



[7590-01-P]

NUCLEAR REGULATORY COMMISSION

[Docket Nos. 72-1031, 50-369, and 50-370; NRC-2020-0044]

Duke Energy Carolinas, LLC

McGuire Nuclear Station, Units 1 and 2

Independent Spent Fuel Storage Installation

AGENCY: Nuclear Regulatory Commission.

ACTION: Exemption; issuance.

SUMMARY: The U.S. Nuclear Regulatory Commission (NRC) is issuing an exemption to Duke Energy Carolinas, LLC (Duke Energy) which would permit Duke Energy to maintain MAGNASTOR® Cask 0FCTKN045 at its McGuire Nuclear Station independent spent fuel storage installation (ISFSI) in a storage condition where the helium density is above the range specified in Certificate of Compliance (CoC) No. 1031, Amendment No. 7, Technical Specification (TS) 3.1.1.

DATES: The exemption became effective on **[INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER]**.

ADDRESSES: Please refer to Docket ID **NRC-2020-0044** 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 Web Site:** Go to <https://www.regulations.gov> and search for Docket ID **NRC-2020-0044**. Address questions about NRC docket IDs in Regulations.gov to Jennifer Borges-Roman; telephone: 301-287-9127; e-mail: Jennifer.Borges@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 Web-based ADAMS Search](#)." For problems with ADAMS, please contact the NRC's Public Document Room reference staff at 1-800-397-4209, 301-415-4737, or by e-mail to pdr.resource@nrc.gov. For the convenience of the reader, instructions about obtaining materials referenced in this document are provided in the "Availability of Documents" section.

FOR FURTHER INFORMATION CONTACT: Yen-Ju Chen, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555; telephone: 301-415-1018; email: Yen-Ju.Chen@nrc.gov.

SUPPLEMENTARY INFORMATION:

I. Background

Duke Energy is the holder of Renewed Facility Operating Licenses No. NPF-9 and NPF-17, which authorize operation of the McGuire Nuclear Plant, Units 1 and 2, in Huntersville, North Carolina, pursuant to part 50 of title 10 of the *Code of Federal Regulations* (10 CFR), "Domestic Licensing of Production and Utilization Facilities."

Consistent with 10 CFR part 72, subpart K, "General License for Storage of Spent Fuel at Power Reactor Sites," a general license is issued for the storage of spent fuel in an ISFSI at power reactor sites to persons authorized to possess or operate nuclear power reactors under 10 CFR part 50. Duke Energy is authorized to operate nuclear power reactors under 10 CFR part 50 and holds a 10 CFR part 72 general license for storage of spent fuel at the McGuire Nuclear Station ISFSI. Under the terms of the general license, Duke Energy stores spent fuel at its ISFSI using the NAC MAGNASTOR® System in accordance with CoC No. 1031, Amendment No. 7.

II. Request/Action

By a letter dated September 12, 2019 (ADAMS Accession No. ML19270E395), and supplemented on February 3, 2020 (ADAMS Accession No. ML20052D934), and June 15, 2020 (ADAMS Accession No. ML20178A548), Duke Energy requested an exemption from the requirements of 10 CFR 72.212(b)(3), 72.212(b)(5)(i), and 72.212(b)(11) that require Duke Energy to comply with the terms, conditions, and specifications of the CoC No. 1031, Amendment No. 7 (ADAMS Accession No. ML17013A481). If approved, Duke Energy's exemption request would accordingly allow Duke Energy to maintain MAGNASTOR® Cask 0FCTKN045 in a storage condition where the helium density is above the range specified in CoC No. 1031, Amendment No. 7, TS 3.1.1.

On June 4, 2018, then-recently loaded MAGNASTOR® Cask 0FCTKN045 was transported to the McGuire Nuclear Station ISFSI storage pad area. Subsequently, Duke Energy reviewed technical details of the completed loading procedure and noticed that during the helium backfill process, the two helium mass flow meters for MAGNASTOR® Cask 0FCTKN045 measured significantly different volumes. Further review revealed the cask helium density within MAGNASTOR® Cask 0FCTKN045 exceeded the helium density range specified in CoC No. 1031, Amendment No. 7, TS 3.1.1, Table A3-1, prior to the transport operations. In addition, the TS 3.1.1 corresponding "Required Actions and Completion Times" were not performed prior to transport operations, as specified.

Duke Energy conducted an investigation in accordance with the TS Required Action B.1 and completed an analysis as part of the corrective actions per TS Required Action B.2. Duke Energy concluded, for all MAGNASTOR® modes of operation, that Cask 0FCTKN045 is in a safe configuration for continued operation. Duke Energy's analysis concluded that the final helium density for MAGNASTOR® Cask 0FCTKN045 is

outside the allowed range of 0.694 – 0.802 grams/liter specified in CoC No. 1031, Amendment No. 7, TS LCO 3.1.1, Table A3-1, “Helium Mass Per Unit Volume for MAGNASTOR [transportable storage canister] (TSC),” and it constitutes a nonconformance with the terms, conditions, and specifications of MAGNASTOR® System CoC No. 1031, Amendment No. 7. The NRC staff has addressed the inspection and enforcement aspects of this nonconformance separately from this exemption request.

