VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

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

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License Nos.	DPR-32
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VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNITS 1 AND 2
LICENSE AMENDMENT REQUEST
PROPOSED INCREASE IN THE LEAD ROD AVERAGE BURNUP LIMIT

Pursuant to 10 CFR 50.90, Virginia Electric and Power Company (Dominion) requests an amendment to Facility Operating License Numbers DPR-32 and DPR-37 for Surry Power Station Units 1 and 2, respectively. This amendment will permit Dominion to irradiate the Surry fuel assemblies to a lead rod average burnup of 62,000 MWD/MTU in accordance with WCAP-12610-P-A, "VANTAGE + Fuel Assembly Report," April 1995 (which also contains ZIRLO approval) and WCAP-12488-A, "Westinghouse Fuel Criteria Evaluation Process," October 1994. Irradiation of Surry fuel to a lead rod average burnup limit of 62,000 MWD/MTU will allow Dominion to optimize the Surry reload patterns in the future. However, in letters dated December 14, 1993 and April 20, 1994, the NRC imposed a 60,000 MWD/MTU lead rod average burnup limit on Dominion's Surry and North Anna units. Since irradiation of the Surry fuel to a lead rod average burnup of 62,000 MWD/MTU would exceed this limit, NRC approval of the amendment is required for the proposed limit to be used. Since the issuance of the above letters, 1) the vendor's fuel performance code has been approved to 62,000 MWD/MTU (WCAP-15063-P-A, Rev.1, with Errata), 2) the NRC has completed an environmental assessment of the effects of extending fuel burnup above 60,000 MWD/MTU (NUREG/CR-6703), and 3) some utilities have been using Westinghouse Fuel Criteria Evaluation Process (FCEP) (WCAP-12488-A) to extend the lead rod average burnup to 62,000 MWD/MTU.

A discussion of the proposed license amendment request is provided in Attachment 1. As discussed in Attachment 1, Dominion will use its standard reload methodology to evaluate the specific reloads to burnups as high as 62,000 MWD/MTU and will document the evaluation in the cycle specific Reload Safety Evaluation. Reload cycles designed to the higher burnup limit will be required to comply with the approved design criteria. The irradiation of the Surry cores to a lead rod average burnup of 62,000 MWD/MTU presents no safety concerns for the Surry units. Auditable records as specified in the approval of the Fuel Criteria Evaluation Process (FCEP) will be maintained by Westinghouse and Dominion in their respective cycle specific files. Marked-up pages of the Surry Units 1 and 2 Operating Licenses which include a proposed license condition that would allow irradiation of the Surry fuel to a lead rod average burnup of 62,000 MWD/MTU are provided in Attachment 2. Typed pages including the proposed license condition are provided in Attachment 3.

We have evaluated the proposed license amendment request and determined that the proposed increase in the lead rod average burnup does not involve a significant hazards consideration as defined in 10CFR50.92. The basis for this conclusion is provided in Attachment 1. The proposed license amendment and supporting evaluation have been reviewed and approved by the Station Nuclear Safety and Operating Committee and the Management Safety Review Committee.

Because the 60,000 MWD/MTU limit was not explicitly stated in the Surry Units 1 and 2 License Conditions or Technical Specifications, Dominion incorporated the limit specified in the aforementioned NRC letters into the Surry UFSAR to ensure the limit is not exceeded when reload design evaluations are performed. Upon approval of this request, the Surry UFSAR will be changed to indicate that the Surry cores are being designed to limit the lead rod average burnup to 62,000 MWD/MTU.

Dominion would like to start designing to the new limit beginning with Surry 1 Cycle 21 scheduled to begin operation in spring 2006. To support the design schedule for this reload, NRC approval is requested by September 2005.

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

Attachments:
1. Discussion of Change
2. Marked-up Operating License Pages
3. Proposed Operating License Pages

Commitments made in this letter: None

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COMMONWEALTH OF VIRGINIA)
)
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The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Leslie N. Hartz, who is 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 foregoing document in behalf of that Company, and that the statements in the document are true to the best of her knowledge and belief.

Acknowledged before me this 17TH day of March, 2005.

My Commission Expires: May 31, 2006.

Vicki L. Hull
Notary Public

(SEAL)

Attachment 1

Discussion of Change

Surry Power Station Units 1 and 2
Virginia Electric and Power Company
(Dominion)

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DISCUSSION OF CHANGES

1.0 INTRODUCTION

Pursuant to 10 CFR 50.90, Virginia Electric and Power Company (Dominion) requests an amendment to Facility Operation License Numbers DPR-32 and DPR-37 for Surry Power Station Units 1 and 2. The proposed change will incorporate a license condition that will permit irradiation of the fuel assemblies to a lead rod average burnup of 62,000 MWD/MTU. This increase in burnup will permit more effective fuel management.

The proposed change qualifies for categorical exclusion for an environmental assessment as set forth in 10 CFR 51.22(c)(9). Therefore, no environmental impact statement or environmental assessment is needed in connection with the approval of the proposed change.

