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SUBJECT: Forwards application for amends to licenses NPF-14 & NPF-22, removing requirement for APRM operability while plant in operational condition 5.

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Director of Nuclear Reactor Regulation
Attention: Mr. C. L. Miller, Project Director
Project Directorate I-2
Division of Reactor Projects
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUSQUEHANNA STEAM ELECTRIC STATION
PROPOSED AMENDMENT NO. 171 TO LICENSE NPF-14 AND
PROPOSED AMENDMENT NO. 125 TO LICENSE NPF-22:
APRM OPERABILITY REQUIREMENTS **Docket Nos. 50-387**
PLA-4202 FILES R41-1/A17-2 **and 50-388**

Dear Mr. Miller:

The purpose of this letter is to propose changes to the Susquehanna SES Units 1 and 2 Technical Specifications. Currently, Susquehanna Technical Specifications require that the neutron flux trips and control rod blocks of the Average Power Range Monitors (APRMs) be OPERABLE while in Operational Condition 5. The proposed Technical Specification change removes the requirement for APRM operability while the plant is in Operational Condition 5. However, the requirement for the APRMs to be OPERABLE during a shutdown margin demonstration, when the mode switch is in Startup, will remain unchanged.

The attached analysis discusses the safety basis for the proposed Technical Specification change and concludes that the change involves no significant hazards. The change has been reviewed by the Plant Operations Review Committee (PORC) and the Susquehanna Review Committee (SRC). The proposed change is consistent with the Improved Standard Technical Specifications, and has been approved for implementation at another BWR-4.

We are committed to making this change to enhance refueling outage performance and reduce unnecessary testing and maintenance activity. The proposed change is expected to reduce manpower related refueling outage costs between $65,000 and $250,000 per refueling outage depending on the planned scope of APRM related work. The proposed change meets the Cost Beneficial Licensing Action criteria.

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We are planning to incorporate the proposed change into outage planning for our next refueling outages, as a result we ask that the NRC complete its review by February 10, 1995. Any questions regarding this request should be directed to Mr. Terence Bannon at (610) 774-7918.

Very truly yours,

R. G. Byram

Attachment

cc: NRC Document Control Desk (original)
NRC Region I
Ms. M. Banerjee, NRC Sr. Resident Inspector - SSES
Mr. C. Poslusny, Jr., NRC Sr. Project Manager - Rockville
Mr. W. P. Dornsife, Pa. DER

SAFETY ASSESSMENT

APRM OPERABILITY REQUIREMENTS

BACKGROUND

Susquehanna Technical Specifications currently require that the neutron flux trips and control rod blocks of the Average Power Range Monitors (APRMs) be OPERABLE while in Operational Condition 5 (OPCON 5). This requirement restricts outage maintenance activities and requires surveillance and maintenance as necessary to maintain system operability. The primary reason for removing the APRM operability requirement is to reduce critical path time between six (6) and 24 hours by allowing maintenance activities to be performed on the Local Power Range Monitor (LPRM) strings (which input to the APRM circuitry) in conjunction with other refueling activities. The exact reduction in refueling outage critical path time is dependent on the planned scope of LPRM maintenance activities. In addition, the proposed change will preclude the need for testing and maintenance to maintain system operability in OPCON 5, except when APRM operability is required for a shutdown margin demonstration.

The safety analysis provided here will show that the proposed change to APRM operability requirements as included in NUREG 1433 (as amended) can be safely adopted at Susquehanna SES. The NRC approved an equivalent change to the Technical Specifications for Limerick Generating Station in a letter and Safety Evaluation Report dated July 30, 1990.

DESCRIPTION OF CHANGE

The proposed Technical Specification changes remove the requirement for APRM operability while the plant is in OPCON 5. However, the requirement (Technical Specification Section 3.10.3) for the APRMs to be OPERABLE during a shutdown margin demonstration when the mode switch is in Startup will remain unchanged. Technical Specification Section 3.10.3 is a Special Test Exception which allows operators to change the reactor mode switch from Refuel to Startup to perform a shutdown margin demonstration. Therefore, the following qualification to the OPCON 5 APRM Technical Specification operability requirements will be added, "The function is required to be OPERABLE only prior to and during shutdown margin demonstrations as performed per Specification 3.10.3." This note is proposed to be added to Technical Specification Tables 3.3.1-1, "Reactor Protection System Instrumentation," and 4.3.1.1-1, "Reactor Protection System Instrumentation Surveillance Requirements," and Technical Specification Tables 3.3.6-1, "Control Rod Block Instrumentation," and 4.3.6-1 "Control Rod Block Instrumentation Surveillance Requirements."

A mark-up of Technical Specification sections affected by the proposed changes are attached to this analysis.

