VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

December 15, 2005

United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D. C. 20555

Serial No.	05-811
NL&OS/GDM	R0
Docket Nos.	50-280
	50-281
License Nos.	DPR-32
	DPR-37

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNITS 1 AND 2
LICENSE AMENDMENT REQUEST
PROPOSED INCREASE IN THE LEAD ROD AVERAGE BURNUP LIMIT

By letter dated March 17, 2005 (Serial No. 05-108), Virginia Electric and Power Company (Dominion) requested amendments to the Operating Licenses for Surry Power Station Units 1 and 2 to increase the lead rod average burnup from 60,000 MWD/MTU to 62,000 MWD/MTU. Surry Units 1 and 2 are currently restricted to a lead rod average burnup of 60,000 MWD/MTU. In a letter dated November 21, 2005, the NRC staff requested additional information to continue their review of the license amendment requests. The NRC's questions and the associated Dominion responses are provided in the attachment.

If you have any questions or require additional information, please contact Mr. Gary D. Miller at (804) 273-2771.

Very truly yours,

Leslie N. Hartz
Vice President – Nuclear Engineering

Attachment

Commitments contained in this letter: None

cc: U.S. Nuclear Regulatory Commission
Region II
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW
Suite 23T85
Atlanta, Georgia 30303

Mr. N. P. Garrett
NRC Senior Resident Inspector
Surry Power Station

Commissioner
Bureau of Radiological Health
1500 East Main Street
Suite 240
Richmond, VA 23218

Mr. S. R. Monarque
NRC Project Manager
U. S. Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike
Mail Stop 8-H12
Rockville, MD 20852

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Leslie N. Hartz, who is the Vice President – Nuclear Engineering of Virginia Electric and Power Company. She has affirmed before me that she is duly authorized to execute and file the forgoing document in behalf of that Company, and that the statements in the document are true and correct to the best of her knowledge, information, and belief.

Acknowledged before me this 15TH day of December, 2005.

My Commission Expires: May 31, 2006

Vicki L. Hull
Notary Public

(SEAL)

Attachment

Request for Additional Information
Proposed Increase in the Lead Rod Average Burnup Limit
Surry Power Station Units 1 and 2

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NRC Question #1

In January of 1988, the NRC approved the use of Surry Improved Fuel (SIF) at Surry Power Station, Units 1 and 2. At that time SIF was described as "... similar to the OFA [Optimized Fuel Assembly] fuel but includes some features of the Vantage 5 fuel." In July of 1995, the NRC approved the use of ZIRLO as a fuel cladding at Surry Power Station, Units 1 and 2. However, those documents lack the specificity deemed necessary for the current review. Please provide a detailed description of SIF from its inception and subsequent iteration(s) until its current form. It is acceptable for the description to reference a standard fuel design such as OFA and provide a detailed description of any difference and its effect.

Dominion Response

The development of the current Surry fuel assembly design began in the late 1980s with the introduction of the Surry Improved Fuel (SIF) assembly design. The SIF fuel design is a Westinghouse 15x15 OFA fuel design, using the OFA mixing vane grid design, guide tube diameter, and three-leaf holddown spring. SIF includes some of the enhanced performance features of the Westinghouse VANTAGE 5 design to increase the burnup capability of the fuel (slightly shorter nozzles, longer guide thimbles, increased fuel rod length), and also uses the VANTAGE 5 reconstitutable top nozzle (RTN). The original SIF design used Zircaloy-4 cladding, guide tubes, instrumentation tube, and mixing vane grids. This product was introduced primarily to improve fuel cycle economics by the use of Zircaloy-4 rather than Inconel mid-grids and to support higher fuel burnups. A request to amend the Surry Operating Licenses to allow the use of this fuel design was submitted to the NRC in Reference 1. This fuel design was approved by the NRC in Amendment 116 to the Surry Unit 1 and Surry Unit 2 Facility Operating Licenses (Reference 2), and the first reload batches of this design (Batch 12 for each unit) were irradiated in Cycle 10 at each unit.

