September 23, 2003

Mr. David A. Christian
Senior Vice President - Nuclear
Virginia Electric and Power Company
Innsbrook Technical Center
5000 Dominion Blvd.
Glen Allen, Virginia 23060

SUBJECT: NORTH ANNA POWER STATION, UNITS 1 AND 2, ISSUANCE OF EXEMPTION FROM THE REQUIREMENTS OF 10 CFR 50.44, 10 CFR 50.46, AND 10 CFR PART 50, APPENDIX K, TO ALLOW THE USE OF THE M5 ALLOY FOR FUEL CLADDING MATERIAL (TAC NOS. MB4700 AND MB4701)

Dear Christian:

By letter dated March 28, 2002, as supplemented by letters dated May 13, June 19, and November 15, 2002, and May 6, May 9, May 27, June 11 (2 letters), July 18, August 26, September 4, and September 5, 2003, Virginia Electric and Power Company (VEPCO) submitted an application for license amendments to use Framatome Advanced Mark-BW fuel at North Anna, Units 1 and 2. Included in the March 28, 2002, submittal was a request for exemption from the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.44, "Standard for Combustible Gas Control in Light-Water-Cooled Power Reactors," and 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors," to use an advanced zirconium-based alloy, designated as M5, for fuel cladding material instead of the ZIRLO or Zircaloy fuel cladding material specified in these regulations. Based upon the information provided, the NRC staff has granted the exemption from the requirements of 10 CFR 50.44 and 10 CFR 50.46.

In addition, in accordance with 10 CFR 50.12(a), the NRC staff, upon its own initiative, has granted an exemption from the requirements of 10 CFR Part 50, Appendix K, "ECCS Evaluation Models." The exemption from the requirements of 10 CFR Part 50, Appendix K, combined with the exemption from the requirements of 10 CFR 50.44 and 10 CFR 50.46, allows VEPCO to use advanced zirconium-based alloy M5 as the fuel cladding material at North Anna, Units 1 and 2.

The NRC staff is continuing to review the proposed license amendments under TAC Nos. MB4714 and MB4715.

Based on its review, the NRC staff finds that granting an exemption from the requirements listed above is authorized by law, will not present an undue risk to public health and safety, is consistent with the common defense and security, and that special circumstances described in 10 CFR 50.12(a)(2)(ii) are present. Accordingly, your request has been granted.

A copy of the exemption has been forwarded to the Office of the Federal Register for publication.

Sincerely,

/RA/

Stephen Monarque, Project Manager, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-338 and 50-339

Enclosure: Exemption

cc w/encl: See next page

Based on its review, the NRC staff finds that granting an exemption from the requirements listed above is authorized by law, will not present an undue risk to public health and safety, is consistent with the common defense and security, and that special circumstances described in 10 CFR 50.12(a)(2)(ii) are present. Accordingly, your request has been granted.

A copy of the exemption has been forwarded to the Office of the Federal Register for publication.

Sincerely,

/RA/

Stephen Monarque, Project Manager, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-338 and 50-339

Enclosure: Exemption

cc w/encl: See next page

DISTRIBUTION
PUBLIC
PDII-1 R/F
EHackett
JNakoski
EDunnington
SMonarque
OGC
ACRS
BSmith, OEDO
KLandis, RII
GHill (4 paper copies)
MShuaibi

ADAMS ACCESSION NO.ML032590881 *See previous concurrence

OFFICE	LA:PDII/S2	PM:PDII/S1	SC:SRXB*	OGC	SC:SPLB	SC:SPLB
NAME	EDunnington	SMonarque	FAkstulewicz	RWeisman(NLO)	RDennig*	DSolorio*
DATE	9/4/2003	9/3/2003	8 /21/2003	9/112003	7/8/2003	7/18/2003

OFFICE	SC:PDII-1	D:PDII	AD:DLPM
NAME	JNakoski	EHackett	ELeeds
DATE	9/12/2003	9/15/2003	9/23/2003

OFFICIAL RECORD COPY

7590-01-P

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

VIRGINIA ELECTRIC AND POWER COMPANY

NORTH ANNA POWER STATION, UNITS 1 AND 2

DOCKET NOS. 50-338 AND 50-339

EXEMPTION

1.0 BACKGROUND

The Virginia Electric and Power Company (the licensee) is the holder of Renewed Facility Operating License Nos. NPF-4 and NPF-7, which authorize operation of the North Anna Power Station, Units 1 and 2. The licenses provide, among other things, that the facilities are subject to all rules, regulations, and orders of the U.S. Nuclear Regulatory Commission (NRC, the Commission) now or hereafter in effect.

