

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of)
Virginia Electric and Power Company) Docket Nos. 50-338
North Anna Power Station, Units 1 and 2) and 50-339

EXEMPTION

I.

Virginia Electric and Power Company (the licensee) is the holder of Facility Operating License Nos. NPF-4 and NPF-7, which authorize operation of North Anna Power Station, Unit Nos. 1 and 2 (NPS1&2). The licenses provide, among other things, that the licensee be subject to all rules, regulations, and Orders of the Nuclear Regulatory Commission (the Commission) now or hereafter in effect.

The facility consists of two pressurized water reactors at the licensee's site located in Louisa County, Virginia.

II.

By letter dated September 4, 1996, as supplemented February 3, 1997, the licensee requested an exemption to 10 CFR 50.44, 10 CFR 50.46, and Appendix K to 10 CFR Part 50 that would enable the use of four demonstration fuel assemblies for three cycles, with the initial irradiation planned for North Anna 1 Cycle 13. Irradiation of these four fuel assemblies may occur in either North Anna Unit 1 or North Anna Unit 2, or a combination of the two units, subject to the following constraints:

- (1) the assemblies are not to be irradiated for more than three full operating cycles, and

- (2) the maximum rod average burnup of any fuel rod in these assemblies shall not exceed the North Anna Units 1 and 2 lead rod burnup restriction of 60,000 megawatt days per metric ton uranium (MWD/MTU).

The regulations cited above refer to pressurized water reactors fueled with uranium oxide pellets within cylindrical zircaloy or ZIRLO cladding. The four demonstration assemblies to be used during these fuel cycles contain fuel rods with zirconium-based claddings that are not chemically identical to zircaloy or ZIRLO.

Since 10 CFR 50.46 and Appendix K to 10 CFR Part 50 identify requirements for calculating emergency core cooling system (ECCS) performance for reactors containing fuel with zircaloy or ZIRLO cladding, and 10 CFR 50.44 relates to the generation of hydrogen gas from a metal-water reaction with reactor fuel having zircaloy or ZIRLO cladding, an exemption is needed to place the four demonstration assemblies containing fuel rods with advanced zirconium-based cladding in the core.

III.

Title 10 of the Code of Federal Regulations at 50.12(a)(2)(ii) enables the Commission to grant an exemption from the requirements of Part 50 when special circumstances are present such that 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 and 10 CFR Part 50, Appendix K, is to establish requirements for the calculation of ECCS performance. The licensee

has performed a calculation demonstrating adequate ECCS performance for NPS1&2 and has shown that the four demonstration assemblies do not have a significant impact on that previous calculation. The peak cladding temperature of the demonstration assemblies was significantly lower than the resident Westinghouse fuel. Using the Baker-Just equation, the local cladding oxidation of the demonstration assemblies was less than 5%. Also, the maximum hydrogen generation was unchanged with the inclusion of four demonstration assemblies. Therefore, the coolable geometry was maintained following a loss-of-coolant accident (LOCA).

Paragraph I.A.5 of Appendix K to 10 CFR Part 50 states that the rates of energy release, hydrogen concentration, and cladding oxidation from the metal-water reaction shall be calculated using the Baker-Just equation. Since the Baker-Just equation presumes the use of zircaloy clad fuel, strict application of the rule would not permit use of the equation for advanced zirconium-based alloys for determining acceptable fuel performance. The underlying intent of this portion of the Appendix, however, is to ensure that analysis of fuel response to LOCAs is conservatively calculated. Due to the similarities in the composition of the advanced zirconium-based alloys and Zircaloy/ZIRLO, the application of the Baker-Just equation in the analysis of advanced zirconium-based clad fuel will conservatively bound all post-LOCA scenarios. Thus, the underlying purpose of the rule will be met. Thus, special circumstances exist to grant an exemption from Appendix K to 10 CFR Part 50 that would allow the licensee to apply the Baker-Just equation to advanced zirconium-based alloys. Only LOCA methods approved by NRC were used to perform the calculations which demonstrated adequate safety performance of ECCS systems. These include: (1) RSG LOCA-B&W LOCA evaluation model, (BAW 10168, Rev. 3), (2) RELAP5/MOD2-B&W