2.0 BACKGROUND

The NRC has imposed a lead rod average burnup restriction of 60,000 MWD/MTU on Surry. This restriction has required Dominion to degrade recent reload patterns for Surry at an economic penalty to maintain the lead rod average burnup below 60,000 MWD/MTU. The burnup restriction at Surry resulted from a May 1980 request to increase the Surry maximum fuel enrichment to 4.1 weight percent U-235. It was recognized that this enrichment would allow an eventual increase in the discharge fuel burnups, and the NRC Safety Evaluation Report that allowed implementation of this change limited the fuel to a batch average burnup of 37,000 MWD/MTU. In late 1983, Dominion requested removal of this batch average burnup limit, citing a Westinghouse topical report supporting higher burnups (Reference 1). The NRC concluded that it was appropriate to increase the limit to 45,000 MWD/MTU, but not to remove the restriction entirely, as NRC review of the Westinghouse topical report was still in progress.

In 1992, citing the NRC's approval of the Westinghouse high burnup topical report, Dominion again requested that the NRC remove the batch average burnup restriction that had been imposed on the Surry units. Upon review of our request the NRC increased the batch average burnup restriction to 50,000 MWD/MTU or above, provided that the maximum rod average burnup of any rod is no greater than 60,000 MWD/MTU (References 2 and 3). Because the burnup restriction is not explicitly stated in the Surry Unit 1 and 2 License Conditions or Technical Specifications, it was incorporated into Section 3.5.2.6.1 of the Surry UFSAR (Reference 4) to ensure that it is not exceeded when reload design evaluations are performed.

Many utilities pursued burnup and enrichment changes after the approval of the Westinghouse topical report and did not have a utility specific burnup limit imposed by the NRC.

Since the lead rod average burnup restriction of 60,000 MWD/MTU was imposed upon Dominion in 1993, many programs have been conducted that have expanded the understanding of burnup on fuel properties. In addition, the NRC has approved the use of the Westinghouse fuel rod design codes to a burnup of 62,000 MWD/MTU (Reference 5), and the NRC has had an environmental study completed (NUREG/CR-6703) (Reference 6) that concludes that it is acceptable to burn fuel to 62,000 MWD/MTU based upon current information. Several utilities that use Westinghouse fuel have a 62,000 MWD/MTU burnup limit that they established by invoking the Westinghouse Fuel Criteria Evaluation Process (FCEP) (Reference 7).

Upon NRC approval of the proposed amendment, Dominion intends to change the burnup restriction in the UFSAR and begin designing reload patterns for Surry such that the lead rod average burnup stays under 62,000 MWD/MTU.

The NRC has completed an environmental assessment of the effects of extending fuel burnup above 60,000 MWD/MTU and concluded there are no significant adverse environmental impacts associated with extending peak rod average burnup to 62,000 MWD/MTU. Therefore, no environmental impact statement or environmental assessment is needed in connection with the approval of the proposed license condition.

3.0 PROPOSED CHANGE

A license condition is being requested for Surry Units 1 and 2 to allow irradiation of the fuel assemblies to a lead rod average burnup of 62,000 MWD/MTU in accordance with WCAP-12610-P-A (Refeference 8), "VANTAGE + Fuel Assembly Report," April 1995 (contains ZIRLO approval), and WCAP – 12488-A (Reference 7), "Westinghouse Fuel Criteria Evaluation Process," October 1994.

4.0 TECHNICAL EVALUATION

4.1 Core Design

Dominion will use its standard reload methodology (References 9 and 10) to evaluate the cores up to a lead rod average burnup of 62,000 MWD/MTU. The nuclear design models currently being used by Dominion have been used to successfully model lead test assemblies (the Framatome LTAs irradiated at North Anna were part of the benchmark dataset used to qualify the Reference 10 code system) to burnups of approximately 68,000 MWD/MTU. The neutronics physics response is not impacted by the slightly higher burnup. Therefore, these models will accurately model reload fuel to 62,000 MWD/MTU.

4.2 Fuel Rod Design

The fuel rod design criteria (including rod internal pressure, clad corrosion, etc.) are evaluated each cycle to ensure that they are satisfied. This evaluation is done with the vendor fuel performance code (Reference 5) that has been approved to 62,000 MWD/MTU. There will be no change to current fuel rod design limits associated with operation of some fuel to 62,000 MWD/MTU.

4.3 Fuel Assembly Mechanical Design

Westinghouse has confirmed that the fuel assembly growth and holddown spring force fuel mechanical design criteria for Surry are evaluated at a burnup well in excess of 62,000 MWD/MTU. They also indicated that the other mechanical design criteria regarding interface with the rod cluster control assemblies (RCCAs), core components, and handling equipment, as well as the criteria for the fuel assembly joints and connections are not affected by high burnups.

4.4 Safety Analyses

4.4.1 Core Kinetics Parameters

4.4.1.1 Moderator Temperature Coefficient (MTC)

WCAP-10125-P-A indicates that extended burnup fuel management leads to a more negative MTC at end of cycle (EOC). The limiting MTC values for recent Surry cycles were reviewed, and it was determined that sufficient margin exists to accommodate the effects of increasing the lead rod average burnup limit to 62,000 MWD/MTU without affecting the current Surry safety analyses.

