[7590-01-P]

NUCLEAR REGULATORY COMMISSION

VIRGINIA ELECTRIC POWER COMPANY, LLC

NORTH ANNA POWER STATION, UNIT NO. 1

DOCKET NO. 50-338

EXEMPTION

[NRC-2010-0246]

1.0 BACKGROUND

Virginia Electric Power Company (VEPCO, the licensee) is the holder of Facility Operating License No. NPF-4, which authorizes operation of North Anna Power Station (NAPS), Unit No. 1. The license provides, among other things, that the facility is subject to all rules, regulations, and orders of the Nuclear Regulatory Commission (NRC, the Commission) now or hereafter in effect.

The facility consists of a pressurized-water reactor located in Louisa County, Virginia.

2.0 REQUEST/ACTION

Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.48(b) requires nuclear power plants licensed before January 1, 1979, to meet 10 CFR Part 50, Appendix R, Section III.O. NAPS Unit No. 1 was licensed on April 1, 1978. Appendix R, Section III.0 requires a reactor coolant pump (RCP) oil collection system (OCS) that is capable of collecting lube oil from all potential pressurized and unpressurized leakage sites in the reactor coolant pump lube oil system.

The licensee requested an exemption from the requirements to the extent that minor oil misting may not be captured within the OCS. This applies to all three Unit 1 RCPs.

In summary, by letter dated April 23, 2010 (Agencywide Documents Access and Management System (ADAMS), Accession No. ML101160376), as supplemented by letters

dated May 13, 2010 (ADAMS Accession No. ML101380270), October 11, 2010 (ADAMS Accession No. ML102870109), and November 15, 2010 (ADAMS Accession No. ML103200451), the licensee requested an exemption from 10 CFR Part 50, Appendix R, Section III.O because small amounts of oil from the RCP were misting, were being transported by the ventilation system, and were condensing on the RCP motor stator coolers (hereafter referred to as coolers). The exemption would allow the licensee to install features to collect any oil that accumulates on the coolers instead of preventing the oil mist from escaping the OCS.

3.0 DISCUSSION

Pursuant to 10 CFR 50.12, the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 50 when (1) the exemptions are authorized by law, will not present an undue risk to public health or safety, and are consistent with the common defense and security; and (2) when special circumstances are present. These circumstances include the special circumstances that application of the regulation is not necessary to achieve the underlying purpose of the rule.

Authorized by Law

This exemption would allow the licensee to install features to collect any oil that accumulates on the coolers from oil mist condensation instead of preventing the oil mist from escaping the OCS. As stated above, 10 CFR 50.12 allows the NRC to grant exemptions from the requirements of 10 CFR Part 50. The NRC staff has determined that granting of the licensee's proposed exemption will not result in a violation of the Atomic Energy Act of 1954, as amended, or the Commission's regulations. Therefore, the exemption is authorized by law.

No Undue Risk to Public Health and Safety

The underlying purposes of 10 CFR Part 50, Appendix R, Section III.O is to ensure that failure of the RCP lube oil system will not lead to fire during normal or design basis accident

conditions and that there is reasonable assurance that the system will withstand the Safe Shutdown Earthquake. The regulation intends licensees to accomplish this by extending the concept of defense-in-depth to fire protection in fire areas important to safety, with the following objectives:

1) to prevent fires from starting;
2) to rapidly detect, control, and extinguish promptly those fires that do occur;
3) to provide protection for structures, systems, and components important to safety so that a fire that is not promptly extinguished by the fire suppression activities will not prevent the safe shutdown (SSD) of the plant.

In their request, as supplemented, the licensee described elements of their fire protection program that provide their justification that the concept of defense-in-depth that is in place in the affected important to safety fire area (FA), FA 1-1, is consistent with that required by the regulation. The licensee states in their request, as supplemented, that the modification to install oil collection trays on the coolers with piping connected to the RCP OCS is scheduled to be installed during the next Unit 1 refueling outage. Operating experience based on a similar design for Unit 2 has indicated that the oil mist primarily condenses on the coolers and the oil collection tray collects oil dripping from the coolers. This will reduce the potential for significant quantities of oil pooling to occur outside the OCS. The remaining oil sheen that may develop due to misting does not present a safety concern due to the small volume of oil. The licensee further states in their request, as supplemented, that the purpose of their request was to address expected, minor RCP oil misting. The collection of the oil in the tray below the coolers and the piping to the OCS is in addition to the protective measures installed to meet Section III.O of 10 CFR Part 50, Appendix R.

In the licensee's request, as supplemented, an analysis was provided that described how fire prevention, detection, control, extinguishment and preservation of safe shutdown capability is addressed for FA 1-1 in the Unit 1 containment, as summarized below.