SAFETY ANALYSIS

Analysis

The proposed Technical Specification changes remove the requirement for APRM operability while the plant is in OPCON 5, except during shutdown margin demonstrations performed in accordance with Technical Specification Section 3.10.3. To assess the impact on safety and the design bases accidents of the proposed change, a review of those systems and mechanisms which contribute to safe operation while the plant is in OPCON 5 has been performed. Each of these systems and mechanisms contribute to the defense-in-depth design and operation. This analysis will show that the current APRM operability requirement is unnecessary to maintain this defense-in-depth.

The Neutron Monitoring System (NMS) is composed of the following subsystems: SRM, IRM, LPRM, APRM, Rod Block Monitor, and Traversing Incore Probe. The purpose of the SRM, IRM, and APRM subsystems is to monitor local and core average neutron flux levels and provide trip signals to the Reactor Protection System (RPS) and control rod block portion of the Reactor Manual Control System (RMCS) as required. The NMS provides local and core average power information to the reactor operator. The IRM and APRM are NMS subsystems which are safety-related.

The SRM subsystem is composed of four detectors that are inserted into the core during shutdown conditions. Although the subsystem is a non-safety subsystem of the NMS, it is important to overall plant safety. The SRMs are required by Technical Specifications to be OPERABLE in OPCON 5. During refueling operations, the plant operators use the SRMs to ensure that neutron flux remains within an acceptable range. Also, plant operators can monitor the SRMs for increases in neutron flux which may indicate that the reactor is approaching criticality.

The IRM subsystem is composed of eight incore detectors that are inserted into the core. The IRM is a five-decade instrument with ten ranges that are ranged up during normal power increases. The IRMs are designed to monitor neutron flux levels at a local core location and provide protection against local criticality events caused by control rod withdrawal errors. The IRMs monitor neutron flux levels from the upper portion of the SRM range to the lower portion of the APRM range. In terms of rated reactor power, the IRMs range from about 10E-4% of full reactor power to greater than 10% of full reactor power. The IRMs provide control rod block and scram functions at 108 and 120 divisions, respectively, of a 125 division scale, on each of ten (10) ranges.

The APRMs do not have incore detectors of their own but receive input from the LPRM detectors which are located at various levels throughout the core. The APRMs monitor core average power over a range from about 1% to 125% of reactor power. The APRMs represent a core average power level while the IRMs and SRMs indicate a local power level. In OPCON 5, the APRMs operate in the setdown mode to provide a control rod block and scram function at 12% and 15% core average power, respectively.

The safety design bases of the IRM subsystem is to generate trip signals to prevent fuel damage resulting from anticipated or abnormal operational transients that could possibly occur while operating in the intermediate power range. The safety design bases of the APRM subsystem is to generate trip signals in response to average neutron flux increases in time to prevent fuel damage while the plant is in the operating power range. The independence and redundancy incorporated in the design of the IRM and APRM subsystems are consistent with the safety design bases of the NMS and RPS.

There are various levels of control to prevent inadvertent reactor criticality and fuel damage during refueling operations.

1) Licensed plant operators are trained to operate equipment and follow approved procedures.

2) Plant approved refueling and maintenance procedures are intended to mitigate the potential for inadvertent reactor criticality.

3) SRMs indicate reactor criticality and generate a control rod block signal on high neutron flux levels. Prior to and during the time any control rod is withdrawn (except via Technical Specification 3.9.10.1 & 3.9.10.2) and Shutdown Margin demonstrations are in progress, Technical Specification Section 3.9.2 requires the shorting links be removed so that the SRMs will operate in the non-coincident scram mode to cause a reactor scram as necessary.

4) Refueling interlocks prevent the withdrawal of more than one control rod and prevent the insertion of fuel bundles into the core unless all control rod insertion signals are present.

5) The IRMs and APRMs provide an indication of local power and average power, respectively. IRMs and APRMs provide rod blocks and scram signals on high neutron flux levels.

The APRMs are not necessary for safe operation of the plant during OPCON 5 because the IRMs will generate an RPS scram or control rod block if neutron flux increases to the applicable setpoint. The IRMs are required by Technical Specifications to be OPERABLE in OPCON 5. The IRMs are a safety-related subsystem of the NMS designed to indicate and respond to neutron flux increases at local core locations. The APRMs are designed to monitor and respond (scram and/or control rod block) to a core average neutron flux level. The most likely reactivity insertion transient expected during refueling would be a core alteration type event, e.g., control rod withdrawal or fuel assembly insertion into the core. A core alteration event would be detected and responded to by the IRMs and/or SRMs prior to the APRMs initiating a scram. The IRMs and/or SRMs would be on scale before the APRMs detected the event because the IRMs and SRMs are designed and calibrated to be more sensitive to neutron flux than the APRMs.

