VIRGINIA ELECTRIC AND POWER COMPANY

RICHMOND, VIRGINIA 23261

November 19, 1993

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC. 20555

Serial No.	93-706
NL&P/MAE:	R0
Docket Nos.	50-338
	50-339
License Nos.	NPF-4
	NPF-7

Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION UNITS 1 and 2
PROPOSED TECHNICAL SPECIFICATIONS CHANGES
RECONSTITUTED FUEL ASSEMBLIES

Pursuant to 10 CFR 50.90, the Virginia Electric and Power Company requests amendments, in the form of changes to the Technical Specifications, to Facility Operating License Nos. NPF-4 and NPF-7 for North Anna Power Station Units 1 and 2, respectively. The proposed changes will allow the use of solid rods of zirconium alloy or stainless steel filler rods to replace fuel rods which have been identified as failed and delete the individual fuel rod uranium weight limit.

A discussion of the proposed Technical Specifications changes is provided in Attachment 1. The proposed Technical Specifications changes are provided in Attachment 2. It has been determined that the proposed Technical Specifications changes do not involve an unreviewed safety question as defined in 10 CFR 50.59 or a significant hazards consideration as defined in 10 CFR 50.92. The basis for our determination that these changes do not involve a significant hazards consideration is provided in Attachment 3. The proposed Technical Specifications changes have been reviewed and approved by the Station Nuclear Safety and Operating Committee and the Management Safety Review Committee.

Should you have any questions or require additional information, please contact us.

Very truly yours,

J. P. O'Hanlon

for W. L. Stewart
Senior Vice President - Nuclear

Attachments

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1/1

cc: U.S. Nuclear Regulatory Commission
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M. R. D. McWhorter
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Commissioner
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COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by J. P. O'Hanlon, who is Vice President - Nuclear Operations, for W. L. Stewart who is Senior Vice President - Nuclear, of Virginia Electric and Power Company. He is duly authorized to execute and file the foregoing document in behalf of that Company, and the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 19TH day of November, 1993.

My Commission Expires: May 31, 1994.

Vicki L. Hull
Notary Public

(SEAL)

Attachment 1

Discussion of Changes

DISCUSSION OF CHANGES

INTRODUCTION

On occasion, failure of individual fuel rods within the assemblies of the core may occur. These fuel rod failures may occur during routine operation of the plant or during movement of fuel assemblies. The current practice at the North Anna Power Station is to not reload fuel assemblies which are known to contain failed fuel rods, as the cladding defects of such rods allow fission products to be released to the primary coolant. However, by replacing failed fuel rods with solid filler rods made from stainless steel or a zirconium alloy, fuel assemblies which have been prematurely discharged because of the presence of the failed rods can safely be reused.

Because the Design Features section of the Technical Specifications currently precludes the use of fuel assemblies containing solid filler rods, changes to the Design Features sections of the Technical Specifications are being requested. The changes would allow the use of solid stainless steel or zirconium alloy filler rods in place of fuel rods which are known to be failed, and also remove the current fuel rod uranium weight limit of 1780 grams.

BACKGROUND

Similar proposed Technical Specifications changes were initially requested for North Anna Units 1 and 2 in January, 1990 (Reference 1).

To modify this request to be consistent with NRC Generic Letter 90-02 (Reference 2), a supplement to this submittal was issued on March 29, 1990 (Reference 3). The March 29, 1990, proposed changes placed no limit on the number of solid filler rods. However, they did require that a special report be submitted to the NRC after startup if more than a specific number of filler rods which were used in a single assembly, or more than a specific number of reconstituted assemblies were used in any given reload core. When informed by the NRC North Anna Project Manager that the Generic Letter allowing the unlimited use of filler rods might be rescinded, an additional supplemental submittal was made on December 13, 1990 (Reference 4). This December, 1990, submittal defined limits on the number of reconstituted assemblies which would be used (5 per core) as well as the number of solid filler rods which would be used in each of these assemblies (3 per assembly).

