UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NOS. 198 AND 179 TO

FACILITY OPERATING LICENSE NOS. NPF-4 AND NPF-7

VIRGINIA ELECTRIC AND POWER COMPANY

OLD DOMINION ELECTRIC COOPERATIVE

NORTH ANNA POWER STATION, UNITS NO. 1 AND NO. 2

DOCKET NOS. 50-338 AND 50-339

1.0 INTRODUCTION

By letter dated October 17, 1995, as supplemented by facsimile on February 26, 1996, Virginia Electric and Power Company (the licensee) proposed an amendment to the North Anna Units 1 and 2 (NA-1&2) Technical Specifications (TS). Specifically, the proposed amendment requested changes to TS section 3.9.4, Containment Building Penetrations, to allow both containment personnel airlock (PAL) doors to remain open during fuel movements or core alterations provided that one door is operable, the door is unblocked and a designated individual is continuously available to close the airlock door after personnel are evacuated if a Fuel Handling Accident (FHA) should occur. Furthermore, section 3.9.4 would be revised to allow both PAL doors to be open only if: (1) at least 23 feet of water is above the top of the reactor pressure vessel (RPV) flange during movement of fuel assemblies within the containment; and (2) at least 23 feet of water is above the top of irradiated fuel assemblies within the reactor pressure vessel during core alterations excluding the movement of fuel assemblies.

The licensee has also proposed changes to the TS bases to clarify the emergency power system requirements relative to mitigation of the consequences of an FHA. Specifically, TS bases section 3/4.8.1 and 3/4.8.2 are being changed to clarify that one train of A.C. and D.C. busses must be available during fuel movement to ensure that the Control Room emergency ventilation system is operable in the event of an FHA. In addition, proposed changes to the facility operating licenses are requested to delete License Condition 2.G for Unit 1 and License Condition 2.I for Unit 2. These license conditions reference the analyses for limiting doses to the control room operators. The February 26, 1996 facsimile was within the scope of the original no significant hazards consideration determination.

2.0 EVALUATION

2.1 Deletion of License Conditions 2.G for Unit 1 and 2.I for Unit 2

On February 28, 1990, the NRC issued Amendment Nos. 126 and 110 to Facility

Operating License Nos. NPF-4 and NPF-7 for North Anna Units 1 and 2, respectively, in response to the licensee's application of March 1, 1989 and December 22, 1989. The amendments added the following sentence as License Condition 2.G for Unit 1 and 2.I for Unit 2:

> The limiting dose to the control room operators shall be revised in accordance with the licensee's submittals dated March 1, 1989 (Serial No. 89-022) and December 22, 1989 (Serial No. 89-022A).

The licensee subsequently incorporated the revised control room dose analyses in revision 23 (October 1993) of the Updated Final Safety Analysis Report (UFSAR), revising the sections on Habitability Systems Functional Design (6.4.1), Control Room Availability (7.7.1.13), the design of the Main Control Room air-conditioning, heating, cooling and ventilation systems (9.4.1) and the Main Control Room Shielding (12.1.2.10).

The license amendment was proposed to resolve an unreviewed safety question associated with control room ingress and egress after an accident. In this case, the original control room dose analysis had not accounted for the impact on control room doses of air infiltration resulting from control room personnel ingress and egress after an accident. The licensee subsequently reevaluated control room doses for certain accidents including the impact of air infiltration to the control room from multiple ingress and egress. The unreviewed safety question associated with this analysis was resolved by amending the Facility Operating Licenses to reference the revised control room dose analysis submittal since the analysis is not an item covered in the TS.

The proposed changes to the TS to allow both PAL doors to remain open during refueling operations is supported by a new FHA analysis including a revised assessment of control room doses. Based on the results of this new FHA analysis, the limiting doses to control room operators still result from the main steam line break and steam generator tube rupture as described in the facility operating licenses. However, because these limiting doses are now described in the UFSAR and the NRC Safety Evaluation Report supporting Amendment Nos. 126 and 110, facility operating license conditions 2.G for Unit 1 and 2.I for Unit 2 are no longer necessary. Therefore, deletion of License Condition 2.G for North Anna Unit 1 and 2.I for North Anna Unit 2 is acceptable.

2.2 Revision to TS 3.9.4

Airlocks

TS 3.9.4 currently requires that one of the containment PAL doors be closed during core alterations or movement of irradiated fuel in containment which results in cycling of the personnel airlock doors for each containment entry. Frequent containment entries are required while core alterations or fuel movement is in progress and the resulting heavy use of the personnel airlock produces wear and high maintenance requirements.