Westinghouse subsequently worked with several other customers who use 15x15 fuel to develop designs that met their specific needs. The axial dimensions for several customers were similar to SIF, but not identical, and in 1989 Westinghouse proposed additional minor changes to the Surry fuel rod and fuel assembly axial dimensions that would allow them to standardize the 15x15 fuel product. At the same time, the flow plate of the fuel assembly bottom nozzle was modified (using a large number of small flow holes) to reduce fuel rod debris fretting failures that had affected the Surry fuel in the 1980's. The standardized fuel rod and fuel assembly dimensions and the debris filter bottom nozzle (DFBN) were incorporated into the SIF design starting with the fresh feed to Cycle 11 (i.e., Batch 13) at each unit. These changes to the fuel assembly were implemented under 10 CFR 50.59.

To further improve the fuel resistance to debris induced failures, an Inconel protective grid (P-grid) was subsequently added to the bottom of the assembly below the first structural grid to capture debris and keep it in the area of the solid end plug on the fuel rods. The length of the fuel rod bottom end plug was also increased slightly to ensure that any debris trapped by the P-grid would wear against solid metal rather than against the relatively thin wall of the cladding. Small changes were made to the size and pattern of flow holes in the debris filter bottom nozzle at this time so that the straps of the P-grids would be positioned over the flow holes, effectively reducing the size of the holes. The P-grids were added to the SIF design in the Batch 15 fuel, which began irradiation in Cycle 13 at each unit. These changes were also implemented under 10 CFR 50.59.

Since the Surry units operate at a relatively low power density, cladding corrosion is not generally an issue. However, several failures occurred in Zircaloy-clad fuel during Surry Unit 1 Cycles 12 and 13 that appeared to be corrosion or burnup related. The loading pattern used in these two cycles was atypical in that eight twice burned assemblies were loaded into the interior of the core in their third cycle of operation and were exposed to high relative powers throughout their operating life. To preclude possible corrosion problems, even in atypical cases, the fuel rod cladding material was changed from Zircaloy-4 to ZIRLO. A request to amend the Surry Operating Licenses to allow the use of ZIRLO cladding was made to the NRC in Reference 3. This change to the Surry fuel design was approved by the NRC under Amendment 202 to the Surry Unit 1 and Surry Unit 2 Facility Operating Licenses (Reference 4). The fuel assembly guide thimbles, instrumentation tube, and mid-grids were also changed from Zircaloy-4 to ZIRLO at the same time to ensure that 2-sided corrosion and hydrogen uptake in these structural components would not become more limiting than the one-sided corrosion in the ZIRLO-clad fuel rods. SIF fuel incorporating ZIRLO cladding and structural components was first implemented in Cycle 14 of each Surry unit (the Batch 16 fuel).

Westinghouse subsequently introduced slightly longer fuel rods (approximately 0.2 inches longer) to all fuel assembly designs to increase the margin to the fuel rod internal pressure limit. This change involved taking advantage of the low growth behavior of ZIRLO and increasing the fuel assembly and fuel rod lengths by 0.2 inch. Dominion agreed to incorporate some of the modifications into the SIF design - specifically, the increase in fuel assembly length by 0.2 inch - to support vendor product standardization. However, because Surry had experienced a small number of debris-related failures even after the P-grids were introduced, Dominion requested that on the SIF design the additional 0.2 inch increase in fuel rod length be used to increase the bottom end plug length rather than the fuel rod plenum length as Westinghouse had proposed. SIF fuel incorporating these axial dimension changes was implemented in Cycle 18 of Unit 2 and Cycle 19 of Unit 1 under 10 CFR 50.59.

Through Cycle 20, Surry Units 1 and 2 have used discrete burnable absorbers that are attached to baseplates and inserted into the guide tubes of selected fuel assemblies that are not positioned under control rods. Starting in Cycle 21 at each unit (Batch 23), Surry plans to include fuel rods with Integral Fuel Burnable Absorber (IFBA) in the SIF design. The IFBA rods include a thin coating of ZrB_2 on some of the fuel pellets in the middle of the fuel stack. Irradiation of the boron in the IFBA generates helium that increases the gas pressure inside the rod. Annular fuel pellets will therefore be used in the top and bottom 6 inches of the fuel stack in rods that include this ZrB_2 coating to provide additional void volume and thus margin to the rod internal pressure design limit. Dominion anticipates incorporating IFBA into the SIF design under 10 CFR 50.59.