Before the NRC took action on these requested submittals, Supplement 1 to Generic Letter 90-02 (Reference 5) was issued by the NRC. After reviewing this document, it was determined that the earlier submittals for North Anna Units 1 and 2 were not completely consistent with the latest guidance, and the license amendment request was withdrawn (Reference 6). This evaluation supports a new request for changes to the Technical Specifications for North Anna Units 1 and 2 which is consistent with the guidance in Supplement 1 to NRC Generic Letter 90-02. No specific numerical limits are placed on the number of solid stainless steel or zirconium alloy filler rods which may be used in a single assembly, or on the number of reconstituted assemblies which may be used in a core. However, the use of filler rods is limited to configurations which have been analyzed with NRC approved codes and methods. Our

methodology for analyzing reconstituted fuel assemblies is discussed in the Safety Significance section of this evaluation. The use of solid stainless steel or zirconium alloy filler rods in fuel assemblies is further constrained by other requirements such as the fuel assembly mechanical design criteria. Technical Specifications which limit parameters potentially affected by the use of reconstituted fuel, such as core operating power and peaking factors, also inherently place some constraints on the locations and numbers of solid stainless steel and zirconium alloy filler rods which can be used. As discussed in the Safety Significance section, all fuel design and performance criteria will continue to be satisfied, and all pertinent licensing basis criteria will be met for the use of reconstituted fuel at the North Anna Power Station.

At the Surry Power Station, the Technical Specifications were changed in 1985 (Surry License Amendment No. 102) to allow the use of solid stainless steel and Zircaloy filler rods. A summary of our experience with the use of reconstituted fuel assemblies in reload designs at the Surry Power Station is presented in Table 1. Fuel assemblies at the Surry Power Station have had individual fuel rods replaced by rods of either solid Zircaloy-4 or solid stainless steel. We have performed all of the cycle nuclear design and safety (thermal-hydraulic, LOCA, and non-LOCA) analyses for the use of these assemblies.

In addition, some experience with reconstituted fuel has been obtained at North Anna Unit 1 in conjunction with the use of two advanced material demonstration fuel assemblies. These demonstration assemblies were designed and manufactured by the Westinghouse Electric Corporation (Westinghouse), and began operation in Cycle 7. With NRC concurrence

(Reference 7), several fuel rods were removed from one of the two demonstration assemblies after its first operating cycle. The replacement rods for this demonstration assembly were fuel rods with alternate cladding materials, in which the fuel enrichment was specified to closely match the reactivity of the replaced fuel rods. This demonstration fuel assembly is currently in its third cycle of operation (i.e., second cycle of operation for the replacement fuel rods). Because these assemblies were part of an advanced materials demonstration program, the impact on the safety analyses was initially addressed by Westinghouse. However, we performed all of the nuclear and thermal-hydraulic cycle design calculations for the use of these assemblies.

In accordance with Supplement 1 to Generic Letter 90-02, the requested changes to the North Anna Units 1 and 2 Technical Specifications will allow the use of solid stainless steel or zirconium alloy filler rods in fuel assemblies to replace failed or damaged fuel rods, provided that the new fuel assembly configurations are analyzed with applicable NRC approved codes and methods. The Safety Significance portion of this evaluation identifies the mechanical, neutronic and thermal-hydraulic analyses which are affected by the presence of the solid stainless steel and zirconium alloy filler rods. In addition, a description is provided of the methodology which will be used to assess the impact of such filler rods on the affected analyses, and to demonstrate that all applicable design criteria and pertinent licensing basis acceptance criteria are satisfied.

The safety significance of removing the limit on the total weight of uranium in each fuel rod is also assessed. Due to pellet design improvements and higher nominal fuel densities than in very early PWR fuel rods, the potential exists for the fuel weight to slightly exceed this limit. However, the actual rod uranium weight has no impact on the power limits, power operating level, or decay heat rate. Therefore, no changes to any design or safety limit are required to support this change. The deletion of the maximum rod uranium weight from the Technical Specifications has already been approved by the NRC for other licensees who also had such a weight limit in their Technical Specifications.

TECHNICAL SPECIFICATION CHANGES

General

The Technical Specification changes described herein apply to North Anna Units 1 and 2.

Technical Specification 5.3.1

The Design Features section (Technical Specification 5.3.1) will be changed to allow the use of solid stainless steel or zirconium alloy filler rods to replace failed fuel rods in fuel assemblies. This change was prepared in accordance with the guidance provided by the NRC in Supplement 1 to Generic Letter 90-02.