4.4.1.2 Doppler Temperature Coefficient

WCAP-10125-P-A indicates that the Doppler coefficient is slightly more negative for extended burnup fuel cycles. A review of the results of recent cycle-specific calculations verified that sufficient margin exists between the reload specific values and those used in the current Surry safety analyses to accommodate the effects of an increased lead rod average burnup limit of 62,000 MWD/MTU.

4.4.1.3 Prompt Neutron Lifetime

The prompt neutron lifetime increases with increasing burnup. A maximum region average burnup has been conservatively defined that, if not exceeded, ensures that the prompt neutron lifetime assumed for current Surry safety analyses remains applicable. Sufficient margin exists between the maximum batch average burnups for recent reload cycles and this maximum region average burnup to accommodate the increase in lead rod average burnup to 62,000 MWD/MTU.

4.4.1.4 Trip Reactivity

Shutdown Margin (SDM)

WCAP-10125-P-A indicates that increased burnup leads to a harder neutron spectrum due to larger plutonium and fission product concentrations. Harder spectrums tend to reduce control rod worth, although the changes are comparable to those for normal reload design variations. The variation in EOC control rod worth for recent Surry reload cycles has been sufficiently below the shutdown margin limit to accommodate the effects of an increase in the lead rod average burnup. There will be no adverse impact on the required shutdown margin used in the safety analysis.

Trip Reactivity

Minimum trip reactivity from both hot full power (HFP) and hot zero power (HZP) conditions shows considerably more margin to the reload safety analysis limits than the shutdown margin analysis. Therefore, the effects of increased burnup on trip reactivity are bounded by those for SDM.

4.4.2 Thermal-Hydraulic / Departure from Nucleate Boiling Ratio (DNBR)

4.4.2.1 Peaking Factors

Peaking factors are typically more limiting near beginning of cycle (BOC) conditions, and decrease with increasing burnups. Peaking is minimized through the use of burnable poisons. The use of burnable poisons will be continued for future reloads; therefore, the uncertainties in the power peak predictions will not be affected by the increased lead rod average burnup limit.

4.4.2.2 Overpower Evaluation

The design basis limit for fuel temperature assures that for Condition I and Condition II events, there is a 95% probability that fuel melt will not occur. The Westinghouse correlation for fuel melting temperature as stated in the UFSAR is:

Melt temperature = 5080°F – 58*(Burnup in MWD/MTU / 10,000)

A peak linear heat rate (kW/ft) limit corresponding to the fuel melt temperature limit is determined via a fuel pin thermal analysis. The linear heat rate limit is checked on a reload basis. Previous analyses have shown that fuel temperatures are limiting at beginning of life (BOL). Therefore, evaluation of fuel temperature limits is not impacted by extension of the burnup limit from 60,000 MWD/MTU to 62,000 MWD/MTU.

4.4.2.3 Maximum Spent Fuel Pool Heat Load

The heat load calculation is performed on a cycle by cycle basis. In general, any change that does not increase cycle length, increase core power, or reduce decay time will have an insignificant impact on refueling heat load. The models used in the calculation deal for the most part with sub-batches or entire batches of fuel. Nothing is modeled to the level of pin burnup. Increasing the lead rod average burnup limit to 62,000 MWD/MTU will not increase the batch burnups beyond those used in the heat load calculations.

4.4.3 Specific Accident Considerations

4.4.3.1 Boron Dilution

The limiting boron dilution event occurs at BOC, as reactivity insertion rates associated with boron dilution decrease with decreasing boron concentrations. Therefore, the current Boron Dilution Analysis of Record (AOR) and reload safety analysis parameters are unaffected by the increased lead rod average burnup limit of 62,000 MWD/MTU.

4.4.3.2 Rod Withdrawal from Subcritical

The key input parameter for this transient is the Doppler Temperature Coefficient (DTC), where the current AOR employs a conservative least negative DTC, normalized at HFP fuel temperature conditions. WCAP-10125-P-A states that the Doppler coefficient will become slightly more negative for extended fuel burnups. Therefore, the current Rod Withdrawal from Subcritical AOR and reload safety analysis parameters are unaffected by the increased lead rod average burnup limit of 62,000 MWD/MTU.

4.4.3.3 Rod Withdrawal from Power

The current Rod Withdrawal from Power AOR indicates that the limiting results for both DBNR concerns and primary-side pressurization are obtained by modeling minimum reactivity feedback effects using the least negative Doppler Temperature Coefficient. Since the Doppler coefficient will become slightly more negative for extended fuel burnups as discussed above, the current Rod Withdrawal from Power AOR and reload safety analysis parameters are unaffected by the increased lead rod average burnup limit of 62,000 MWD/MTU.

