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

ENCLOSURE 1

SAFETY EVALUATION OF WASHINGTON PUBLIC POWER SUPPLY SYSTEM NUCLEAR PLANT No. 2 COMPLIANCE WITH ATWS RULE 10CFR50.62 RELATING TO ALTERNATE ROD INJECTION (ARI) AND RECIRCULATION PUMP TRIP (RPT) SYSTEMS DOCKET NO. 50-397

1.0 INTRODUCTION

On July 26, 1984, the Code of Federal Regulations (CFR) was amended to include Section 10 CFR50.62, "Requirements for Reduction of Risk from Anticipated Transients Without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants" (known as the "ATWS Rule"). An ATWS is an expected operational transient (such as loss of feedwater, loss of condenser vacuum, or loss of offsite power) which is accompanied by a failure of the reactor trip system (RTS) to shutdown the reactor. The ATWS rule requires specific improvements in the design and operation of commercial nuclear power facilities to reduce the likelihood of failure to shutdown the reactor following anticipated transients, and to mitigate the consequences of an ATWS event.

For each boiling water reactor, three systems are required to mitigate the consequences of an ATWS event.

1. It must have an alternate rod injection (ARI) system that is diverse (from the reactor trip system) from sensor output to the final actuation device. The ARI system must have redundant scram air header exhaust valves. The ARI system must be designed to perform its function in a reliable manner and be independent (from the existing reactor trip system) from sensor output to the final actuation device.

2. It must have a standby liquid control system (SLCS) with a minimum flow capacity and boron content equivalent in control capacity to 86 gallons per

minute of 13 percent by weight of sodium pentaborate solution. The SLCS and its injection location must be designed to perform its function in a reliable manner.

3. It must have equipment to trip the reactor coolant recirculating pumps automatically under conditions indicative of an ATWS. This equipment must be designed to perform its function in a reliable manner.

This safety evaluation report addresses the ARI system (Item 1) and the ATWS/RPT system (Item 3). The SLCS (Item 2) was addressed in a separate document.

2.0 REVIEW CRITERIA

The systems and equipment required by 10CFR50.62 do not have to meet all of the stringent requirements normally applied to safety-related equipment. However, this equipment is part of the broader class of structures, systems, and components important to safety defined in the introduction to 10CFR50, Appendix A General Design Criteria (GDC). GDC-1 requires that "structures, systems and components important to safety shall be designed, fabricated, erected and tested to quality standards commensurate with the importance of the safety functions to be performed." Generic Letter 85-06 "Quality Assurance Guidance for ATWS Equipment that is not Safety Related" details the quality assurance that must be applied to this equipment.

In general, the equipment to be installed in accordance with the ATWS Rule is required to be diverse from the existing RTS, and must be testable at power. This equipment is intended to provide needed diversity (where only minimal diversity currently exists in the RTS) to reduce the potential for common mode failures that could result in an ATWS leading to unacceptable plant conditions. The criteria used in evaluating the licensee's submittal include 10CFR50.62 "Rule Considerations Regarding Systems and Equipment Criteria" published in Federal Register Volume 49, No. 124 dated June 26, 1984 and Generic Letter 85-06 "Quality Assurance Guidance for ATWS Equipment that is not Safety Related."

3.0 WNP UNIT 2 ARI & RPT SYSTEMS DESCRIPTION

WNP Unit 2 by letters dated April 13, 1987 and June 24, 1988 has provided information to conform with the ATWS Rule. The plant has installed the ARI and the RPT systems to mitigate the potential consequences of an anticipated transient without scram event. The systems consist of reactor pressure and reactor water level sensors, logic, power supplies, and instrumentation to initiate the protective actions to mitigate an ATWS event.

The ARI logic configuration is a two-out-of-two for the reactor low water level or the reactor high pressure. There are two redundant divisions. Each division will energize one of two alternate rod insertion valves in each venting path. There are eight 2-way solenoid valves and one 3-way solenoid valve to accomplish the ARI function. The ARI valves and bleed paths are sized to allow insertion of all control rods to begin within 15 seconds after their initiation, and be completed in 25 seconds.

The function of the RPT is to reduce the severity of thermal transients on fuel elements by tripping the recirculation pumps early in the transient events (such as turbine trip, or load rejections). The rapid core flow reduction increases void content and thereby introduces negative reactivity in the reactor to reduce the thermal power. The RPT logic configuration is a one-out-of-two for reactor low water level and/or the reactor high pressure. There are two separate actuation circuits to trip two pumps independently. Although there are three breakers in series from the power supply to each pump motor, only one breaker receives the ATWS/RPT trip signal. The low frequency motor generator set output breaker is also tripped by the ATWS/RPT trip signal when pump is at a low-power operation mode.