The North Anna units are pressurized-water reactors located in Louisa County in the Commonwealth of Virginia.

2.0 REQUEST/ACTION

Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.44, "Standard for Combustion Gas Control in Light-Water-Cooled Power Reactors," requires, in part, reactors fueled with Zircaloy or ZIRLO cladding to provide means to control any hydrogen gas that may be generated after a postulated loss-of-coolant accident (LOCA). 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors," requires that emergency core cooling systems (ECCSs) for reactors containing fuel with Zircaloy or ZIRLO fuel cladding material be designed such that their performance, as calculated

as set forth in that section, meets specified acceptance criteria. Finally, 10 CFR Part 50, Appendix K, "ECCS Evaluation Models," requires that the Baker-Just equation be used to predict the rates of energy release, hydrogen concentration, and cladding oxidation from the metal water reaction for reactors using Zircaloy fuel cladding.

By letter dated March 28, 2002, as supplemented by letters dated May 13, June 19, and November 15, 2002, and May 6, May 9, May 27, June 11 (2 letters), July 18, August 26, September 4, and September 5, 2003, the licensee requested an exemption from the requirements of 10 CFR 50.44 and 10 CFR 50.46 to use an advanced zirconium-based alloy, designated as M5, for the fuel cladding material instead of the ZIRLO or Zircaloy fuel cladding material specified in these regulations. The licensee's exemption request was submitted in conjunction with an application for license amendments to use Framatome Advanced Mark-BW fuel containing M5 cladding material at North Anna, Units 1 and 2. The proposed amendment is currently under NRC staff review. Together, the exemption and amendments would allow Framatome Advanced Mark-BW fuel with M5 cladding to be used at North Anna, Units 1 and 2.

In addition, in accordance with 10 CFR 50.12(a), the NRC staff, upon its own initiative, has developed an exemption from the requirements of 10 CFR Part 50, Appendix K, with respect to the use of Framatome Advanced Mark-BW fuel containing M5 cladding at North Anna, Units 1 and 2. In its submittal dated March 28, 2002, the licensee indicated that an exemption from 10 CFR Part 50, Appendix K, was not necessary to use M5 fuel cladding since Framatome Advanced Nuclear Power (ANP) had demonstrated in the NRC staff-approved Topical Report BAW-10227P, "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel," dated February 11, 2000, that the Baker-Just equation can be used to conservatively predict the metal-water reaction rates for M5 fuel cladding. However, after reviewing its Safety Evaluation Report (SER) dated February 4, 2000, for Topical Report BAW-10227P, the NRC staff has determined that an exemption from 10 CFR Part 50,

Appendix K, was also needed in order to use M5 fuel cladding at North Anna, Units 1 and 2. The NRC staff's rationale for developing this exemption on its own initiative is explained in the following section.

3.0 DISCUSSION

Pursuant to 10 CFR 50.12, the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 50 when (1) the exemptions are authorized by law, will not present an undue risk to public health or safety, and are consistent with the common defense and security; and (2) special circumstances are present. In accordance with 10 CFR 50.12(a)(2)(ii), special circumstances exist whenever application of a particular regulation under the circumstances is not necessary to achieve the underlying purpose of the rule.