4.4.3.4 Loss of Load

The minimum EOC delayed neutron fraction is evaluated each reload cycle, with the limiting value being based on the current Loss of External Electrical Load AOR. The reload specific value for this parameter, and thus the margin to the limiting value, has remained consistent through recent cycles. WCAP-10125-P-A indicates that the effective delayed neutron fraction would tend to be lower for extended fuel burnups, due to the larger fraction of fissions in plutonium. However, the change is expected to be small, and can be accommodated by the margin that has existed between recent reload specific values and the minimum value assumed for EOC delayed neutron fraction in the AOR. Therefore, the current Loss of External Electrical Load AOR will not be adversely affected by the increased lead rod average burnup limit of 62,000 MWD/MTU.

4.4.3.5 Loss of Flow

The current Loss of Flow AOR indicates that the limiting results for DBNR concerns are obtained by modeling minimum reactivity feedback effects using the least negative Doppler Temperature Coefficient. Since the Doppler coefficient will become slightly more negative for extended fuel burnups, the current Loss of Flow AOR and reload safety analysis parameters will be unaffected by the increased lead rod average burnup limit of 62,000 MWD/MTU.

4.4.3.6 Locked Rotor

An acceptance criterion for the Locked Rotor event requires that the fuel cladding temperature remain below 2700°F to preclude cladding embrittlement and to maintain a coolable core geometry. This acceptance criterion is satisfied through the use of the Surry RETRAN Hot Spot Model, where conservatively high fuel temperatures (including uncertainties) at near-BOL conditions are employed, based on older more conservative Westinghouse models. Since fuel temperatures tend to decrease with burnup, and newer fuel performance models tend to predict lower fuel average temperatures, the Hot Spot Model analysis is not adversely affected by the increased lead rod average burnup limit of 62,000 MWD/MTU.

The impact of increasing the lead rod average burnup limit to 62,000 MWD/MTU on the radiological consequences of this accident are discussed in Section 4.5 of this discussion.

4.4.3.7 Steam Generator Tube Rupture

The Steam Generator Tube Rupture event is relatively insensitive to reactor kinetics parameters, which may be affected by increased fuel burnup. There are no reload safety analysis parameters currently associated with the Steam Generator Tube Rupture AOR.

The impact of increasing the lead rod average burnup limit to 62,000 MWD/MTU on the radiological consequences of this accident are discussed in Section 4.5 of this discussion.

4.4.3.8 Main Steamline Break

The AOR for this event employs the reload safety analysis limit value for most negative Doppler Temperature Coefficient to conservatively model reactivity feedback effects. As discussed above, the Doppler coefficient is slightly more negative for extended burnup fuel cycles. Based on the margin to this reload safety analysis parameter demonstrated in recent reloads, this reload safety analysis parameter will not be adversely affected by the increased lead rod average burnup limit of 62,000 MWD/MTU.

Reactivity insertion due to moderator temperature feedback may be potentially increased, as extended fuel burnup may lead to a more negative moderator temperature coefficient at EOC as discussed above. The reactivity insertion due to the MSLB event is verified on a reload basis to ensure that the minimum shutdown margin criterion is met.

The impact of increasing the lead rod average burnup limit to 62,000 MWD/MTU on the radiological consequences of this accident are discussed in Section 4.5 of this discussion.

4.4.3.9 Control Rod Ejection

Burnup limits are not stated in the Rod Ejection Topical Report (VEP-NFE-2-A) (Reference 11) or the current Rod Ejection analysis of record. Fuel irradiation limits are implicitly imposed by the VEP-NFE-2-A acceptance criterion that the average hot spot fuel enthalpy remain below 200 cal/gm (360 BTU/lbm) for irradiated fuel. This acceptance criterion is conservative with respect to the current NRC criterion of 280 cal/gm cited in Regulatory Guide 1.77.

Energy deposition due to reactivity initiated events is affected by fuel burnup and is currently being investigated by the NRC. The observed burnup dependence of this parameter has occurred within the range of the current burnup limit, and is therefore not a new issue associated with the increased lead rod average burnup limit of 62,000 MWD/MTU. Pending new regulatory requirements, the current fuel enthalpy acceptance criteria of VEP-NFE-2-A remain valid and conservative.

Hot Spot Model

The RETRAN Hot Spot model used in the Rod Ejection AOR employs fuel modeling assumptions consistent with zero burnup. This was judged to be conservative and consistent with Westinghouse FACTRAN models used as a benchmark in the Rod Ejection Topical Report. Therefore, the Hot Spot Model assumptions and associated Rod Ejection results are not impacted by the increased lead rod average burnup limit of 62,000 MWD/MTU.

A review of representative reload cycles determined that the peak F_Q point occurred in feed assemblies and that it was not necessary to track the maximum burnup at the rod ejection hot spot. However, the reload safety analysis checklist is being expanded to generate BOC and EOC limits on burnup at the hot spot to insure that the assumptions on the fuel melt temperatures used in the rod ejection analyses are not violated.

4.4.3.10 LOCA

The current Surry analyses for the large break loss of coolant accident (LBLOCA) and the small break loss of coolant accident (SBLOCA) employ fuel average temperatures and rod internal pressures at near-BOL conditions (500 MWD/MTU and 150 MWD/MTU for LB and SBLOCA analyses respectively) that were calculated using Westinghouse's PAD 3.4 fuel performance models. The increase in lead rod average burnup to 62,000 MWD/MTU will not impact these LOCA input parameters. The NRC review of the newer PAD 4.0 fuel performance models demonstrated that PAD 3.4 is conservative relative to PAD 4.0 with regard to fuel average temperatures and rod internal pressures for non-integral fuel burnable absorber (IFBA) fuel. Westinghouse has employed the PAD 4.0 code on a forward fit basis.