Therefore, the licensee proposes to revise TS 3.9.4 to allow the opening of both PAL doors at the same time during fuel movement or core alterations as

long as certain conditions are met. This would reduce airlock door wear and would facilitate personnel access. When both airlock doors are open, a footnote to TS 3.9.4 will ensure that there is 23 feet of water above the fuel assemblies to provide iodine scrubbing in the event of an accident. TS 3.9.3 will ensure a minimum 150-hour period between unit shutdown and initiation of fuel movement; the dose analyses by the licensee and staff conservatively include only 100 hours of radioactive decay.

The footnote to 3.9.4b proposed by the licensee stated that both doors of the containment personnel airlock may be open provided that one personnel airlock door is OPERABLE. However, OPERABLE was not defined in the footnote. Instead, the licensee defined OPERABILITY of the containment airlock door in the BASES for 3/4.9.4. Of the conditions proposed by the licensee in the BASES, only two were relied on in the staff's evaluation of this license amendment; namely, that the door would be capable of being closed and that the licensee designate some individual to close the airlock door in the unlikely event that there was a fuel handling accident resulting in a significant release of radioactivity. The staff's position on "capable of being closed" is exactly what it says. One of the doors has to be able to be closed; it does not have to be sealed or meet the leakage criteria in TS 3.6.1.3/SR 4.6.1.3 that have to be met in Modes 1, 2, 3 and 4. The licensee has proposed that the individual designated to close the airlock door must be stationed near the airlock. This is acceptable but beyond what the staff has approved for other licensees. The staff's position is that there should be an individual, who, in addition to his normal duties, also is responsible for making sure one of the personnel airlock doors is closed when the last person is out of containment. The individual should not be outside the protective area but neither does the person have to remain near the airlock. In the BASES for 3/4 9.4, the licensee also proposed a condition that the airlock door is unblocked and no cables or hoses are being run through the airlock. This is acceptable but also beyond what the staff has approved in other licensee amendments. Licensees normally place guards over the door seals to protect the seals from being damaged by persons bringing tools and equipment through the airlock. This is not considered as blocking the door as long as they are removable in a reasonable time.

As noted above, two of the definitions of OPERABILITY for the airlock doors were relevant to the staff finding the proposed amendment acceptable. It was the staff's position that the term "OPERABLE" should be defined to reflect these two conditions, even though they would be in the BASES. By facsimile of February 26, 1996, the licensee amended the application to amplify footnote "a" to define OPERABLE as meaning the door is capable of being closed and that an individual is designated to close the door. With this clarification, the proposed TS changes are acceptable.

2.3 Fuel Handling Accident Evaluation

During core alterations, the most severe radiological consequences result from an FHA. The FHA is a postulated event that involves damage to irradiated fuel. FHAs include dropping a single irradiated fuel assembly and handling tool or a heavy object onto other irradiated fuel assemblies. The TS requirements associated with refueling are intended to ensure that the release

of fission product radioactivity, subsequent to an FHA, results in doses that are "well within" the guideline values specified in 10 CFR Part 100. Standard Review Plan (SRP) Section 15.7.4, Rev. 1, defines "well within" 10 CFR Part 100 to be 25% or less of the 10 CFR Part 100 values, i.e., 6 rem to the whole body and 75 rem to the thyroid.

Regulatory Guide (RG) 1.25, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Fuel Handling Accident in the Fuel Handling and Storage Facility for Boiling and Pressurized Water Reactors," provides acceptable assumptions that may be used in evaluating the radiological consequences of an FHA. The licensee's FHA analysis is consistent with the assumptions of RG 1.25.

Control room habitability following an FHA must also be considered using the dose criteria in 10 CFR Part 50, Appendix A, General Design Criteria 19 (GDC 19). During core alterations or fuel movements at North Anna, direct communication is established between fuel handling personnel in containment and the control room. Upon verbal notification of an FHA with the potential for radionuclide release or upon receipt of a high radiation signal from the containment radiation monitors, the control room will be manually isolated, and the bottled air supply initiated. The licensee has stated that it is estimated that up to a 2-minute delay can occur between detection of a high radiation level and isolation of the control room. However, the transit time for any released activity from the radiation detection point is expected to exceed 2 minutes. Therefore, control room isolation is modeled as occurring at the start of the accident. The licensee's analysis assumes the control room is supplied with bottled air for 1 hour after the start of an FHA and then with filtered air at a flow rate of 1000 cubic feet per minute (cfm) with an iodine filtration efficiency of 95% for organic and inorganic iodine through the remainder of the 30-day dose calculation period. No credit is taken for operation of fan/filter units to provide recirculation of the control room air. The fan/filter unit which supplies the 1000 cfm of filtered intake is supplied by emergency power to ensure that GDC 19 limits are met. The licensee found that the dose consequences calculated from the analyses met the applicable dose acceptance criteria.