The licensee proposes to use M5 material for fuel rod cladding and fuel assembly structural tubing and grids at North Anna, Units 1 and 2. On February 4, 2000, the NRC staff approved Topical Report BAW-10227P. This topical report provided the basis for the use of Framatome ANP's M5 cladding and structural material in pressurized-water reactor cores. In its SER dated February 4, 2000, for Topical Report BAW-10227P, the NRC staff concluded that M5 properties and the mechanical design methodology as defined in this topical report, "are in accordance with Standard Review Plan Section 4.2, 10 CFR 50.46, and 10 CFR Part 50, Appendix K, and therefore are acceptable for reload licensing applications up to rod average burnup levels of 62,000 MWd/MTU and 60,000 MWd/MTU for Mark B and Mark-BW fuel designs, respectively." The NRC staff's SER and the approved topical report were published on February 11, 2000, as Topical Report BAW-10227P-A. By letter dated March 28, 2002, the licensee presented a mixed core analysis methodology and a transition core penalty to account for the differences in the core geometry between the Mark-BW fuel and the Advanced Mark-BW fuel proposed for use at North Anna, Units 1 and 2. The NRC staff has determined that Topical

Report BAW-10227P-A is applicable to the use of Advanced Mark-BW fuel at North Anna, Units 1 and 2, because the core geometrical differences are consistent with the range of conditions for which analyses of fuel performance are documented in the NRC staff-approved topical report regarding the use of M5 fuel cladding.

The underlying purpose of 10 CFR 50.44 is to ensure that means are provided for control of hydrogen gas following a LOCA. However, this rule applies only to reactors using Zircaloy or ZIRLO cladding. 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. Furthermore, in its NRC staff-approved Topical Report BAW-10227P-A, Appendix A, Framatome ANP demonstrated that M5 fuel cladding material is similar in chemical composition to Zircaloy cladding. Accordingly, this chemical similarity ensures that the previous calculations of hydrogen production resulting from metal-water reaction will not be significantly changed. As such, application of 10 CFR 50.44 is not necessary for the licensee to achieve its underlying purpose in these circumstances.

The underlying purpose of 10 CFR 50.46 is to ensure that facilities meet appropriate acceptance criteria for calculated ECCS performance. However, this rule applies only to reactors using Zircaloy or ZIRLO cladding. In its topical report, Framatome ANP demonstrated that ECCS acceptance criteria are also applicable to reactors that use M5 fuel rod cladding and structural material. The NRC staff has determined that this finding is applicable to North Anna because the fuel designs are consistent with the range of conditions for which analyses of fuel performance are documented in the NRC staff-approved topical report. Thus, the performance of M5 material is similar to that of Zircaloy and ZIRLO fuel cladding, and application of the regulation (i.e., using Zircaloy or ZIRLO) is not necessary to achieve the underlying purpose of 10 CFR 50.46.

In its submittal dated March 28, 2002, the licensee stated that Framatome ANP had conducted oxidation testing to demonstrate that the Baker-Just equation can be used to conservatively predict the metal-water reaction rates for M5 fuel cladding, and these test results had demonstrated that Paragraph I.A.5 of 10 CFR Part 50, Appendix K, was applicable to M5. The licensee indicated that since these test results were documented in the NRC staff-approved Topical Report BAW-10227P-A, an exemption from the requirements of 10 CFR Part 50, Appendix K, was not necessary to use M5 fuel cladding. However, based upon the review of the NRC staff's SER for Topical Report BAW-10227P-A, the NRC staff has determined that an exemption from the requirements of 10 CFR Part 50, Appendix K, is necessary in order for the licensee to use M5 fuel cladding. In Section 7.0 of the SER on Topical Report BAW-10227P-A, the NRC staff concluded that while it is appropriately conservative to apply the criteria of 10 CFR 50.46 and 10 CFR Part 50, Appendix K, to M5 fuel applications, the criteria in the SER are specifically identified for only Zircaloy fuel cladding material. Furthermore, as set forth in that SER, the NRC staff found that an exemption from the requirements of 10 CFR Part 50, Appendix K, must be obtained in order to use M5 fuel cladding. In short, as set forth in 10 CFR Part 50, Appendix K, I.A.5, the Baker-Just equation, by its terms, applies only to fuel cladding made of Zircaloy material. As a result, the NRC staff, upon its own initiative, developed an exemption from the requirements of 10 CFR Part 50, Appendix K, for the requested use of M5 fuel cladding at North Anna, Units 1 and 2.