<u>Summary</u>

The resulting Surry fuel design still has the 15x15 OFA grids and reconstitutable top nozzle introduced with the SIF design. There have been minor adjustments of the fuel assembly and fuel rod length made under 10 CFR 50.59, but the fuel assembly retains the high burnup capability identified as a feature of the original SIF design. The pattern of holes in the bottom nozzle flow plate was changed to improve debris resistance, and an Inconel protective grid was also added directly above the bottom nozzle for the same purpose. These changes to the SIF design were made in accordance with 10 CFR 50.59. The operating license was amended to replace the Zircaloy-4 in the guide tubes, instrumentation tube, grids, and fuel rod cladding of the SIF fuel with ZIRLO. The next batch of reload fuel at each unit will also include fuel rods containing integral fuel burnable absorber and annular pellets at the top and bottom of the fuel stack. Implementation of these latest changes to the SIF design will be evaluated and documented in accordance with 10 CFR 50.59.

Feature	***Batch First Used (Year)***	***Licensing Approach***
SIF: 15x15 OFA grids, guide tube diameter, hold down spring; VANTAGE 5 nozzle heights, guide tube length, RTN	Surry 1 Batch 12 (1988) Surry 2 Batch 12 (1989)	License Amendment (No. 116)
Standardized high burnup assembly dimensions (guide tube length), DFBN	Surry 1 Batch 13 (1990) Surry 2 Batch 13 (1991)	10 CFR 50.59
P-grid (and associated changes to fuel rod bottom end plug length and DFBN flow holes)	Surry 1 Batch 15 (1994) Surry 2 Batch 15 (1995)	10 CFR 50.59
ZIRLO clad, guide tubes, instrumentation tube, mid-grids	Surry 1 Batch 16 (1995) Surry 2 Batch 16 (1996)	License Amendment (No. 202)

Rod length increases (assembly length increase, increase in rod length, increase in fuel rod bottom end plug length)	Surry 2 Batch 20 (2002) Surry 1 Batch 21 (2003)	10 CFR 50.59
IFBA, annular 'blanket' pellets in IFBA rods	Surry 1 Batch 23 (2006) Surry 2 Batch 23 (2006) *(planned)*	10 CFR 50.59

In summary, the current SIF product comprises features found on several of the licensed Westinghouse products identified in Reference 5. However, the current design can be characterized as essentially being a Westinghouse 15x15 OFA product, with ZIRLO cladding and a protective grid. The assembly and rod dimensions of SIF are now consistent with the 15x15 OFA product, and the reconstitutable top nozzle and debris filter bottom nozzle are now standard on all Westinghouse fuel designs.

NRC Question #2

In Reference 6, the licensee requested the lead pin burnup be extended in accordance with WCAP-12488-P-A, "Westinghouse Fuel Criteria Evaluation Process." WCAP-12488-P-A describes a Fuel Criteria Evaluation Process (FCEP) whereby Westinghouse may make a change to a currently approved fuel design provided the change meets the criteria in WCAP-12488-P-A and notification of the change is made to the NRC.

a. In Reference 5, Westinghouse did not explicitly list SIF as a product "... considered as licensed by the NRC under FCEP." Provide the justification for applying the FCEP to SIF.
b. Please provide the FCEP notification for the analysis for SIF to extend the lead pin burnup to 62,000 MWD/MTU.

Dominion Response #2a

As discussed in Response 1, SIF is essentially a 15x15 OFA design with some additional features (e.g., RTN, ZIRLO) that have been either licensed under Westinghouse WCAPs, or added under 10 CFR 50.59 (e.g., to standardize the product).