III. Discussion

Pursuant to 10 CFR 72.7, the Commission may, upon application by any interested person or upon its own initiative, grant such exemptions from the requirements of the regulations of 10 CFR part 72 as it determines are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest.

Authorized by Law

This exemption would allow Duke Energy to maintain MAGNASTOR® Cask 0FCTKN045 at its McGuire Nuclear Station ISFSI in a storage condition where the helium density is above the range specified in CoC No. 1031, Amendment No. 7, TS 3.1.1. The provisions in 10 CFR part 72 from which Duke Energy is requesting exemption require the licensee to comply with the terms, conditions, and specifications of the CoC for the approved cask model it uses. Section 72.7 allows the NRC to grant exemptions from the requirements of 10 CFR part 72. Issuance of this exemption is consistent with the Atomic Energy Act of 1954, as amended, and is not otherwise inconsistent with NRC’s regulations or other applicable laws. Therefore, the exemption is authorized by law.

Will Not Endanger Life or Property or the Common Defense and Security

This exemption would allow Duke Energy to maintain MAGNASTOR® Cask 0FCTKN045 at the McGuire Nuclear Station ISFSI in a storage condition where the helium density is above the range specified in CoC No. 1031, Amendment No. 7, TS 3.1.1. The requested exemption is not related to any aspect of the physical security or defense of the McGuire Nuclear Station ISFSI, therefore granting the exemption would not result in any potential impacts to common defense and security. As detailed in the safety evaluation below, the NRC staff has determined that under the requested exemption, the storage system will continue to meet the safety requirements of 10 CFR part 72 and the offsite dose limits of 10 CFR part 20 and, therefore, will not endanger life or property.

Safety Evaluation

The MAGNASTOR® System has been approved for storage of spent fuel under the conditions of CoC No. 1031. The cask under consideration for exemption (0FCTKN045) was loaded under CoC No. 1031, Amendment No. 7. The requested exemption does not change the fundamental design, components, contents, or safety features of the storage system. The NRC staff has evaluated the potential safety impacts of granting the exemption, as applicable, in the areas of structural integrity, thermal performance, and confinement capability. The evaluation and resulting conclusions are presented below.

Structural Review for the Requested Exemption: The TSC contained in the NAC MAGNASTOR® is required by the MAGNASTOR® TS to be within a specific helium density range of 0.694 - 0.802 grams/liter while maintaining internal pressures within evaluated pressure limits for normal, off-normal, and accident conditions. The internal pressure limits of the TSC with a helium density range of 0.694 - 0.802 grams/liter are provided in the MAGNASTOR® Final Safety Analysis Report (FSAR), Revision 6

(ADAMS Accession No. ML20196L776) as 110 psig, 130 psig, and 250 psig for normal, off-normal, and accident conditions, respectively.

In June 2018, Duke Energy found that the TSC contained in the MAGNASTOR® Cask 0FCTKN045 is filled with a helium density up to 1.082 grams/liter, which is higher than the helium density specified in the TS. As a result, Duke Energy recalculated the internal pressures of the TSC due to the helium density of 1.082 grams/liter using the same method described in the MAGNASTOR® FSAR, Revision 6. The new internal pressures of the TSC were found to be 142.1 psig, 158 psig, and 265 psig for normal, off-normal, and accident conditions, respectively. Using these new internal pressures, Duke Energy calculated new component stress intensities at the most critical cross section (where it has the lowest reported factor of safety) in the TSC to demonstrate the adequacy of the TSC's structural design under normal, off-normal, and accident conditions.

Duke Energy used the results of the ANSYS finite element (FE) structural analysis and a linear superposition of hand calculations to calculate component stresses in the TSC. The ANSYS FE analysis and its results were previously reviewed and accepted by the staff, and they are provided in the MAGNASTOR® FSAR, Revision 6. Based on the calculated stresses at the critical location of the TSC from the previous ANSYS FE analysis, the new stresses at the same critical location of the TSC were recalculated by: (i) adding the induced stresses due to the increased pressures from the helium density increase, and (ii) subtracting the reduced stresses due to the decreased weight of the TSC. For the second factor regarding the stress reduction from the weight of the TSC, Duke Energy stated that the actual weight of the TSC is 77,000 lbs, while the weight of the TSC in the MAGNASTOR® FSAR, Revision 6 that was used as a bounding weight in the previous ANSYS FE analysis was 90,000 lbs. The staff reviewed the methodology used to calculate the revised stresses of the TSC and finds it

acceptable because the superposition method is an acceptable approach in engineering practice and the revised calculations considered the actual weight and helium density.

