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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATING TO REQUEST FOR REVISED EXEMPTION FROM 10 CFR 70.24(a)

VIRGINIA ELECTRIC AND POWER COMPANY

SURRY POWER STATION, UNITS 1 AND 2

DOCKET NO. 50-280 & 50-281

1.0 INTRODUCTION

By letter dated January 14, 1998, Virginia Electric and Power Company, (the licensee) requested a revised exemption from the requirements of 10 CFR 70.24(a) to reflect the use of 4.3 weight percent enriched U235 fuel. An exemption previously granted August 21, 1997, reflected the use of fuel enriched to 4.1 weight percent U235. The Commission has reviewed the licensee's submittal and has determined that procedures and design features make an inadvertent criticality in special nuclear materials handling or storage at the Surry Power Station unlikely, in accordance with General Design Criterion 62, as described below.

2.0 EVALUATION

Title 10 of the Code of Federal Regulations (10 CFR) Section 70.24, "Criticality Accident Requirements," at subsection (a) requires that each licensee authorized to possess special nuclear material shall maintain in each area where such material is handled, used, or stored, a criticality accident monitoring system "using gamma- or neutron-sensitive radiation detectors which will energize clearly audible alarm signals if accidental criticality occurs." Subsection (a)(1) and (a)(2) of
10 CFR 70.24 specify the detection, sensitivity, and coverage capabilities of the monitors required by 10 CFR 70.24(a). Subsection (a)(3) of 10 CFR 70.24 requires that the licensee shall maintain emergency procedures for each area in which this licensed special nuclear material is handled, used, or stored and provides (1) that the procedures ensure that all personnel withdraw to an area of safety upon the sounding of a criticality monitor alarm, (2) that the procedures must include drills to familiarize personnel with the evacuation plan, and (3) that the procedures designate responsible individuals for determining the cause of the alarm and placement of radiation survey instruments in accessible locations for use in such an emergency. Subsection (b)(1) of 10 CFR 70.24 requires licensees to have a means to identify quickly personnel who have received a dose of 10 rads or more. Subsection (b)(2) of 10 CFR 70.24 requires licensees to maintain personnel decontamination facilities, to maintain arrangements for a physician and other medical personnel qualified to handle radiation emergencies, and to maintain arrangements for the transportation of contaminated individuals to treatment facilities outside the site boundary. Paragraph (c) of 10 CFR 70.24 exempts Part 50 licensees from the requirements of paragraph (b) of 10 CFR 70.24 for special nuclear material used or to be used in the reactor. Subsection (d) of 10 CFR 70.24 states that any

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licensee who believes that there is good cause why he should be granted an exemption from all or part of 10 CFR 70.24 may apply to the Commission for such an exemption and shall specify the reasons for the relief requested.

The purpose of 10 CFR 70.24(a), (a)(2), and (a)(3) is to ensure that any inadvertent criticality is detected and that action is taken to protect personnel and correct the problem. By letter dated January 14, 1998, the licensee requested a revised exemption from the requirements of 10 CFR 70.24(a). The licensee proposes to handle and store the unirradiated fuel and other special nuclear material without having either the criticality monitoring system or the emergency procedures specified in 10 CFR 70.24(a). The licensee believes that procedures and design features make an inadvertent criticality unlikely, in accordance with General Design Criterion 62.

Special nuclear material, as nuclear fuel, is stored in the spent fuel pool and the new fuel storage area. The spent fuel pool is used to store irradiated fuel under water after its discharge from the reactor, and new fuel prior to loading into the reactor. New fuel is stored dry (in air) in the new fuel storage area.

Special nuclear material is also present in the form of fissile material incorporated into nuclear instrumentation. The small quantity of special nuclear material present in these items precludes an inadvertent criticality.

Consistent with Technical Specification Section 5.4, the spent fuel pool is designed to store the fuel in a geometric array that precludes criticality. The spent fuel racks are designed such that the effective neutron multiplication factor, k_{eff}, will remain less than or equal to 0.95 under all normal and accident conditions for fuel of maximum nominal enrichment of 4.3 weight percent U235. The staff has found this design adequate.

The new fuel storage area is used to receive and store new fuel in a dry condition upon arrival on site and prior to loading in the reactor or spent fuel pool. The spacing between new fuel assemblies in the storage racks is sufficient to maintain the array in a subcritical condition even under accident conditions assuming the presence of moderator. The maximum nominal enrichment of 4.3 weight percent U235 for the new fuel assemblies results in a maximum k_{eff} less than or equal to 0.95 under conditions of accidental flooding by unborated water, and k_{eff} less than or equal to 0.98 under conditions of low-density optimum moderation. The staff has found the design of the licensee's new fuel storage racks to be adequate to store fuel enriched to 4.3 weight percent U235.

Nuclear fuel is moved between the shipping container, the new fuel storage racks, the reactor vessel, and the spent fuel pool to accommodate refueling operations. In all cases, fuel movements are procedurally controlled and designed to preclude conditions involving criticality concerns. The fuel handling equipment used to unload and transfer the new fuel assemblies from the shipping containers to the storage racks precludes handling more than one fuel assembly at a time.

Procedures and controls prevent an inadvertent criticality during fuel handling; nevertheless, radiation monitoring, as required by General Design Criterion 63, is provided in the new fuel storage area. An area radiation monitor is provided in the new fuel storage area and a second radiation monitor is provided on the fuel pit bridge crane. These required radiation monitors have associated area alarms and control room annunciators and would detect excessive radiation levels.

Training is required of all nuclear employees prior to receiving a badge to enter the nuclear power station. Nuclear employee retraining is provided annually to nuclear workers thereafter. This training provides those individuals having access to the Radiological Control Area direction regarding their required response upon hearing an alarm associated with an area radiation monitor.

The purpose of 10 CFR 70.24 is to ensure that if a criticality were to occur during the handling of special nuclear material, personnel would be alerted to that fact and would take appropriate action. Although the staff has determined that reasonable and satisfactory precautions exist to preclude a nuclear criticality accident, thereby meeting the requirements of General Design Criterion 62, the licensee has radiation monitors, as required by General Design Criterion 63, in fuel storage and handling areas. These monitors will alert personnel to excessive radiation levels and allow them to initiate appropriate safety actions. The low probability of an inadvertent criticality together with the licensee's adherence to General Design Criterion 63 and radiation worker training constitute good cause for granting a revised exemption to the requirements of 10 CFR 70.24(a).

3.0 CONCLUSION

Based upon the information provided, there is reasonable assurance that irradiated and unirradiated fuel will remain subcritical during handling and storage. The circumstances for granting a revised exemption to 10 CFR 70.24(a) are met because criticality is extremely unlikely with the present design configuration, TS requirements, administrative controls, and the fuel handling equipment and procedures. Therefore, the staff concludes that the licensee's request for a revised exemption from the requirements of 10 CFR 70.24(a) is acceptable and should be granted.

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Dated: July 15, 1998