Dominion's reload design process, which closely mimics the Westinghouse process, has been reviewed and approved by the NRC in References 7 and 8. Fuel rod design calculations are performed by Westinghouse for Dominion on a reload specific basis and LOCA calculations are provided by Westinghouse, as required. As documented in Reference 6, the models and methods used in the Dominion reload process, along with the Westinghouse calculations, will accurately model the fuel to a lead rod average burnup of 62,000 MWD/MTU and ensure that the fuel design bases and limits discussed in Section 4.0 of WCAP-12488-A, "Westinghouse Fuel Criteria Evaluation Process," are met.

The SIF product has the same Specified Acceptable Fuel Design Limits (SAFDLs) as all other Westinghouse fuel regardless of the array design. Therefore, the design meets FCEP criteria since all SAFDLs are met. Since SIF consists of licensed Westinghouse fuel products, and since the reload process used by Dominion will ensure that the fuel design bases and limits defined in the FCEP process are met, the FCEP process is applicable to Dominion's SIF product.

Dominion Response #2b

Since the current SIF product is characterized as essentially being a Westinghouse 15x15 OFA product with ZIRLO cladding and a protective grid, the extension of SIF product to 62,000 MWD/MTU is covered by the FCEP notification sent to the NRC via NTD-NRC-94-4275 dated August 29, 1994 and the Reference 6 submittal. Therefore, no new FCEP notification needs to be submitted.

NRC Question #3

As noted above, SIF has undergone at least one major change, the incorporation of ZIRLO cladding material. Identify the specific SIF iteration(s) covered by the FCEP notification. If the FCEP notification is to be extended to any other SIF iteration(s), provide justification for that extension.

Dominion Response

The initial SIF product was licensed by the NRC. The only major change to the SIF product, the incorporation of the ZIRLO cladding, was also reviewed and approved by the NRC. The other changes to SIF were evaluated and documented under 10 CFR 50.59. The extension of the lead rod average burnup limit for the SIF fuel to 62,000 MWD/MTU is covered by the FCEP notification documented in NSD-NRC-94-4275.

References

1. Letter from W. L. Stewart to U. S. Nuclear Regulatory Commission, "Proposed Technical Specifications Change, Surry Improved Fuel Assembly," Serial No. 87-188, May 26, 1987.

2. Letter from Chandu P. Patel (U.S. Nuclear Regulatory Commission) to W. L. Stewart, "Surry Units 1 and 2 - Issuance of Amendments Re: Control Rod Assemblies and Surry Improved Fuel (TAC Nos. 63166, 63167, 65432, 65433, 65561 and 65562)," January 6, 1988 (Dominion Serial No. 88-029).

3. Letter from J. P. O'Hanlon to U. S. Nuclear Regulatory Commission, "Surry Power Station Units 1 and 2, Proposed Technical Specification Changes to Implement ZIRLO Fuel Cladding," Serial No. 94-673, November 29, 1994.

4. Letter from Bart C. Buckley (U. S. Nuclear Regulatory Commission) to J. P. O'Hanlon, "Surry Units 1 and 2 - Issuance of Amendments Re: Use of ZIRLO (TAC Nos. M91003 and M91004)," July 27, 1995 (Dominion Serial No. 95-410).

5. Letter from B. F. Maurer (Westinghouse) to U. S. Nuclear Regulatory Commission, "Clarification on 62,000 MWD/MTU Lead Rod Average Burnup (Proprietary/Non-Proprietary," LTR-NRC-05-62, October 20, 2005.

6. Letter from L. N. Hartz to U. S. Nuclear Regulatory Commission, "Virginia Electric and Power Company Surry Power Station Units 1 and 2 License Amendment Request Proposed Increase in the Lead Rod Average Burnup Limit," Serial No. 05-108, March 17, 2005.

7. Dominion Topical Report VEP-FRD-42 Rev.2.1-A, "Reload Nuclear Design Methodology," August 2003.

8. Dominion Topical Report VEP-NAF-1-Rev.0.0-P-A, "Qualification of the Studsvik Core Management System Reactor Physics Methods for Application to North Anna and Surry Power Stations," June 2003.