The revisions to Technical Specification 5.3.1 will also delete the single rod uranium weight limit of 1780 grams.

SAFETY SIGNIFICANCE

1. Fuel Reconstitution

1.1 Mechanical Design

Access to the failed rods in a fuel assembly is gained by removal of either the top or bottom fuel assembly fitting. The removed end fitting will be reattached using an attachment design (e.g., locking cup thimble screws on the bottom nozzle or insert lock tubes in the top nozzle) which is similar to that used on the fitting when the assembly was originally manufactured.

From the perspective of compliance with the the fuel assembly mechanical design and fuel coolability requirements specified in Section 4.2 of the Standard Review Plan (Reference 8), the two criteria which are impacted by fuel reconstitution are the fuel assembly holddown force and the fuel assembly structural response to seismic and LOCA loads. The design basis for the fuel assembly holddown forces requires that the fuel assembly not be allowed to lift due to flow during normal operating conditions. The basis for the fuel assembly structural response to seismic and LOCA loads is given in Appendix A to Section 4.2 of the Standard Review Plan.

The impact of fuel reconstitution on the fuel mechanical design has been assessed by the fuel vendor, Westinghouse. It was demonstrated that even for replacement of a significant fraction of the fuel rods in an assembly with solid stainless steel or zirconium alloy filler rods, the mechanical effects of reconstitution are acceptable for all Westinghouse fuel

assembly designs. Details of this evaluation are documented in Reference 9.

The fuel rod mechanical design criteria are indirectly affected by fuel reconstitution, because the displacement of active fuel rods by solid stainless steel or zirconium alloy filler rods slightly increases the core average linear heat generation rate. Those fuel rod design criteria which could be affected by this change are evaluated as part of the cycle specific fuel rod design evaluation.

All reconstituted fuel assemblies scheduled for further use will continue to satisfy the minimum fuel assembly and fuel rod mechanical design requirements.

1.2 Nuclear Design

A nuclear design evaluation, consistent with the approved methodology described in Reference 10, is performed on a cycle specific basis to demonstrate that a fuel reload will meet all applicable design criteria. Table 2 provides a list of reload design key safety parameters which are reviewed each cycle to confirm that the core configuration is bounded by existing safety analyses. This safety evaluation process is discussed in more detail in Section 1.4 below.

Reconstituted assemblies will be incorporated into core loading plans as normal assemblies. Reconstituted assemblies will typically be grouped with other fuel assemblies with similar exposure histories, and the assemblies in these groups will then be placed in symmetric core

locations. Alternatively, a reconstituted fuel assembly may be used singly in the center of the core. Once a decision is made by the nuclear design group on which reconstituted assemblies will be used in a specific reload, the appropriate core physics models will be applied to reflect the actual geometry of the reconstituted assemblies in that reload cycle.

Fuel assembly reconstitution affects reactivity and local peaking due to the redistribution of power within the assembly. In the nuclear design analysis for each reload, reconstituted assemblies will be explicitly modeled in a conservative manner on a pin-by-pin basis to evaluate the effect on local power peaking and corewide reactivity parameters (i.e., critical boron concentration and boron coefficient). If the effect is significant, it will be reflected in all phases of the design and safety analysis by either explicit calculations or additional uncertainties, as appropriate, to ensure that the reconstituted assemblies are treated in a conservative manner.

1.3 Thermal and Hydraulic Design

The thermal-hydraulic evaluation of reconstituted fuel assemblies is performed in accordance with the thermal-hydraulic methodology described in References 11 and 12, using NRC approved codes and methods. The evaluation assesses the safety significance of fuel rod reconstitution and ensures that a core containing reconstituted fuel meets the same design criteria which are applicable to existing fuel designs.

Fuel rod reconstitution affects predictions of departure from nucleate boiling (DNB) in hot channels due to a local power reduction and the

resultant effects on enthalpy and flow. The DNB effects of fuel reconstitution are evaluated on a cycle specific basis to account for the local power reduction which occurs when fuel rods are replaced with solid stainless steel or zirconium alloy filler rods. Reference 9 shows that it is conservative to model a reconstituted assembly as a regular fuel assembly in DNB analyses.