The ARI system can be tested while the plant is operating. The sensor, logic, actuation device and the circuits are separate from the RTS, and environmentally qualified to the anticipated operational occurrence conditions. The ARI function can be reset by the ARI reset switches after a time delay to ensure that the ARI scram goes to completion. Manual reset is controlled by plant operating procedures. Both ARI and RPT functions can be manually initiated.

4.0 EVALUATION OF ARI SYSTEM

4.1 ARI SYSTEM FUNCTION TIME

The licensee stated that the ARI system is designed to begin control rod insertion in 15 seconds and complete control rod insertion within 25 seconds after an ARI initiation. The licensee has performed a pre-operational test to verify that the ARI function time is within the design limit. The test results will be verified during the staff inspection of the ATWS rule implementation.

4.2 SAFETY RELATED REQUIREMENTS (IEEE STANDARD-279)

The ATWS Rule does not require the ARI system to be safety grade, but the implementation must be such that the existing protection system continues to meet all applicable safety related criteria.

The ARI system is designed and installed as a Class 1E system that complies with the applicable safety related requirements. The implementation will allow the existing protection system to continue to meet all applicable safety related criteria. The staff finds this acceptable.

4.3 REDUNDANCY

The ATWS Rule requires that the ARI system must have redundant scram air header exhaust valves, but the ARI system itself does not need to be redundant.

The ARI system has redundant scram air header exhaust valves each with their own initiation and control circuits. The ARI performs a function redundant to the backup scram system. This is in conformance with the ATWS rule guidance, and therefore is acceptable.

4.4 DIVERSITY FROM EXISTING RTS

The ATWS Rule requires that the ARI system should be diverse from the existing reactor trip system. The ARI system uses energize-to-function valves instead of de-energize-to-function valves. It has dc powered valve actuators and logic instead of ac powered valve actuators and logic. The licensee identified the instrument sensor type and model numbers for the ARI/RPT system and the reactor trip system as follows:

	ARI/RPT SYSTEM	RTS
High Pressure Measurement	S.O.R-9N6-BB45	S.O.R-29N6-B45
Low Level Measurement	Barton-580A-1	Barton-288-A

Although these pressure switches and level switch instruments are manufactured by the same vendors, these sensors are fed to the diverse actuation logics respectively (2/2 logic for ARI and 1/2 twice for RTS). In accordance with the ATWS rule guidance, the sensors need not be of a diverse design or manufacturer. The staff finds the WNP-2 design acceptable.

4.5 ELECTRICAL INDEPENDENCE FROM THE EXISTING RTS

The ARI actuation is independent from the RTS logic. The ARI circuits and power sources are totally independent from the RTS circuits and power sources. The staff finds this acceptable.

4.6 PHYSICAL SEPARATION FROM EXISTING RTS

The ATWS Rule guidance states that the implementation of the ARI system must be such that separation criteria applied to the existing protection system are not violated.

The ARI system, except for the use of common instrument sensing lines is physically separated and electrically independent from the Reactor Trip System. It has redundant circuits from sensors to the ARI valves. The ARI circuits are routed independently from the RTS. The separation between the RTS and the ARI system satisfies the guidance provided in the ATWS Rule. The staff finds this acceptable.

4.7 ENVIRONMENTAL QUALIFICATION

The ATWS Rule guidance states that the qualification of the ARI system is for anticipated operational occurrences only, not for accidents.

The ARI system is qualified to the anticipated operational occurrence condition. The staff finds this acceptable.

4.8 QUALITY ASSURANCE

NRC Generic Letter 85-06 dated April 16, 1985 provides quality assurance guidance for the ARI system. The licensee has committed to follow this guidance. This is acceptable.

4.9 SAFETY RELATED (IE) POWER SUPPLY

The ATWS Rule guidance states that the ARI system must be capable of performing its safety function with loss of offsite power, and that the power source should be independent from the existing reactor trip system.

The ARI system redundant divisions are powered from the Class 1E 125 Vdc station batteries. The ARI system is capable of performing its safety functions with loss of offsite power and the ARI power sources are independent from the existing RTS system power sources. The staff finds this acceptable.

4.10 TESTABILITY AT POWER

The ATWS Rule guidance states that the ARI system should be testable at power.

The WNP-2 ARI system is fully testable at power from sensors up to and including the solenoid valves. Because each venting path has two valves in series, testing one valve at a time will not cause inadvertent ARI actuation. Testing is administratively controlled to assure only one division will be actuated at a time. The testing condition is annunciated in the control room. The staff finds this acceptable.