The underlying purpose of 10 CFR Part 50, Appendix K, is to ensure that cladding oxidation and hydrogen generation are appropriately limited during a LOCA and conservatively accounted for in the ECCS evaluation model. This regulation sets forth requirements for plants that use either Zircaloy or ZIRLO fuel cladding. Specifically, Paragraph I.A.5 of 10 CFR Part 50, Appendix K, requires that the Baker-Just equation be used in the ECCS evaluation model to determine the rate of energy release, hydrogen generation, and cladding

oxidation. This equation conservatively bounds all post-LOCA scenarios. In the SER that approved Topical Report BAW-10227P, the NRC staff concluded that the Baker-Just correlation is conservative for determining high temperature M5 oxidation for LOCA analysis, and that the correlation is acceptable for LOCA ECCS analysis up to the currently approved burn-up levels. The NRC staff has determined that this finding is applicable to North Anna because the fuel designs are consistent with the range of conditions for which analyses of fuel performance are documented in the NRC staff-approved topical report. Therefore, when M5 is used as fuel rod cladding and structural material, the Baker-Just correlation bounds post-LOCA scenarios, and ECCS evaluation model criteria will be met. Accordingly, application of the rule requirements to use Zircaloy or ZIRLO is not necessary to achieve the underlying purpose of 10 CFR Part 50, Appendix K.

4.0 CONCLUSION

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12(a), 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. Based on the above, the Commission has determined that pursuant to 10 CFR 50.12(a)(2)(ii), special circumstances are present. Therefore, the Commission hereby grants the licensee an exemption from the requirements of 10 CFR 50.44, 10 CFR 50.46, and Appendix K to 10 CFR Part 50 for North Anna, Units 1 and 2, with respect to the use of fuel incorporating M5 material as cladding and structural material at North Anna, Units 1 and 2.

Pursuant to 10 CFR 51.32, the Commission has determined that the granting of this exemption will not have a significant effect on the quality of the human environment (68 FR 55070).

This exemption is effective upon issuance.

Dated at Rockville, Maryland, this 23rd day of September 2003.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Eric J. Leeds, Acting Director
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Mr. David A. Christian
Virginia Electric and Power Company

North Anna Power Station
Units 1 and 2

cc:

Mr. C. Lee Lintecum
County Administrator
Louisa County
P. O. Box 160
Louisa, Virginia 23093

Ms. Lillian M. Cuoco, Esq.
Senior Counsel
Dominion Resources Services, Inc.
Millstone Power Station
Building 475, 5th floor
Rope Ferry Road
Rt. 156
Waterford, Connecticut 06385

Dr. W. T. Lough
Virginia State Corporation
Commission
Division of Energy Regulation
P. O. Box 1197
Richmond, Virginia 23218

Old Dominion Electric Cooperative
4201 Dominion Blvd.
Glen Allen, Virginia 23060

Mr. Chris L. Funderburk, Director
Nuclear Licensing & Operations Support
Virginia Electric Power Company
Innsbrook Technical Center
5000 Dominion Blvd.
Glen Allen, Virginia 23060-6711

Office of the Attorney General
Commonwealth of Virginia
900 East Main Street
Richmond, Virginia 23219

Senior Resident Inspector
North Anna Power Station
U. S. Nuclear Regulatory Commission
1024 Haley Drive
Mineral, Virginia 23117

Mr. David A. Heacock
Site Vice President
North Anna Power Station
P. O. Box 402
Mineral, Virginia 23117-0402

Mr. Richard H. Blount, II
Site Vice President
Surry Power Station
Virginia Electric and Power Company
5570 Hog Island Road
Surry, Virginia 23883-0315

Mr. Robert B. Strobe, M.D., M.P.H.
State Health Commissioner
Office of the Commissioner
Virginia Department of Health
P. O. Box 2448
Richmond, Virginia 23218

Mr. William R. Matthews
Vice President-Nuclear Operations
Virginia Electric and Power Company
Innsbrook Technical Center
5000 Dominion Boulevard
Glen Allen, Virginia 23060-6711