The results of the evaluation in Reference 9 are also applicable to our methods because our thermal-hydraulic evaluation methodology is based on the Westinghouse methodology (Reference 11). The Westinghouse WRB-1 correlation has also been used with our COBRA models to perform DNB safety analyses for the use of Westinghouse fuel in North Anna Units 1 and 2 (Reference 13). This correlation has been applied to the analyses of both the older 17x17 Westinghouse fuel design with all Inconel grids (also known as their low parasitic, or LOPAR design) and the current Westinghouse 17x17 VANTAGE 5H fuel, which has Inconel top and bottom grids, but Zircaloy-4 mid-grids.

Using the design basis radial power distribution with our COBRA models, we performed the same set of DNB calculations described by Westinghouse in Reference 9. The results of these calculations confirmed that the thermal-hydraulic evaluations in Reference 9, including the conclusions about the effect of reconstitution on the DNB margins of adjacent fuel assemblies, are applicable to our methodology for the use of reconstituted fuel.

The DNB design basis defined in Reference 11 remains applicable for reconstituted cores. As discussed in Reference 9, cycle specific

evaluations will be performed for reload cores using reconstituted fuel. These evaluations, which will consider the exact configuration and associated core power distribution of the reconstituted assemblies, will confirm the conservative assumption that a reconstituted assembly is bounded by a regular fuel assembly in DNB analyses.

1.4 Non-LOCA Evaluation

Reload safety analyses are performed in accordance with the approach discussed in Reference 10 to determine if a core configuration is bounded by existing safety analyses. The reload design methodology defines a set of key analysis parameters (Table 2) that fully describe a valid conservative safety analysis (reference analysis). If the values of the key analysis parameters for a reload core are conservatively bounded by the values of these parameters for the reference analysis, this reference analysis is bounding and further analysis is unnecessary. When a key analysis parameter is not bounded, further analysis is considered necessary to ensure that the required safety margin is maintained. This last determination is made either through a complete reanalysis of the accident, or through a simpler, though conservative, evaluation process using parameter sensitivities. Any reanalysis will follow standard procedures and employ models and methods which have been used and approved in previous submittals to the NRC.

The Standard Review Plan (Reference 8) design parameters which may be impacted by fuel reconstitution are:

1. Fuel pellet overheating
2. Non-LOCA clad temperature
3. Clad embrittlement during locked rotor/shaft break accident
4. Violent expulsion of fuel (during a rod ejection accident)
5. Power distribution

The potential for fuel reconstitution to affect these parameters is due to the increase in the core average linear heat generation rate that results when fuel rods are removed and the core power level is unchanged. Although the impact is very small (for example, replacement of two fuel rods in each of four assemblies, or eight rods total, with solid stainless steel or zirconium alloy filler rods increases the core average linear heat generation rate by only 0.02 percent), this in turn increases the fuel rod heat flux and the nominal fuel temperatures.

Increases in the nominal fuel and clad temperatures and the fuel rod heat flux may affect the non-LOCA licensing basis analysis results for peak fuel and clad temperatures as well as the margin to the critical heat flux (minimum DNB ratio, or DNBR). The cycle specific non-LOCA safety evaluations are designed to identify any changes in the fuel design which may invalidate existing safety analyses and also to address all the above design parameters. Therefore, the cycle specific Reload Safety Evaluation process will ensure that the impact of the use of reconstituted fuel assemblies is evaluated for the appropriate non-LOCA analyses.

1.5 LOCA Evaluation

As discussed in Reference 10, our normal reload design methodology assures that fuel parameters which are significant to analyses of the Emergency Core Cooling System either remain applicable to or bounded by the parameter values used in the LOCA analysis. LOCA analyses for North Anna Units 1 and 2 are performed by our personnel using Westinghouse models and methodology. The discussion of the impact of fuel reconstitution on LOCA evaluations in Reference 9 is therefore directly applicable to the use of reconstituted fuel in North Anna Units 1 and 2.