The IRM subsystem is designed and calibrated to respond to a neutron flux level that is significantly less than the flux level monitored by the APRMs. For example, during refueling, when the IRMs are on their most sensitive range, the IRMs will generate a scram signal at less than 0.01% core average power while the APRMs will generate a scram signal at 15% core average power. The IRM subsystem acts as a backup protection system to the Refueling Interlocks during refueling.

Refueling Interlocks are required to be OPERABLE during refueling operations in OPCON 5. They are not safety-related but are designed such that a single component failure does not cause an interlock failure. The purpose of the Refueling Interlocks is to restrict the movement of the control rods and the operation of the refueling equipment to reinforce operational procedures that prevent the reactor from becoming critical during refueling operations. Refueling Interlocks require that an "all-rods-in" signal be present prior to allowing reactor operators to select and withdraw a single control rod. Other Refueling Interlocks will prevent the withdrawal of a control rod if the fuel grapple is loaded and the refueling platform is over the core. Also, the Refueling Interlocks require an "all-rods-in" signal before allowing a fuel loaded refueling platform to go over the core.

Technical Specifications, plant operating procedures, and plant design control the withdrawal or removal of control rods to minimize the potential for an inadvertent criticality event. The core loading pattern and core shuffling sequence are designed to ensure that the core is subcritical by a specified margin with the most reactive control rod at the full out position. Withdrawal of one control rod would not cause criticality and the event would not register on the APRMs.

The design of the control rod drive system reduces the probability of a control rod drop during refueling. For example, the latching action of the collet finger assembly serves to lock the index tube in place. The velocity limiter physically prevents the control blade from being removed from the core with fuel in place.

The Susquehanna Final Safety Analysis Report (FSAR) Section 15.4.1, "Rod Withdrawal Error - Low Power," evaluated the potential for a control rod removal error during refueling. The concern is potential inadvertent criticality due to the following events.

1. Removal of the highest worth control rod.

2. Withdrawal of a second control rod.

3. Accidental insertion of fuel into a cell not controlled by a control rod blade.

The FSAR concludes that the above scenarios are adequately precluded by refueling interlocks, core design, and control rod hardware design. However, should operator errors, followed by equipment malfunctions, result in an inadvertent criticality event, necessary safety actions (control rod block or scram) will be taken prior to violation of a safety limit. The IRMs would provide a rod block or scram function as appropriate.

In summary, the APRMs are not necessary for safe operation of the plant while operating in OPCON 5 with the mode switch in "Refuel" for the following reasons.

- The IRMs are a safety-related subsystem of the NMS required by Technical Specifications to be OPERABLE in OPCON 5. The IRMs will generate an RPS scram or control rod block if neutron flux increased to the applicable setpoint.

- The IRMs and SRMs are designed and calibrated to be more sensitive to neutron flux than the APRMs.

- The IRMs are designed to monitor local core events while the APRMs provide a measure of core average power condition. The IRMs can monitor and react to the most probable reactivity events expected during refueling, i.e., control rod withdrawal or fuel insertion.

- The IRMs would detect and respond (control rod block or reactor scram) to an inadvertent criticality event before the APRMs would provide a trip function.

- The withdrawal of only one control rod in OPCON 5 is permitted by the "one-rod-out" interlock while in "Refuel". The core is designed to be subcritical with one rod out.

- The withdrawal of a second control rod or inadvertent addition of a fuel bundle in OPCON 5 is precluded by refueling interlocks, refueling procedures, and administrative controls.

- The APRMs will still be required to be OPERABLE during a shutdown margin demonstration performed in OPCON 5 (a special test exception in the Technical Specifications).

- The SRMs are required to be OPERABLE in OPCON 5.

Conclusion

The monitoring of neutron flux levels, administrative controls, plant procedures, refueling interlocks, and SRM and IRM protective features provide and maintain the defense-in-depth design and operation which precludes the need for the APRMs to be OPERABLE in OPCON 5, except during shutdown margin demonstrations performed in accordance with Technical Specification Section 3.10.3. Therefore, the change to APRM operability requirements will not result in a significant reduction in the margin of safety.

NO SIGNIFICANT HAZARDS CONSIDERATIONS

I. *This proposal does not involve a significant increase in the probability or consequences of an accident previously evaluated.*

Not requiring APRMs to be OPERABLE in OPCON 5 will not increase the probability of inadvertent reactor criticality during refueling operations. Refueling Interlocks, NMS (SRMs, IRMs), and procedural restrictions provide assurance that inadvertent criticality does not occur due to the simultaneous withdrawal or removal of two control rods or due to the inadvertent insertion of a fuel bundle into a core location with a control blade removed.