The stack height reduction factor used in the LOCA analyses is verified on a reload basis. The increase in lead rod average burnup to 62,000 MWD/MTU could potentially increase predictions of fuel swelling, but ample margin exists between the reload specific value for recent cycles and the value used in the AOR to accommodate this effect.

The fuel rod stored energy is likely to be unaffected by the increased burnup limit. The value used in the AOR is based on PAD 3.4 data for zircaloy-4 fuel, and used a conservative assumption to account for burned regions of fuel. For ZIRLO fuel, Westinghouse has taken credit for burned regions of fuel to offset the increased ZIRLO fuel temperatures. Fuel average temperatures decrease with burnup, and PAD 4.0 models now approved for use generally provide lower fuel average temperatures than the PAD 3.4 models used to generate input for the Surry AOR. The combination of PAD 4.0 and increased burnup credit would likely result in lower fuel average temperatures, and therefore lower core stored energy.

4.4.3.11 Loss of Normal Feedwater

The total fuel rod stored energy for the Loss of Normal Feedwater analysis is likely to be unaffected by the increased burnup limit, for reasons similar to those described above for the LOCA analysis.

4.4.3.12 Fuel Handling Accident

The impact of increasing the lead rod average burnup limit to 62,000 MWD/MTU on the radiological consequences of this accident are discussed in Section 4.5 of this discussion.

4.5 Radiological Consequences

Extending the burnup to 62,000 MWD/MTU at Surry will not affect normal plant effluents. The effects of high burnups on source terms and the associated doses have been discussed in a previous document (Reference 12). The evaluations determined that operation to high burnups increases the inventory of certain long lived fission products such as Cs-134 and Cs-137, but even with routine operation of entire reload batches to high burnup and no changes in the reactor coolant cleanup, there would be only a small increase in the annual release of these isotopes.

The accidents where the radiological consequences may be impacted by the presence of slightly higher burnup fuel fall into three categories: 1) the fuel handling accident, 2) accidents with cladding failure only, and 3) accidents with cladding failure and fuel melt.

The doses from the fuel handling accident are dependent upon the fuel rod gap fraction. Under the alternate source term methodology applied in the Surry fuel handling accident analysis, the fuel rod gap fraction is dependent upon the assembly average burnup and relative power distribution (RPD). This impact is evaluated on a cycle specific basis as part of the reload safety analysis checklist process.

For accidents such as the steam generator tube rupture (SGTR) and the main steam line break (MSLB), no fuel failures are predicted to occur as a consequence of the accident, and the calculated doses are based on failures that exist at the time of the accident. Specifically, the analyses of these accidents assume that the initial primary and secondary coolant activities are at the Technical Specifications limits for Dose Equivalent I-131. The case that assumes a pre-accident iodine spike assumes that the spike is at the limit defined in the Technical Specifications. The case that assumes a concurrent iodine spike uses an appearance rate specified by regulations. These limits are not sensitive to changes in burnup.

For Surry, analyses of loss of flow accidents show that the minimum DNBR does not decrease below the limit, so no cladding failure or release of fission products is predicted. For the current Surry locked rotor accident (LRA) NSSS thermal hydraulic analysis, no fuel rods are predicted to experience DNB. However, the offsite dose calculation for the LRA conservatively assumes failure and gap activity release for 1.4% of the fuel rods. In general, any failures during a LRA would likely occur in high power locations because high power rods are more likely to enter a boiling regime. The gap fraction used in the LRA analysis is valid to 62,000 MWD/MTU provided that the peak rod average linear heat rate is less than 6.3 kw/ft ($F\Delta H < 0.974$) for burnup greater than 54,000 MWD/MTU (Reference 13). Fuel rods with a burnup of 62,000 MWD/MTU would be operating at powers at or below the core average and likely would not fail for this accident scenario. The acceptability of the LRA analysis is evaluated on a cycle specific basis as part of the reload safety analysis checklist process by continuing to validate that the minimum DNBR does not decrease below the limit, so no cladding failure or release of fission products is predicted.

The LBLOCA, SBLOCA, and rod ejection accident fall into a class of accidents that predict both cladding failure and some fuel melt. Dose calculations for these accidents are bounded by the evaluation of the LBLOCA, which conservatively assumes damage to the entire core. The Surry LBLOCA follows the guidelines of Reference 13, which requires the dose calculations be based on specific distributions of the core inventory of fission products. The core inventory modeled in the Surry LBLOCA is based on the ORIGEN2 code with 3 regions (batches) of fuel, where the batch average burnup for the 3rd cycle batch of fuel is approximately 50,000 MWD/MTU. Normal variation of batch burnups will not impact the LOCA dose analysis since, as for most accidents, the doses are primarily due to short lived iodine and noble gas isotopes, and the core inventory of these isotopes is primarily a function of operating power rather than cumulative burnup. Extending lead rod average burnups to 62,000 MWD/MTU will not significantly change the EOC batch average burnup for the 3rd cycle assemblies, and the LOCA dose analysis of record will remain applicable.