The staff's analysis used the accident source term given in RG 1.4, assumptions contained in RG 1.25, and the review procedures specified in SRP Section 15.7.4. The staff assumed an instantaneous puff release of noble gases and radioiodine from the gap of the broken fuel rods as gas bubbles pass up through the 23 feet of water covering the fuel. All airborne radioactivity reaching the containment atmosphere is exhausted within 2 hours into the environment. All radioactive material in the fuel rod gap is assumed to have decayed for a period of 100 hours. The staff assumed an entire fuel assembly of 264 rods is damaged by the FHA.

The staff computed the control room operator doses and the doses for the exclusion area boundary (EAB), using the NRC computer code HABIT, Version 1.1., Table 1, which presents the doses calculated by the staff and the applicable acceptance criteria. Table 2 presents the staff's calculational assumptions. The offsite and control room doses are within the acceptance criteria given in SRP Section 15.7.4 and GDC 19.

The staff's dose calculation was based on the assumption that all of the radioactive material released to the containment escapes the containment within 2 hours. However, the staff has historically required plant technical specifications to maintain containment closure during core alterations and fuel handling as a defense-in-depth measure to further limit releases. Recently the staff has allowed changes to plant technical specifications to keep both doors to a containment air lock open during core alterations and fuel handling with provisions in place to close one door quickly, thereby reestablishing containment closure. The provisions described in this safety evaluation provide reasonable assurance that containment closure as a defense-in-depth measure can be reestablished quickly to limit releases to much lower than assumed in the dose calculations.

The staff has reviewed the licensee's analysis and has performed an independent assessment of the radiological consequences resulting from a fuel handling accident during refueling operations with the containment air locks open. The staff concludes that the radiological consequences associated with this accident are within the acceptance criteria set forth in 10 CFR Part 100 and the control room operator dose criteria specified in GDC-19 of Appendix A to 10 CFR Part 50 and are acceptable. Based on these reasons, the staff finds the proposed changes to TS 3.9.4 acceptable.

3.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Virginia State official was notified of the proposed issuance of the amendment. The State official had no comment.

4.0 ENVIRONMENTAL CONSIDERATION

The amendments change a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 or change a surveillance requirement. The staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluent that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration and there has been no public comment on such finding (61 FR 187). Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9).

Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of these amendments.

5.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such

activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

Attachment: Tables 1 and 2

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TABLE 1

CALCULATED RADIOLOGICAL CONSEQUENCES
(rem)

Exclusion Area Boundary	Dose	SRP 15.7.4 Guidelines
Whole Body	0.01	6
Thyroid	44	75
Control Room Operator	**Dose**	**GDC-19 Guidelines**
Whole Body	< 1	5
Thyroid	21	Equivalent to 5 rem whole body*

* Guideline doses provided in Standard Review Plan Section 6.4 define the dose-equivalent as 30 rem to the thyroid.

TABLE 2

ASSUMPTIONS USED FOR CALCULATING RADIOLOGICAL CONSEQUENCES

Input Parameters	Quantity
Power Level, Mwt	2900
Number of Fuel Rods Damaged	264
Total Number of Rods	41,448
Shut time, hours	100
Power Peaking Factor	1.65
Fission Product Release Duration	2 hours
Release Fraction	
Iodine	10%
Noble Gas	10%
Krypton Gas	30%
Iodine Form	
Elemental	75%
Organic	25%
Core Fission Product Inventories per TID-14844	
Receptor Point Variables	
Exclusion Area Boundary**	
Atmospheric Relative Concentration, X/Q (sec/m^3) 0-2 hours (NUREG-0053, Supplement No.6)	4.2×10^{-4}
Control Room	
Atmospheric Relative Concentration, X/Q (sec/m^3)	6.0×10^{-3}
Control Room Volume, cubic feet	23.0×10^{4}
Maximum Infiltration Rate, ft^3/min	1000
Iodine Protection Factor	30
Geometry Factor	18.1