The impact of fuel reconstitution on the LOCA methodology is defined in detail in Reference 9, and may be summarized as follows:

1. If the failed fuel rods are replaced by fuel-bearing rods, the enrichment of the replacement rods is tailored to approximate the power generation of the rods being replaced. Typically, there will be no effect on the LOCA analysis of record as the result of this type of fuel reconstitution.
2. For replacement of failed fuel rods with solid stainless steel or zirconium alloy filler rods:
    a. A conservative peak clad temperature penalty will be assessed to account for the possible steady state effects on the Large Break LOCA only. The magnitude of this penalty is defined in Reference 9, and is proportional to the number of reconstituted rods in the fuel assembly.
    b. Based on the number of failed fuel rods to be replaced, the potential increase in linear heat rate to retain total core power constant at its rated value will be calculated. This change will be incorporated into both the Large Break and Small Break LOCA analyses. Evaluations of the change in linear heat rate will be performed to assess the Peak Clad Temperature (PCT) penalty for the number of rods to be reconstituted.

3. The total PCT effect is determined by adding the contributions described above. This total effect is then added to the sum of the evaluations performed to date for the current plant configuration. This reconstitution penalty will be tracked throughout the core residence of the affected assemblies, and will be removed from the plant assessment against PCT margin when the reconstituted assemblies are removed from the core.

Presuming ongoing tracking of the reconstituted assemblies and available margin, the use of reconstituted fuel can be addressed on a cycle specific basis under the auspices of 10CFR50.59 with respect to the LOCA analyses.

2. Removal of Weight Limit on Individual Fuel Rods

Technical Specification 5.3.1 currently defines a maximum total uranium weight per rod of 1780 grams. This value was originally intended to be descriptive and representative of the fuel loading (Reference 14). Due to pellet design modifications (including changes to the dish size and the use of chamfered pellets), it has become possible for fuel rods with as-built pellet densities which fall toward the high end of the normal allowable manufacturing range to slightly exceed the specified maximum uranium weight. Such rods would typically exceed the current weight limit by less than 5 grams uranium.

The description in Technical Specification 5.3.1 contains the only reference to fuel rod weight in the Technical Specifications. Fuel rod design calculations use fuel and cladding dimensions as well as the initial fuel density in predictions of operating performance. The individual fuel rod mass is not input directly into the calculation. Uncertainties in the evaluation are set to cover the range of densities and dimensions allowed by the manufacturing tolerances and

specifications. Thus, fuel performance calculations remain valid over the possible range of manufactured fuel rod weights.

Although a number of safety analyses are indirectly affected by the fuel weight, the analyses are more sensitive to the fuel configuration, length, enrichment, and physical design, which are also specified in the Technical Specifications. The Technical Specifications for each unit limit power and power distribution, thus controlling the fission rate and the rate of decay heat production. Fuel rod weight does not have any direct bearing on the power limits, power operating level, or decay heat rate. The composition of the fuel is closely monitored during fabrication to assure acceptable fuel performance. The fuel weight changes that could be made as a result of eliminating the limit from the Technical Specifications are not of sufficient magnitude to cause a significant difference in fuel performance. There are no expected observable changes in normal operation due to minor fuel rod weight changes, and the remaining fuel parameters listed in the Technical Specifications are considered in the Reload Safety Evaluation process (Reference 10).

Other Design Basis Events were examined to assess the effects of possible changes in fuel rod weight. Fuel rod weight will only change as a result of a specific change in the physical design, which is addressed within the Reload Safety Evaluation process or within the manufacturing tolerances. The small variations allowed by the fuel design tolerances are inherently incorporated into existing design calculation uncertainties. The fuel vendor manufacturing specifications on fuel density and pellet dimensions will continue to limit the amount of fuel in an individual rod.

Changes in nuclear design resulting from fuel rod weight changes are controlled as discussed above. New and spent fuel criticality analyses are unaffected by the small variations in fuel assembly (or fuel rod) uranium mass. The fuel assembly fission product source term is insensitive to small variations in fuel mass, so the effects of a fuel handling accident will remain bounded by existing analyses. Fuel handling equipment and procedures are not affected. Seismic and LOCA analyses contain sufficient conservatism to bound these weight changes. Other accident analyses are not affected by rod weight as a direct parameter, and the existing analyses remain bounding.

No changes are being made to any design or safety related limit in conjunction with this Technical Specifications change. Confirmation that the limits are satisfied will continue to occur as part of the Reload Safety Evaluation process.