4.6 Industry Operating Events

4.6.1 Incomplete Rod Insertion

During the mid to late 1990s, the industry experienced several incomplete control rod insertion (IRI) events due to guide tube distortion in Westinghouse designed fuel assemblies. In response to these events the NRC issued NRC Bulletin 96-01, "Control Rod Insertion Problems," requesting that the licensees determine the continued operability of control rods in their units, and continue to collect data at higher burnups to determine the extent of the issue.

In response to this Bulletin, the industry provided significant data through the Westinghouse Owners Group. WCAP-15712 (Proprietary), "IRI Burnup Threshold Assessment Program," documents the results of the effort to collect data for Westinghouse twelve (12) foot fuel assemblies at burnups greater than 50,000 MWD/MTU (assembly average). Transmittal of this document completed the high burnup threshold assessment program. Based upon this project, the IRI burnup threshold for Westinghouse 15x15 fuel designs with ZIRLO guide tubes (both with and without Integral Flow Mixing (IFMs) grids) was set at 57,000 MWD/MTU (assembly average). If a rodded fuel assembly is projected to exceed this threshold burnup, a mechanical evaluation is performed to assess potential susceptibility to IRI.

The current fuel assembly design being used in the Surry reactors is the Westinghouse 15x15 Optimized Fuel Assembly (OFA) design with ZIRLO guide tubes, but without Integral Flow Mixing (IFM) grids. Therefore, the current burnup threshold for IRI in the Surry units is 57,000 MWD/MTU (assembly average). In past reload designs at Surry, no Surry Rod Cluster Control Assemblies (RCCAs) have been placed in assemblies that have exceeded an assembly average burnup of 57,000 MWD/MTU. Therefore, no specific IRI evaluations have had to be performed for past cycles.

Although the extension of the lead rod average burnup limit to 62,000 MWD/MTU may slightly raise the assembly average burnup for a few assemblies, it is expected that the Surry reload designs will typically place RCCAs in assemblies that achieve a much lower burnup. However, if a reload design places an RCCA in an assembly that achieves an assembly average burnup greater than 57,000 MWD/MTU during the cycle, an evaluation will be performed (e.g., by Westinghouse using their GROBOW code) to determine the acceptability of placing the RCCA in the assembly. If the calculation yields unacceptable results, the core will have to be redesigned.

5.0 REGULATORY SAFETY ASSESSMENT

5.1 No Significant Hazards Consideration

Virginia Electric and Power Company (Dominion) proposes to irradiate the fuel in the Surry Unit 1 and Unit 2 reactors to a lead rod average burnup of 62,000 MWD/MTU in accordance with WCAP-12610-P-A and WCAP-12488-A. The production fuel assemblies currently being irradiated at Surry are Westinghouse 15x15 Optimized Fuel Assemblies.

Operation of the Surry cores with a limited number of fuel assemblies with some fuel rods irradiated to a lead rod average burnup of 62,000 MWD/MTU will not compromise the safe operation of the plants. No Technical Specifications changes are required, although a license condition providing NRC approval is needed to increase the lead rod average burnup to 62,000 MWD/MTU because Dominion is currently limited to 60,000 MWD/MTU by References 2 and 3.

Irradiation of the standard production fuel at Surry to a lead rod average burnup of 62,000 MWD/MTU does not involve a significant hazards consideration as defined in 10 CFR 50.92. The basis for this determination is delineated below:

1. The probability of occurrence or the consequence of an accident previously evaluated is not significantly increased.

   For most of the accidents analyzed in the UFSAR (e. g., LOCA, Steam Line Break, etc.) the fuel design has no impact on the likelihood of initiation of an accident. Fuel performance is evaluated as a consequence of the accident. The only accident where the fuel design may have an impact on the likelihood of a Chapter 14 accident is the Fuel Handling Accident discussed in Chapter 14.4.1 of the Surry UFSAR. The activity being evaluated is a slight increase in the lead rod average burnup limit for the fuel assemblies. No change in fuel design or fuel enrichment will be required to increase the lead rod average burnup. The fuel rods at the extended lead rod average burnup will continue to meet the design limits with respect to fuel rod growth, clad fatigue, rod internal pressure and corrosion. Thus, there will be no impact on the capability to engage the fuel assemblies with the handling tools. Therefore, it is concluded that the change will not result in more than a minimal increase in the frequency of occurrence of any accident previously evaluated in the UFSAR. The impact of extending the lead rod average burnup to 62,000 MWD/MTU from 60,000 MWD/MTU on the Core Kinetics Parameter, Core Thermal-Hydraulics/DNBR, Specific Accident Considerations, and Radiological Consequences was considered. Based on the evaluation of these considerations, it is concluded that increasing the lead rod average burnup limit to 62,000 MWD/MTU will not result in a significant increase in the consequences of the accidents previously evaluated in the Surry UFSAR.