Using the methodology described above, Duke Energy calculated component stresses and stress intensities at the critical location of the TSC and provided the factor of safety, which is a ratio of the allowable stress intensity with respect to the actual stress intensity, for normal, off-normal, and accident conditions. The staff reviewed Duke Energy's analysis and stress calculation and finds that the results of the stress calculation show that all calculated factors of safety are greater than 1.0, which meets the design criteria for the TSC specified in the MAGNASTOR® FSAR, Revision 6. Revision 6 uses the design criteria required by the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (B&PV) Division I, Section III, Subsection NB. Thus, the staff determines that Duke Energy's stress calculation and its results are acceptable.

The staff concludes that, with the helium density higher than that specified in the TS, the design of the TSC continues to meet the design criteria of the ASME B&PV Code, as specified in the MAGNASTOR® FSAR, Revision 6. The TSC is designed to accommodate the combined loads (i.e., dead weight, internal pressure, handling load, and impacts from natural phenomena) in normal, off-normal, and accident conditions with an adequate margin of safety. The total stresses at the critical location of the TSC under the combined loads during normal, off-normal, accident conditions are acceptable and are found to be within the limits in the ASME B&PV Code, as specified in the MAGNASTOR® FSAR Revision 6. Therefore, the staff finds that the MAGNASTOR® Cask 0FCTKN045 continues to maintain its structural integrity and meet the structural requirements of 10 CFR part 72 and the offsite dose limits of 10 CFR part 20.

Confinement Review for the Requested Exemption: According to the MAGNASTOR® System FSAR Revision 5 (ADAMS Accession No. ML17132A265), the

confinement boundary includes a lid welded consistent with Interim Staff Guidance-18, “The Design and Testing of Lid Welds on Austenitic Stainless Steel Canisters as the Confinement Boundary for Spent Fuel Storage” (ADAMS Accession No. ML082750469). The remaining confinement boundary is tested to a “leaktight” criteria per the American National Standard Institute N14.5 standard. Duke Energy stated in its exemption request that the increased helium pressure within the TSC was used to compute updated factors of safety due to revised stress intensities. The calculations were updated for the most critical cross sections for the bounding load cases of each of the four service levels evaluated in the design basis MAGNASTOR® TSC structural evaluation. The service levels are taken from the ASME B&PV Code, and correspond to different conditions of operation. Duke Energy stated that the updated factors of safety for Service Level A, Service Level B, Service Level C, and Service Level D conditions were greater than one. Therefore, Duke Energy determined that MAGNASTOR® Cask 0FCTKN045 is safe because it continues to meet the structural criteria used to evaluate the MAGNASTOR® system.

The NRC staff reviewed the exemption request and concludes that the cask confinement performance is not affected by the increased helium pressure because, according to Duke Energy’s analysis and the staff’s structural evaluation, the integrity of the TSC is maintained and, therefore, there would be no release from the canister.

The NRC staff finds that the confinement function of MAGNASTOR® Cask 0FCTKN045, loaded under CoC No. 1031, Amendment No. 7, addressed in the exemption request remains in compliance with 10 CFR 72.236(d) and (l) and the offsite dose limits of 10 CFR part 20.

Thermal Review for the Requested Exemption: According to Duke Energy’s analysis in the exemption request, the higher helium density (1.082 g/L) and pressure of MAGNASTOR® Cask 0FCTKN045 have a positive effect on the thermal performance of

the vertical-oriented TSC confining the spent fuel. In addition, in the February 2020 submittal (ADAMS Accession No. ML20052D934), Duke Energy noted that MAGNASTOR® Cask 0FCTKN045 has a decay heat load of less than 30 kW which is less than the design basis heat load for the MAGNASTOR® system of 35.5 kW. Duke Energy analyzed a MAGNASTOR® canister with a 30 kW heat load and helium density of 1.082 g/L. The results were a 575° F maximum fuel temperature, which is less than the design basis temperature (718° F) found in Table 4.4-3 of the MAGNASTOR® System FSAR, Revision 7 (ADAMS Accession No. ML15265A419). The staff concludes that the positive effects of the higher pressure and the lower heat load in the canister would reduce the actual temperatures and increase the margin between the actual temperatures and the design temperatures.

The NRC staff reviewed the exemption request and concludes that the cask thermal performance is not affected by the higher helium density because it would not adversely affect thermal performance and, according to Duke Energy's analysis and the staff's structural evaluation, the integrity of the TSC is maintained. The integrity of the primary confinement boundary ensures that the spent fuel is stored in an inert environment and with unaffected heat transfer characteristics that keep peak cladding temperatures below allowable limits.