3. Assessment of Unreviewed Safety Question

From the evaluations presented above, it is concluded that neither the deletion of the individual fuel rod uranium weight limit nor the use of fuel assemblies containing solid stainless steel or zirconium alloy filler rods will result in the acceptable safety limits for any incident being exceeded at North Anna Units 1 and 2. It has also been determined that an unreviewed safety question as defined in 10 CFR 50.59 does not exist due to either of the proposed changes. The basis for this determination is delineated below.

3.1 Probability of Previously Evaluated Accidents

This Safety Assessment documents that the probability of an accident previously evaluated in the North Anna Units 1 and 2 UFSAR is not increased. The designs for all cycles at both units will continue to meet all applicable design criteria and ensure that all pertinent licensing basis acceptance criteria are met. Though the fuel and core designs are not directly related to the probability of occurrence of any previously evaluated accident, the demonstrated adherence to applicable standards and acceptance criteria precludes new challenges to components and systems that could increase the probability of any previously evaluated accident. Specifically, neither the use of solid stainless steel or zirconium alloy filler rods in the fuel assemblies nor the removal of the individual fuel rod uranium weight limit will increase the probability of occurrence of an accident previously evaluated in the North Anna Units 1 and 2 UFSAR. The clad integrity is maintained and the structural integrity of the fuel rods, fuel assemblies, and core is not adversely affected. Use of solid filler rods in fuel assemblies enhances the fuel assembly structural capability. Neither removal of the rod uranium weight limit nor the use of solid stainless steel or zirconium alloy filler rods will cause the core to operate in excess of pertinent design basis operating limits. Therefore, the probability of occurrence of an accident previously evaluated in the UFSAR has not increased.

3.2 Consequences of Previously Evaluated Accidents

This Safety Assessment documents that the consequences of an accident previously evaluated in the North Anna Units 1 and 2 UFSAR are not

increased. The reload core designs for both units will continue to meet the same fuel assembly and fuel rod design criteria as the current fuel assemblies, and will ensure that all pertinent licensing basis acceptance criteria are met. The demonstrated adherence to these standards and criteria precludes new challenges to components and systems that could (a) adversely affect the ability of existing components and systems to mitigate the consequences of any accident, and/or (b) adversely affect the integrity of the fuel rod cladding as a fission product barrier. Furthermore, adherence to applicable standards and criteria ensures that these fission product barriers maintain design margin to safety limits. Neither the removal of the individual rod uranium weight limit nor the use of solid stainless steel or zirconium alloy filler rods will increase the consequences of an accident previously evaluated in the North Anna Units 1 and 2 UFSAR. Since the dose predictions presented in the UFSAR are not sensitive to the presence of a small number of unfueled rods or to variations in individual fuel rod weights, the radiological consequences of accidents previously evaluated in the North Anna Units 1 and 2 UFSAR have not increased.

3.3 Possibility of Accidents Not Previously Evaluated

This Safety Assessment documents that the possibility of an accident which is different from any already in the North Anna Units 1 and 2 UFSAR is not created. The cycle designs for each unit will meet all applicable design criteria and ensure that all pertinent licensing basis acceptance criteria are met. The demonstrated adherence to these standards and criteria precludes new challenges to components and systems that could introduce a new type of accident. Specifically, neither the removal of

the individual rod uranium weight limit nor the use of solid stainless steel or zirconium alloy filler rods in the core will create the possibility of an accident of a different type than any previously evaluated in the North Anna Units 1 and 2 UFSAR. In all cases, the fuel assemblies, including those containing the stainless steel or zirconium alloy filler rods, will satisfy the same design bases used for fuel assemblies in previous fuel regions (References 10, 15 through 17). All design and performance criteria will continue to be met. No new single failure mechanisms have been created, nor will the core operate in excess of pertinent design basis operating limits. Therefore, the possibility of an accident of a different type than any previously evaluated in the UFSAR has not been created.