2. <u>The possibility for a new or different type of accident from any accident previously evaluated is not created</u>.

   The fuel is the only component affected by the change in the burnup limit. The change does not affect the thermal hydraulic response to any transient or accident. The fuel rod design criteria continue to be met at the higher burnup limit. Thus, the change does not create the possibility of an accident of a different type.

3. <u>The margin of safety as defined in the Bases to the Surry Technical Specifications is not significantly reduced</u>.

   The operation of the Surry cores with a limited number of fuel assemblies with some fuel rods irradiated to a lead rod average burnup of 62,000 MWD/MTU will not change the performance requirements of any system or component such that any design criteria will be exceeded. The normal limits on core operation defined in the Surry Technical Specifications will remain applicable for the irradiation of the fuel to a lead rod average burnup of 62,000 MWD/MTU. Therefore, the margin of safety as defined in Bases to the Surry Technical Specifications is not significantly reduced.

5.2 Environmental Assessment

The NRC has completed an environmental assessment of the effects of extending fuel burnup above 60,000 MWD/MTU (Reference NUREG/CR-6703, January 2001). The environmental effects of extending the Surry lead rod average burnup limit to 62,000 MWD/MTU are bounded by the NUREG.

<u>6.0 CONCLUSION</u>

The lead rod average burnup limit for the Surry units is currently limited to 60,000 MWD/MTU by References 2 and 3. Approval of the proposed amendment will allow Dominion to begin designing reloads to a lead rod average burnup limit of 62,000 MWD/MTU. Recent reload patterns have been degraded at an economic penalty to maintain the burnup below the existing limit.

The irradiation of a limited number of assemblies containing a few fuel rods that are irradiated to a lead rod average burnup limit of 62,000 MWD/MTU will not compromise the safe operation of the Surry units. Cycle specific reload calculations to confirm this conclusion will be performed and documented as part of the normal Reload Safety Evaluation. In addition, for each reload cycle in which the lead rod average burnup limit is extended beyond 60,000 MWD/MTU, the Westinghouse Fuel Criteria Evaluation Process will be used by Westinghouse and Dominion to ensure that all fuel design and damage criteria have been met. Westinghouse and Dominion will maintain auditable records resulting from this process in their respective cycle specific files. Preliminary evaluations discussed above indicate that assemblies containing rods irradiated to a lead rod average burnup of 62,000 MWD/MTU will remain acceptable from a fuel assembly and fuel rod mechanical standpoint. Core design and safety analysis limits should continue to be met.

If the cycle specific evaluations are unable to demonstrate that a design criterion will be satisfied or that the safety analyses of record remain bounding, an alternate reload pattern will be developed or the burnup will be limited to a value where all criteria remain satisfied.

7.0 REFERENCES

1. WCAP-10125-P,"Extended Burnup Evaluation of Westinghouse Fuel," December 1982.

2. Letter from the NRC (Mr. B. C. Buckley, Sr. and Mr. L. B. Engle) to Virginia Electric and Power Company (Mr. W. L. Stewart), "Surry, Units 1 and 2 and North Anna, Units 1 and 2 – Removal of 45,000 MWD/MTU Batch Average Burnup Restriction (TAC NOS. M87767, M87768, M87812, and M87813)," December 14, 1993.

3. Letter from the NRC (Mr. B. C. Buckley, Sr. and Mr. L. B. Engle) to Virginia Electric and Power Company (Mr. W. L. Stewart), "Surry, Units 1 and 2 and North Anna, Units 1 and 2 – Removal of 45,000 MWD/MTU Batch Average Burnup Restriction (TAC NOS. M87767, M87768, M87812, and M87813)," April 20, 1994.

4. Surry Updated Final Safety Analysis Report.

5. WCAP-15063-P-A, Revision 1, with Errata, "Westinghouse Improved Performance Analysis and Design Model (PAD 4.0)," July 2000.

6. NUREG/CR-6703, "Environmental Effects of Extending Fuel Burnup Above 60 GWD/MTU," January 2001.

7. WCAP-12488-A, "Westinghouse Fuel Criteria Evaluation Process," October 1994.

8. WCAP-12610-P-A, "VANTAGE+ Fuel Assembly Reference Core Report," April 1995.

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

10. 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.

11. VEP-NFE-2-A, "VEPCO Evaluation of Control Rod Ejection Transient," September 26, 1984.

12. S. L. Davidson (Ed.) et al., "VANTAGE+ Fuel Assembly Reference Core Report," WCAP-14342-A (Non-Proprietary), April 1995.

13. NRC Regulatory Guide 1.183, Rev. 0, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," July 2000.

Attachment 2

Marked-up Operating License Pages

Surry Power Station Units 1 and 2
Virginia Electric and Power Company
(Dominion)

(2) The Updated Final Safety Analysis Report supplement as revised on July 25, October 1, November 4, and December 2, 2002, shall be included in the next scheduled update to the licensee's Updated Final Safety Analysis Report required by 10 CFR 50.71(e)(4), following the issuance of this renewed license. Until that update is complete, the licensee may make changes to the programs described in such supplement without prior Commission approval, provided that the licensee evaluates each such change pursuant to the criteria set forth in 10 CFR 50.59, and otherwise complies with the requirements in that section.