The NRC staff finds that the thermal function of MAGNASTOR® Cask 0FCTKN045, loaded under CoC No. 1031, Amendment No. 7, addressed in the exemption request remains in compliance with 10 CFR 72.236 (b) and (f) and the offsite dose limits of 10 CFR part 20.

Otherwise in the Public Interest

The proposed exemption is to maintain MAGNASTOR® Cask 0FCTKN045 at McGuire Nuclear Station ISFSI in the storage condition where the helium density is above the range specified in CoC No. 1031, Amendment No. 7, TS 3.1.1. The NRC staff

notes that in this condition there will be no operations involving the opening of the storage canister, which confines the spent nuclear fuel, and there will be no operations involving the opening of the MAGNASTOR® cask.

In considering whether granting the exemption is in the public interest, the NRC staff also considered the alternative of not granting the exemption. If the exemption were not granted, in order to comply with the CoC, Duke Energy would have to unload MAGNASTOR® Cask 0FCTKN045 to restore compliance with helium density in the TS. This would subject onsite personnel to additional radiation exposure, generate additional contaminated waste, increase the risk of a possible fuel handling accident, and increase the risk of a possible heavy load handling accident.

Approving the requested exemption reduces the opportunity for a release of radioactive material compared to the alternative to the proposed action, while continuing to provide reasonable assurance of public health and safety. Therefore, the staff concludes that approving the exemption is in the public interest.

Environmental Consideration

The NRC staff also considered whether there would be any significant environmental impacts associated with the exemption. For this proposed action, the NRC staff performed an environmental assessment pursuant to 10 CFR 51.30. The environmental assessment concluded that the proposed action would not significantly impact the quality of the human environment. The NRC staff concluded that the proposed action would not result in any changes in the types or amounts of any radiological or non-radiological effluents that may be released offsite, and there is no significant increase in occupational or public radiation exposure because of the proposed action. The Environmental Assessment and the Finding of No Significant Impact was published on July 22, 2020 (85 FR 44329).

IV. Availability of Documents

The documents identified in the following table are available to interested persons through one or more of the following methods, as indicated.

Document	ADAMS Accession No.
Duke Energy Carolinas, LLC (Duke Energy), McGuire Nuclear Station, Units 1 and 2, Independent Spent Fuel Storage Installation (ISFSI), Exemption Request for NAC MAGNASTOR® Cask Loaded to Incorrect Helium Backfill Density, dated September 12, 2019.	ML19270E395
Duke Energy Carolinas, LLC (Duke Energy), McGuire Nuclear Station, Response to NRG Request for Additional Information (RAI) Regarding NAC MAGNASTOR® Cask Loaded to Incorrect Helium Backfill Density, dated February 3, 2020.	ML20052D934
Duke Energy Carolinas, LLC (Duke Energy), McGuire Nuclear Station, Response to NRC Request for Additional Information (RAI) Regarding NAC MAGNASTOR® Cask Loaded to Incorrect Helium Backfill Density, dated June 5, 2020.	ML20178A548
NAC International, MAGNASTOR® Cask System, Certificate of Compliance No. 1031, Amendment No. 7.	ML17013A481
Final Safety Analysis Report, Revision 6 for MAGNASTOR® Cask System.	ML20196L776
Final Safety Analysis Report, Revision 5 for MAGNASTOR® Cask System.	ML17132A265
Interim Staff Guidance, ISG-18, Revision 1, “The Design and Testing of Lid Welds on Austenitic Stainless Steel Canisters as the Confinement Boundary for Spent Fuel Storage.”	ML082750469
Final Safety Analysis Report, Revision 7 for MAGNASTOR® Cask System.	ML15265A419

The NRC may post materials related to this document, including public comments, on the Federal rulemaking Web site at <https://www.regulations.gov> under Docket ID **NRC-2020-0044**. The Federal rulemaking Web site allows you to receive alerts when changes or additions occur in a docket folder. To subscribe: 1) Navigate to

the docket folder (**NRC-2020-0044**); 2) click the “Sign up for E-mail Alerts” link; and 3) enter your e-mail address and select how frequently you would like to receive e-mails (daily, weekly, or monthly).

V. Conclusion

Based on the above considerations, the NRC has determined that, pursuant to 10 CFR 72.7, the exemption is authorized by law, will not endanger life or property or the common defense and security, and is otherwise in the public interest. Therefore, the NRC grants Duke Energy an exemption from the requirements of 10 CFR 72.212(b)(3), 72.212(b)(5)(i), and 72.212(b)(11) with respect to the ongoing storage of MAGNASTOR® Cask 0FCTKN045.

This exemption is effective upon issuance.

Dated: August 14, 2020.

For the Nuclear Regulatory Commission.

John B. McKirgan, Chief,
Storage and Transportation Branch,
Division of Fuel Management,
Office of Nuclear Material Safety,
and Safeguards.