code, (BAW 10164, Rev. 3), (3) the BEACH implementation of RELAP 5, (BAW-10166, Rev. 4), and (4) REFLOD3B (BAW-10171-PA, Rev. 3). The licensee documented calculations which demonstrate that existing North Anna calculations based on the current fuel design conservatively bound the LOCA performance of the demonstration assemblies as calculated by NRC-approved methods. Results of comparative LOCA calculations with the same plant operating parameters demonstrated that the LOCA calculational methods used are acceptable for the demonstration assemblies at North Anna. As such, the licensee has achieved the underlying purpose of 10 CFR 50.46 and 10 CFR Part 50, Appendix K. The underlying purpose of 10 CFR 50.44 is to ensure that means are provided for the control of hydrogen gas that may be generated following a postulated LOCA accident. The licensee has provided means for controlling hydrogen gas and has previously considered the potential for hydrogen gas generation stemming from a metal-water reaction. The small number of fuel rods in the four demonstration assemblies containing advanced zirconium-based claddings in conjunction with the chemical similarity of the advanced claddings to zircaloy and ZIRLO ensures that previous calculations of hydrogen production resulting from a metal-water reaction would not be significantly changed. As such, the licensee has achieved the underlying purpose of 10 CFR 50.44.

The four demonstration assemblies that will be placed in the NPS-1 reactor during Cycles 13, 14, and 15, or in NPS-2 under constraints previously described, meet the same design bases as the fuel in the reactor during previous cycles. No safety limits or setpoints have been altered as a result of the use of the four demonstration assemblies. The demonstration assemblies will be placed in core locations that will not experience limiting power

peaking during the aforementioned operating cycles. The advanced claddings have been tested for corrosion resistance, tensile and burst strength, and creep characteristics. The results indicate that the advanced claddings are safe for reactor service.

IV.

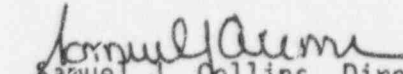
For the foregoing reasons, the NRC staff has concluded that the use of the four demonstration assemblies in the NPS-1 reactor during Cycles 13, 14, and 15, or in NPS-2 under constraints previously described, will not present an undue risk to public health and safety and is consistent with the common defense and security. The NRC staff has determined that there are special circumstances present as specified in 10 CFR 50.12(a)(2)(ii) such that application of 10 CFR 50.46, 10 CFR Part 50, Appendix K, and 10 CFR 50.44 to only apply to zircaloy or ZIRLO is not necessary in order to achieve the underlying purpose of these regulations.

Accordingly, the Commission has determined that pursuant to 10 CFR 50.12, an exemption is authorized by law and will not endanger life or property or common defense and security and is otherwise in the public interest, and hereby grants Virginia Electric and Power Company an exemption from the requirements of 10 CFR 50.44, 10 CFR 50.46, and Appendix K to 10 CFR Part 50 in that explicit consideration of the advanced zirconium-based clad fuel present within the four demonstration assemblies is not required in order to be in compliance with these regulations. This exemption applies only to the four demonstration assemblies for the three total operating cycles for which these assemblies will be in the NPS-1 and NPS-2 reactor cores under the constraints stated in Section II above.

Pursuant to 10 CFR 51.32, the Commission has determined that the granting of this exemption will have no significant impact on the quality of the human environment (62 FR 23504).

This exemption is effective upon issuance.

FOR THE NUCLEAR REGULATORY COMMISSION


Samuel J. Collins, Director
Office of Nuclear Reactor Regulation

Dated at Rockville, Maryland
This 9th day of May 1997.