4. This renewed license is effective as of the date of issuance, and shall expire at midnight on May 25, 2032.

FOR THE NUCLEAR REGULATORY COMMISSION

Samuel J. Collins, Director
Office of Nuclear Reactor Regulation

Attachment: Appendix A, Technical Specifications

Date of Issuance: March 20, 2003

Q. Fuel Burnup

Virginia Electric and Power Company may irradiate the fuel in the Surry Unit 1 reactor to a lead rod average burnup of 62,000 MWD/MTU in accordance with WCAP-12610-P-A and WCAP-12488-A.

P. <u>Updated Final Safety Analysis Report</u>

(1) The Updated Final Safety Analysis Report supplement submitted pursuant to 10 CFR 54.21(d), as revised on July 25, 2002, October 1, 2002, November 4, 2002, and December 2, 2002 describes certain future inspection activities to be completed before the period of extended operation. The licensee shall complete these activities no later than January 29, 2013, and shall notify the NRC in writing when implementation of these activities is complete and can be verified by NRC inspection.

(2) The Updated Final Safety Analysis Report supplement as revised on July 25, 2002, October 1, 2002, November 4, 2002, and December 2, 2002, shall be included in the next scheduled update to the Updated Final Safety Analysis Report required by 10 CFR 50.71(e)(4), following the issuance of this renewed license. Until that update is complete, the licensee may make changes to the programs described in such supplement without prior Commission approval, provided that the licensee evaluates each such change pursuant to the criteria set forth in 10 CFR 50.59 and otherwise complies with the requirements in that section.

4. This renewed license is effective as of the date of issuance, and shall expire at midnight on January 29, 2033.

FOR THE NUCLEAR REGULATORY COMMISSION

Samuel J. Collins, Director
Office of Nuclear Reactor Regulation

Attachment: Appendix A, Technical Specifications

Date of Issuance: March 20, 2003

Q. <u>Fuel Burnup</u>

Virginia Electric and Power Company may irradiate the fuel in the Surry Unit 2 reactor to a lead rod average burnup of 62,000 MWD/MTU in accordance with WCAP-12610-P-A and WCAP-12488-A.

Attachment 3

Proposed Operating License Pages

Surry Power Station Units 1 and 2
Virginia Electric and Power Company
(Dominion)

(2) The Updated Final Safety Analysis Report supplement as revised on July 25, October 1, November 4, and December 2, 2002, shall be included in the next scheduled update to the licensee's Updated Final Safety Analysis Report required by 10 CFR 50.71(e)(4), following the issuance of this renewed license. Until that update is complete, the licensee may make changes to the programs described in such supplement without prior Commission approval, provided that the licensee evaluates each such change pursuant to the criteria set forth in 10 CFR 50.59, and otherwise complies with the requirements in that section.

Q. Fuel Burnup

Virginia Electric and Power Company may irradiate the fuel in the Surry Unit 1 reactor to a lead rod average burnup of 62,000 MWD/MTU in accordance with WCAP-12610-P-A and WCAP-12488-A.

4. This renewed license is effective as of the date of issuance, and shall expire at midnight on May 25, 2032.

FOR THE NUCLEAR REGULATORY COMMISSION

Samuel J. Collins, Director
Office of Nuclear Reactor Regulation

Attachment: Appendix A, Technical Specifications

Date of Issuance: March 20, 2003

P. Updated Final Safety Analysis Report

(1) The Updated Final Safety Analysis Report supplement submitted pursuant to 10 CFR 54.21(d), as revised on July 25, 2002, October 1, 2002, November 4, 2002, and December 2, 2002 describes certain future inspection activities to be completed before the period of extended operation. The licensee shall complete these activities no later than January 29, 2013, and shall notify the NRC in writing when implementation of these activities is complete and can be verified by NRC inspection.

(2) The Updated Final Safety Analysis Report supplement as revised on July 25, 2002, October 1, 2002, November 4, 2002, and December 2, 2002, shall be included in the next scheduled update to the Updated Final Safety Analysis Report required by 10 CFR 50.71(e)(4), following the issuance of this renewed license. Until that update is complete, the licensee may make changes to the programs described in such supplement without prior Commission approval, provided that the licensee evaluates each such change pursuant to the criteria set forth in 10 CFR 50.59 and otherwise complies with the requirements in that section.

Q. Fuel Burnup

Virginia Electric and Power Company may irradiate the fuel in the Surry Unit 2 reactor to a lead rod average burnup of 62,000 MWD/MTU in accordance with WCAP-12610-P-A and WCAP-12488-A.

4. This renewed license is effective as of the date of issuance, and shall expire at midnight on January 29, 2033.

FOR THE NUCLEAR REGULATORY COMMISSION

Samuel J. Collins, Director
Office of Nuclear Reactor Regulation

Attachment: Appendix A, Technical Specifications

Date of Issuance: March 20, 2003