4.11 INADVERTENT ACTUATION

The ATWS Rule guidance states that inadvertent ARI actuation which challenges other safety systems should be minimized.

The ARI system has coincident logic circuits and two sensors in each channel must be tripped in order to initiate the protective actions. The ARI setpoints will not challenge the normal scram setpoints. As a result, inadvertent actuation is minimized. This is in conformance with the ATWS rule guidance, and therefore is acceptable.

4.12 MANUAL INITIATION

The ARI system has manual initiation switches for each division located on the main control room panel. The staff finds this acceptable.

4.13 INFORMATION READOUT

The ARI system provides system status indications in the main control room. The annunciators are provided for

(1) the ARI system is in testing or loss of power, and
(2) the ARI function initiated.

The ARI valves have position indicators on the control panel in the main control room. The staff finds this acceptable.

4.14 COMPLETION OF PROTECTIVE ACTION ONCE IT IS INITIATED

The ARI system has a seal-in feature to ensure the completion of protective action once it is initiated. ARI reset is accomplished manually by reset push buttons located on panel H13-P650 in the control room. Two push buttons, one for each division are required to reset the ARI system. Reset operation is controlled by plant operating procedures. The staff finds this acceptable.

4.15 CONCLUSION ON ARI SYSTEM

Based on this review, the ARI design basis requirements identified above are in compliance with ATWS Rule 10 CFR 50.62 paragraph (C)(3) and the guidance published in Federal Register Volume 49 No. 124 dated June 26, 1984, and therefore, the design of the ARI system is acceptable.

5.0 EVALUATION OF ATWS/RPT SYSTEM

The WNP-2 RPT initiation logic design uses a one-out-of-two logic scheme. The trip signal is initiated by either one of two reactor vessel low water level or one of two reactor vessel high pressure signals. The staff finds that the "one-out-of-two" logic scheme is not in conformance with ATWS Rule implementation guidance in two aspects:

1. The BWROG topical report NEDE-31096 specifies that the RPT shall be designed such that periodic surveillance tests can be performed during normal plant operation to provide assurance that the RPT logic and controls are capable of functioning as designed. Testing of the final actuation devices (trip coils and breakers), while reactor is at power, is not required. The staff finds that the WNP-2 RPT design only allows testing of the individual instrument channel. There is no provision to test the logic relays to energize the breaker trip coil. Therefore, the design is not in full conformance with the ATWS rule implementation guidance.

2. The ATWS Rule guidance states that the design should be such that frequency of inadvertent actuation and challenges to other safety systems is minimized. The staff finds that with a "one-out-of-two" trip scheme, the potential for inadvertent actuation is higher than the coincident logic scheme. In view of this the recent LaSalle Unit 2 power oscillation event (NRC Bulletin No. 88-07), in which the inadvertent recirculation pump trip was the trigger event, the staff concludes that the "one-out-of-two"trip scheme is not a prudent design to minimize the inadvertent recirculation pump trip.

The licensee should modify their design such that it meets the ATWS implementation guidance for the two areas discussed above or clearly demonstrate that their design will satisfy the objectives of the ATWS mitigation function.

5.1 CONCLUSION ON ATWS/RPT SYSTEM

The staff finds that the WNP-2 ATWS/RPT initiation logic design is not in full conformance with the ATWS Rule, 10CFR50.62, and as a result, the ATWS/RPT system is not acceptable.

6.0 TECHNICAL SPECIFICATIONS

The equipment required by the ATWS Rule to reduce the risk associated with an ATWS event must be designed to perform its function in a reliable manner. A method acceptable to the staff for demonstrating that the equipment satisfies the reliability requirements of the ATWS Rule is to provide equipment technical specifications including operability and surveillance requirements. The staff will provide guidance on technical specification requirements for the ARI and RPT systems in a separate document.

7.0 REFERENCES

1. Washington Public Power Supply System letter from G.C. Sorensen to NRC document control desk dated April 13, 1987.

2. Washington Public Power Supply System letter from G.C. Sorensen to NRC document control desk dated June 24, 1988.

3. BWROG Topical Report NEDE-31096-P "Anticipated Transients Without Scram; Response to NRC ATWS Rule 10CFR50.62," dated December 1985.

4. Staff SER on BWROG Topical Report NEDE-31096-P. Letter from Gus Lainas (NRC) to Terry A. Pickens (BWR Owners' Group Chairman), dated October 21, 1986.

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