The FSAR Section 15.4.1 discusses the potential for a control rod withdrawal error during refueling and start-up operations. The discussion concludes that the withdrawal of one control rod does not require a safety action because the total worth of one control rod is not sufficient to cause criticality. The attempted withdrawal of two control rods, assuming an operator error and a single active failure, would result in a control rod block initiated by the Refueling Interlocks. The safety-related IRM subsystem, which is required by Technical Specifications to be OPERABLE while in OPCON 5, is designed to generate a rod block or reactor scram on high neutron flux and is therefore a backup protective system for the Refueling Interlocks during refueling.

The Safety-related IRM subsystem of the NMS is required by Technical Specifications to be OPERABLE during OPCON 5 to support the safety design bases of the NMS and RPS. The SRM is not a safety-related subsystem but is important to plant safety and is required by Technical Specifications to be OPERABLE in OPCON 5. The SRM subsystem provides the plant operator with neutron flux levels from startup conditions to the IRM operating range. The SRMs and IRMs are designed to respond to local core conditions and would indicate and respond (control rod block or scram) to an accident condition to mitigate the transient. Thus, the APRMS are not necessary to be OPERABLE in OPCON 5. The proposed Technical Specification change will not alter the current requirements that the APRMs be OPERABLE during shutdown margin demonstrations in OPCON 5 when the mode switch is in Startup.

The proposed Technical Specification change would reduce the APRM operability requirement in OPCON 5 and would not affect the FSAR evaluation of the inadvertent criticality due to the withdrawal or removal of the highest worth control rod or due to the insertion of fuel bundles in uncontrolled cells. The FSAR concludes that the Refueling Interlocks and plant procedures provide assurance that inadvertent criticality does not occur during refueling.

The consequences of an accident will not be increased by the proposed Technical Specification change because of the existing lines of defense which prevent an inadvertent criticality event during refueling, e.g., administrative restrictions, refueling procedures, licensed plant operators, SRMs, Refueling Interlocks, and IRMs. Furthermore, should the number of operable IRM or SRM channels be less than that required by Technical Specifications, the Technical Specifications require that core alteration activities be suspended and all insertable control rods be inserted into the core.

Therefore, the proposed changes do not result in an increase in the probability or consequences of an accident previously evaluated.

II. *This proposal does not create the possibility of a new or different kind of accident from any accident previously evaluated.*

The proposed changes to the Technical Specifications will remove the APRM operability requirement while in OPCON 5 (except for shutdown margin demonstration testing); however, the SRMs and IRMs will still be required to be OPERABLE in OPCON 5.

The IRMs are safety-related and are designed to detect and respond to increases in neutron flux within the local core regions. Any inadvertent increases in neutron flux during refueling would originate at a local core location, i.e., rod withdrawal error or fuel bundle insertion. Technical Specifications require IRM operability and will generate an RPS scram or control rod block if neutron flux increased to the setpoint. Therefore, removing the APRM operability requirement in OPCON 5 would not effect any safety related equipment or equipment important to safety.

The APRMs provide core power information to the control room operator and also provide trip signals to the RMCS and RPS as required. The absence of an APRM input signal will not affect these systems during refueling operations.

Removing the APRM operability in OPCON 5 will not affect the response of safety-related equipment as previously evaluated in the FSAR. The proposed changes to the Technical Specifications do not affect any safety-related equipment or equipment important to safety.

The proposed changes to the Technical Specifications would remove the APRM operability requirement during refueling operations. Technical Specifications require IRM operability and will generate an RPS scram or control rod block if neutron flux increased to the applicable setpoint.

No new types of accidents would be introduced since the SRMs and IRMs are available and required to be OPERABLE in OPCON 5. Both SRMs and IRMs would indicate and provide a control rod block or scram signal, as appropriate, to an increase in neutron flux to mitigate a transient event. Furthermore, should the number of OPERABLE IRM or SRM channels be less than that required by Technical Specifications, the Technical Specifications require that core alteration activities be suspended and all insertable control rods be inserted into the core.

Therefore, the proposed Technical Specification changes do not create the possibility of a new or different kind of accident from any accident previously evaluated.

III. *This change does not involve a significant reduction in a margin of safety.*

For the reasons discussed in items 1 and 2 above and because the Technical Specification Bases do not discuss or require APRM operability during OPCON 5, Refueling, the proposed Technical Specification changes do not involve a significant reduction in a margin of safety.

ENVIRONMENTAL CONSEQUENCES

An environmental assessment is not required for the proposed changes because the requested changes conform to the criteria for actions eligible for categorical exclusion as specified in 10 CFR 51.22(c)(9). The requested changes will have no impact on the environment. The proposed changes do not involve a significant hazards consideration as discussed in the preceding section. The proposed changes do not involve a significant change in the types or significant increase in the amounts of any effluents that may be released offsite. In addition, the proposed changes do not involve a significant increase in individual or cumulative occupational radiation exposure.

IMPLEMENTATION

It is requested that this change be approved as soon as possible but no later than February 10, 1995 with implementation within 30 days of the date of issuance.