Fire Prevention

The licensee states that administrative controls are in place to control combustibles in the plant. No transient combustible materials are normally allowed in the containment while the unit is at power. This is ensured by implementing a Unit 1 containment checklist prior to placing the unit into operation. Hot work does not occur within the RCP cubicles during power operations. The RCP cubicles are concrete compartments that are open to the containment on the top and house the RCPs, the steam generators and the reactor coolant system piping.

NRC Information Notice 94-58, "Reactor Coolant Pump Lube Oil Fire" (ADAMS Accession No. ML031060498), alerted industry that a credible ignition source for RCP oil is hot RCS piping. Ignition has typically occurred due to the oil soaking fibrous insulation. Inadequately designed oil collection systems and oil leaking onto RCP piping insulation was identified as a cause.

The licensee's April 23, 2010, letter proposes to modify the OCS to further eliminate the potential for oil pooling outside the OCS. The modification will also prevent oil from collecting on three sections of fiberglass cloth covered Tempmat insulation under the RCP motors. Tempmat insulation is noncombustible and is not an Appendix R concern with respect to combustible loading. The licensee states that the modifications to the OCS are scheduled to be installed during the next refueling outage.

The licensee states that additional defense-in-depth at NAPS Unit No. 1 is achieved through the physical properties of the oil itself combined with the limited amount of ignition sources within the area. The flashpoint of the oil currently used is 374°F, with an auto-ignition

temperature of 608°F. Nominal temperatures of the RCP motor and pump flange are approximately 220°F and 550°F, respectively. These temperatures would not be sufficient to cause auto-ignition of the oil. However, given the flashpoint of the oil, it is conceivable that the oil could be ignited in the presence of an ignition source. A review of equipment in the area has identified one potential ignition source in addition to the RCPs themselves. The RCP is protected from being an ignition source by the installed OCS. The other potential ignition source is the cold leg loop stop valve (LSV) motor operated valve (MOV), which is in close proximity to the RCP. Due to the size of the LSV MOV actuator motor, it could also be considered an ignition source. However, power is removed from the cold leg LSV MOVs by opening the supply breakers prior to startup and administratively verified open throughout the cycle. Therefore, the ignition source is effectively eliminated. In addition, guidance in the "Station Lubrication Manual" outlines the procedural controls that ensure that RCP oil of different properties is not used. The Station Lubrication Manual is procedurally controlled and requires authorization to be changed.

With the exception of the oil contained within the RCP motor, combustibles within each cubicle and loop room are negligible. Furthermore, containment is maintained at a sub-atmospheric pressure and not routinely occupied during operation. As a result, the introduction of transient combustibles into this area at power is negligible.

Each RCP motor has a dedicated OCS tank that is designed to contain the entire oil inventory of the motor. A vent and flame arrestor are provided on top of the tank. Operations procedures verify the oil collection tanks are empty prior to unit start-up from Mode 5. In addition, tank drain lines were extended in the mid-1990's to allow draining the tank from outside the loop rooms (lower radiation dose area).

A design change to enhance the baffled ventilation openings of the RCP oil lift pump enclosure that ensures that all oil will be contained in the event of pressurized oil leakage inside these enclosures has been installed on NAPS Unit No. 1.

A design change to install oil collection trays on the coolers with piping connected to the RCP OCS tank is scheduled to be installed on NAPS Unit No. 1 during the next refueling outage. This piping will direct the oil in the cooler collection trays to the RCP OCS tank. The oil collection trays will be installed in the areas where the most oil outside the OCS has been found. Prior to installation of the collection trays on NAPS Unit No. 2, licensee staff identified oil pooling under the coolers. Approximately 6 months after the collection trays were installed, a walkdown of NAPS Unit No. 2 RCP A and B verified that the oil collection trays were performing as designed.

The licensee states that all preventative maintenance tasks are controlled by established preplanned work orders under the recurring task evaluation (RTE) process. Deferral of any of these work orders will require an RTE that will be evaluated by VEPCO on a case-by-case basis. The licensee states that they follow the manufacturer's recommendations for maintenance of the RCPs and that the RCPs are refurbished every 9 years by an offsite vendor.

Detection, Control and Extinguishment

Fire detection within the NAPS Unit Nos. 1 and 2 containment consists of linear heat detection on each RCP, smoke and heat detection within the cable penetration area of containment, heat detection for the residual heat removal pumps, and duct smoke detection on the outlet of each of the three containment air recirculation fans. The RCP linear heat detection alarms at 575°F. The alarm is received locally in containment at the local control panel, on the control room vertical board, and on the control room fire detection panel. System trouble conditions are annunciated similarly.

