed exemption does not involve a significant reduction in the margin of safety. The licensee's analysis of the spectrum of postulated LOCA events for fuel rods clad with AXIOM® exhibits results comparable to those for the fuel currently in use at Catawba for the small-break and the large-break LOCA events. Furthermore, the fuel vendor has generically evaluated the performance of AXIOM® cladding relative to the zircaloy cladding specifically identified in 10 CFR 50.46. The vendor concluded that the performance of the AXIOM® cladding material is quite similar to or enhanced relative to the ZIRLO™ cladding material. The NRC staff has performed a review of these conclusions and documented in its safety evaluation on TR WCAP-18546NP-A that the AXIOM® material properties and mechanical design methodology are in accordance with applicable regulations and regulatory guidance.

Therefore, the proposed exemption does not involve a significant reduction in a margin of safety.

The NRC staff concludes that the proposed exemption presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of no significant hazards consideration is justified (i.e., satisfies the provision of 10 CFR 51.22(c)(9)(i)).

Requirements in 10 CFR 51.22(c)(9)(ii) - There is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite

The proposed exemption would allow the use of AXIOM® fuel rod cladding material in the reactors. AXIOM® cladding has similar properties and performance characteristics as the currently licensed optimized ZIRLO™ cladding. Therefore, the use of the AXIOM® fuel rod cladding material will not significantly change the types of effluents, or significantly increase the amount of effluents that may be released offsite. Therefore, the provision of 10 CFR 51.22(c)(9)(ii) is satisfied.

Requirements in 10 CFR 51.22(c)(9)(iii) - There is no significant increase in individual or cumulative occupational radiation exposure

The proposed exemption would allow the use of the AXIOM[®] fuel rod cladding material in the reactors. AXIOM cladding has similar properties and performance characteristics as the currently licensed optimized ZIRLO cladding. Therefore, the use of the AXIOM[®] fuel rod cladding material will not significantly increase individual occupational radiation exposure or significantly increase cumulative occupational radiation exposure. Therefore, the provision of 10 CFR 51.22(c)(9)(iii) is satisfied.

The NRC staff concludes that the proposed exemption meets the eligibility criteria for the categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, in accordance with 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the NRC's proposed granting of this exemption.

IV. Conclusions.

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12, the exemption is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security. Also, special circumstances are present. Therefore, the Commission hereby grants Duke Energy Carolinas, LLC's request for an exemption from the specific requirements of 10 CFR 50.46 for use of AXIOM[®] fuel rod cladding.

This exemption is effective upon issuance.

Dated: March 10, 2026

For the Nuclear Regulatory Commission.

/RA/

Aida Rivera-Varona, Acting Director
Division of Operating Reactor Licensing,
Office of Nuclear Reactor Regulation.