3.4 Probability of Previously Evaluated Malfunction of Equipment Important to Safety

This Safety Assessment documents that the probability of a malfunction of equipment important to safety previously evaluated in the North Anna Units 1 and 2 UFSAR is not increased. The cycle designs at both units will meet all applicable design criteria and ensure that all pertinent licensing basis acceptance criteria are met. Demonstrated adherence to applicable standards and acceptance criteria precludes new challenges to components and systems that could increase the probability of any previously evaluated malfunction of equipment important to safety. Neither the use of solid stainless steel or zirconium alloy filler rods in compliance with the methodology described, nor the deletion of the individual fuel rod uranium weight limit, will increase the probability of occurrence of a malfunction of equipment important to safety previously

evaluated in the North Anna Units 1 and 2 UFSAR. No new performance requirements are being imposed on any system or component such that any design criteria will be exceeded, nor will the core be operated in excess of pertinent design basis operating limits. No new modes or limiting single failures have been created with the use of solid stainless steel or zirconium alloy filler rods or with the removal of the individual rod weight limit. Therefore, the probability of occurrence of a malfunction of equipment important to safety previously evaluated in the UFSAR has not increased.

3.5 Consequences of Previously Evaluated Malfunction of Equipment Important to Safety

This Safety Assessment documents that the consequences of a malfunction of equipment important to safety previously evaluated in the North Anna Units 1 and 2 UFSAR are not increased. The reload cycle designs for each unit will continue to meet all applicable design criteria and ensure that all pertinent licensing basis acceptance criteria are met, so the bases (assumptions, actions, etc.) for the current analyses described in the North Anna Units 1 and 2 UFSAR remain valid. The demonstrated adherence to these standards and criteria precludes new challenges to components and systems that could (a) adversely affect the ability of existing components and systems to mitigate the consequences of any accident, and/or (b) adversely affect the integrity of the fuel rod cladding as a fission product barrier. Furthermore, adherence to applicable standards and criteria ensures that these fission product barriers maintain the design margin of safety. Specifically, neither the use of a limited number of solid stainless steel or zirconium alloy filler rods nor the

removal of the individual rod uranium weight limit will increase the consequences of a malfunction of equipment important to safety previously identified in the North Anna Units 1 and 2 UFSAR. The dose predictions presented in the UFSAR are not sensitive to the presence of a very small number of unfueled rods in the core or to minor variations in individual fuel rod weights. There is no change to the performance requirements of any system or component such that any design criteria will be exceeded. Similarly, neither the use of solid stainless steel or zirconium alloy filler rods nor the removal of the individual fuel rod weight limit will cause the core to operate in excess of pertinent design basis operating limits. No new modes or limiting single failures have been created. Therefore, the radiological consequences of a malfunction of equipment important to safety previously evaluated in the North Anna Units 1 and 2 UFSAR have not increased.

3.6 Possibility of Malfunction of Equipment Important to Safety Not Previously Evaluated

This Safety Assessment documents that the possibility of a malfunction of equipment important to safety different from any already evaluated in the North Anna Units 1 and 2 UFSAR is not created. The cycle designs will meet all applicable design criteria and ensure that all pertinent licensing basis acceptance criteria are met. The demonstrated adherence to these standards and criteria precludes new challenges to components and systems that could introduce a new type of malfunction of equipment important to safety. Specifically, neither the use of solid stainless steel or zirconium alloy filler rods, nor the removal of the individual fuel rod uranium weight limit, will create the possibility of a

malfunction of equipment important to safety of a different type than any previously evaluated in the North Anna Units 1 and 2 UFSAR. All original design and performance criteria continue to be met, and no new failure modes have been created for any system, component, or piece of equipment. No new single failure mechanisms have been introduced, nor will the core operate in excess of pertinent design basis operating limits. Therefore, the possibility of a malfunction of equipment important to safety of a different type than any previously evaluated in the UFSAR has not been created.

3.7 Margin of Safety

This Safety Assessment documents that the margin of safety as defined in the Bases to any Technical Specifications is not reduced. The cycle designs at both units will meet all applicable design criteria and ensure that all pertinent licensing basis acceptance criteria are met. The North Anna Units 1 and 2 current design and safety limits, as supported by the applicable Technical Specifications, remain applicable. Neither the use of fuel assemblies containing a limited number of solid stainless steel or zirconium alloy filler rods, nor the removal of the individual fuel rod uranium weight limit, will reduce the margin of safety as defined in the basis for any Technical Specification. The use of such fuel assemblies will continue to be bounded by the normal core operating conditions defined in the Technical Specifications. For each cycle reload core, the fuel assemblies will be specifically evaluated using approved reload design methods (Reference 10) and approved fuel rod design models and methods (References 15 through 17). This will include consideration of the core physics analysis peaking factors and core average linear heat

rate effects, and effects on safety and LOCA analyses, and on thermal hydraulic calculations (particularly DNB). Therefore, the margin of safety as defined in the Bases to the Technical Specifications has not been reduced.