Manual fire suppression equipment for containment consists of a 100 lb.-wheeled CO_2 unit on each floor of containment, three CO_2 and one dry chemical extinguisher at the personnel entrance to containment, and a dry standpipe system with hose stations. Hoses are not normally connected to the hose valves. A fire brigade equipment locker is provided outside of the personnel entrance to containment.

The licensee states that the CO_2 extinguishers and the dry chemical extinguisher are rated for a Class B fire (flammable and combustible liquids). The initial fire fighting attack can be made using either a CO_2 or dry chemical extinguisher. A fire hose can be used if CO_2 is ineffective or does not completely extinguish the fire. In addition, foam is available and can be applied if determined necessary by the fire brigade.

Preservation of Safe Shutdown Capability

The licensee states that FA 1-1 is the primary containment for NAPS Unit No. 1. The area is a multi-level structure. The boundary fire barriers for containment are of heavy reinforced concrete construction with an inherent fire rating in excess of 3 hours. Access is gained into containment through a personnel access lock. The RCP motor cubicles are located above the associated reactor coolant system loop room. The floor of the RCP motor cubicle consists of steel grating with multiple openings between the motor cubicle and reactor coolant system loop room. The rooms are separated from the remainder of containment by heavy concrete shield walls, with a personnel access door for each cubicle and loop room. There are multiple openings in the ceiling of the motor cubicles. Although not maintained as rated fire boundaries, the heavy shield walls provide a degree of separation.

The license states that the only SSD function instruments present are the three resistance temperature detectors (RTDs) that provide indication of the RCS hot leg temperature in the control room. There is no credible means for minor oil misting to impact the safe

shutdown function of the hot leg RTDs. Each RTD is separated from the closest redundant RTD located in another pump cubicle by two heavy concrete walls. Therefore, a credible fire in one RCP cubicle would not affect RCS temperature indication from the other two loops.

Summary of Defense-in-Depth

In summary, the defense-in-depth concept for a fire in FA 1-1 discussed above provides an adequate level of safety through the prevention of fires, detection, control and extinguishment of fires that occur and the protection of structures, systems and components important to safety. As discussed above, the licensee has provided preventative and protective measures that together demonstrate the licensee's ability to preserve or maintain SSD capability in the event of a fire within an RCP cubicle or reactor coolant system loop room.

Based on the above, the NRC staff concludes that the licensee has met the defense-in-depth objectives and no new accident precursors are created by the installation of features to collect any oil that accumulates on the coolers from oil mist condensation instead of preventing the oil mist from escaping the OCS, thus, the probability of postulated accidents is not increased. Also, based on the above, the consequences of postulated accidents are not increased. Therefore, there is no undue risk to public health and safety.

Consistent with Common Defense and Security

The proposed exemption would allow the licensee to install features to collect any oil that accumulates on the coolers from oil mist condensation instead of preventing the oil mist from escaping the OCS. This change to the plant has no relation to security issues. Therefore, the common defense and security is not impacted by this exemption.

Special Circumstances

Special circumstances, in accordance with 10 CFR 50.12(a)(2)(ii), are present whenever application of the regulation in the particular circumstances is not necessary to achieve the

underlying purpose of the rule. The underlying purposes of 10 CFR Part 50, Appendix R, Section III.O is to ensure that failure of the RCP lube oil system will not lead to fire during normal or design basis accident conditions and that there is reasonable assurance that the system will withstand the Safe Shutdown Earthquake. As described above, the defense-in-depth concept for a fire in FA 1-1 discussed above provides an adequate level of safety through prevention of fires, detection, control and extinguishment of fires that do occur and the protection of structures, systems and components important to safety. In addition, the licensee has provided preventative and protective measures that together demonstrate the ability to preserve or maintain SSD capability in the event of a fire in an RCP cubicle and loop room. Allowing the collection of oil that accumulates on the coolers instead of preventing the oil mist from escaping the OCS does not impact the ability of the OCS to withstand the Safe Shutdown Earthquake. Therefore, since the underlying purpose of 10 CFR Part 50, Appendix R is achieved, the special circumstances required by 10 CFR 50.12(a)(2)(ii) for the granting of an exemption from 10 CFR Part 50, Appendix R exist.

4.0 CONCLUSION

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12, the exemption is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security. Also, special circumstances are present. Therefore, the Commission hereby grants VEPCO an exemption from 10 CFR Part 50, Appendix R, Section III.O to the extent that minor oil misting may not be captured within the OCS. This applies to all three RCPs for NAPS Unit No. 1. Pursuant to 10 CFR 51.32, the Commission has determined that the granting of this exemption will not have a significant effect on the quality of the human environment as published in the *Federal Register* on July 8, 2010 (75 FR 39285).

This exemption is effective upon issuance.

Dated at Rockville, Maryland, this 21st day of April 2011.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

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