4. Conclusions

The Technical Specifications ensure that the plants operate in a manner that provides acceptable levels of protection for the health and safety of the public. The Technical Specifications are based upon assumptions made in the safety and accident analyses, including those relating to the core design. This ensures adequate margin to the regulated acceptance criteria for the accident analyses. It has been concluded that the core design parameters and assumptions utilized in the accident analyses remain applicable for the removal of the individual fuel rod uranium weight limit and the use of solid stainless steel or zirconium alloy filler rods in place of failed fuel rods. Therefore the regulated margin of safety as defined in the Bases of the Technical Specifications is not affected by removal of the individual rod weight limit or by the use of reconstituted fuel assemblies in North Anna Units 1 and 2.

Based on the evaluations and analysis results presented above, it can be concluded that neither the use of a limited number of solid stainless steel or zirconium alloy filler rods, nor the removal of the individual fuel rod uranium weight limit, will significantly affect the performance of the fuel assemblies, and that these changes to the Technical Specifications do not constitute an unreviewed safety question as defined by 10 CFR 50.59 (a)(2).

SUMMARY

The foregoing analyses and evaluations demonstrate that the conclusions of the accident analyses in the North Anna Units 1 and 2 UFSAR remain valid for both the proposed use of solid stainless steel or zirconium alloy filler rods in the fuel assemblies and for the removal of the individual fuel rod uranium weight limit. The core design parameters and assumptions utilized in the accident analyses remain applicable for both the use of solid stainless steel or zirconium alloy filler rods and the removal of the individual fuel rod uranium weight limit. The impact of either of these changes was evaluated for each pertinent design and safety criterion, and all evaluation results were found to be acceptable.

Table 1

Experience with Reconstituted Fuel at Surry

Total number of assemblies reconstituted:	32
Total number of rods replaced:	60
Typical number of rods replaced per assembly:	1 to 4
Number of reconstituted assemblies used to date:	30
Number used for one additional cycle:	7
Number used for two additional cycles:	23

Table 2

Reload Design Key Safety Parameters

Core Thermal Limits
Moderator Temperature (Density) Coefficient
Doppler Temperature Coefficient
Doppler Power Coefficient
Delayed Neutron Fraction

Prompt Neutron Lifetime
Boron Worth
Control Bank Differential Worth
Dropped Rod Worth
Ejected Rod Worth

Shutdown Margin
Boron Concentration for Required Refueling Shutdown Margin
Reactivity Insertion Rate Due to Rod Withdrawal
Trip Reactivity Shape and Magnitude
Power Peaking Factor

Limiting Total Peaking Factor * Power Vs. Core Height
Maximum (from Depletion) Total Peaking Factor * Power Vs. Core Height
Radial Peaking Factor
Ejected Rod Hot Channel Factor
Initial Fuel Temperature

Initial Hot Spot Fuel Temperature
Fuel Power Census
Densification Power Spike
Axial Fuel Rod Shrinkage
Fuel Rod Internal Gas Pressure

Fuel Stored Energy
Decay Heat
Overpower Peak kW/ft

REFERENCES

1. Letter from W. L. Stewart (Virginia Electric and Power Company) to the U.S. NRC, "North Anna Power Station Units 1 and 2 Proposed Technical Specifications Change," Serial No. 89-773, January 16, 1990.

2. NRC Generic Letter 90-02, "Alternative Requirements for Fuel Assemblies in the Design Features Section of Technical Specifications," February 1, 1990.

3. Letter from W. L. Stewart (Virginia Electric and Power Company) to the U.S. NRC, "North Anna Power Station Units 1 and 2 Proposed Technical Specifications Change - Supplement," Serial No. 89-773A, March 29, 1990.

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