B 3.9 REFUELING OPERATIONS

B 3.9.3 Nuclear Instrumentation

BASES

BACKGROUND

The source range neutron flux monitors are used during refueling operations to monitor the core reactivity condition. The installed source range neutron flux monitors are part of the Nuclear Instrumentation System (NIS) while the Wide Range Neutron Flux Monitoring System (Gamma-Metrics) are not. Source range indication is provided via the NIS source range channels and the Gamma-Metrics shutdown monitors using detectors located external to the reactor vessel. These detectors monitor neutrons leaking from the core. Neutron flux indication for these monitors are provided in counts per second.

The Westinghouse-supplied boron triflouride (BF_3) detectors used for the NIS Source Range Channels are being replaced with Thermo Scientific-supplied fission chamber detectors. The Westinghouse NIS Source Range Channels utilizing BF_3 detectors have a range of 1 to 1E6 cps. The replacement Thermo Scientific NIS Source Range Channels utilizing fission chamber detectors have a range of 0.1 to 1E6 cps. The Wide Range (Gamma-Metrics) channels are fission chambers with a range of 0.1 to 1E5 cps (in the startup range). The NIS source range channels and the Gamma-Metrics shutdown monitors provide continuous visible count rate indication in the control room and a high flux control room alarm to alert operators to any unexpected positive reactivity additions. Since TS 3.9.2 requires isolation of unborated water sources, the shutdown monitors (Gamma-Metrics) audible alarm, NIS source range audible indication and audible alarm are not required for OPERABILITY in Mode 6.

The NIS source range detectors and the Gamma-Metrics are designed in accordance with the criteria presented in Reference 1.

APPLICABLE SAFETY ANALYSES

Two OPERABLE source range neutron flux monitors (any combination of the two NIS source range monitors and the two Gamma-Metrics wide range monitors) are required to provide an indication to alert the operator to unexpected changes in core reactivity such as with a boron dilution accident (Ref. 2) or an improperly loaded fuel assembly.

The source range neutron flux monitors satisfy Criterion 3 of 10 CFR 50.36 (Ref. 3).

LCO

This LCO requires that two source range neutron flux monitors be OPERABLE to ensure that redundant monitoring capability is available to detect changes in core reactivity. To be operable, each monitor must provide a visual indication in the Control Room. The visual indication can be, but not limited to, either a gauge, chart recorder, CRT, or some other recording device. The two required source range neutron flux monitors may consist of any combination of the two NIS source range monitors and the two Gamma-Metrics wide range shutdown monitors.

As required by LCO 3.9.2, "Unborated water source isolation valves", all isolation valves for reactor makeup water sources containing unborated water that are connected to the Reactor Coolant System (RCS) must be closed to prevent unplanned boron dilution of the reactor coolant during MODE 6 and thus avoid a reduction in shutdown margin. As such, the required source range monitors OPERABILITY includes only a visual monitoring function. A high flux alarm is not a required function for OPERABILITY.

APPLICABILITY

In MODE 6, the source range neutron flux monitors must be OPERABLE to determine changes in core reactivity. There are no other direct means available to check core reactivity levels. In MODES 2, 3, 4, and 5, the NIS source range detectors and circuitry are also required to be OPERABLE by LCO 3.3.1, "Reactor Trip System (RTS) Instrumentation." The Gamma-Metrics wide range shutdown monitors do not provide an automatic reactor trip protective function .

ACTIONS

A.1 and A.2

With only one required source range neutron flux monitor OPERABLE, redundancy has been lost. Since these instruments are the only direct means of monitoring core reactivity conditions, CORE ALTERATIONS and introduction of coolant into the RCS with boron concentration less than required to meet the minimum boron concentration of LCO 3.9.1 must be suspended immediately. Suspending positive reactivity additions that could result in failure to meet the minimum boron concentration limit is required to assure continued safe operation. Introduction of coolant inventory must be from sources that have a boron concentration greater than that which would be required in the RCS for minimum refueling boron concentration. This may result in an overall reduction in RCS boron concentration, but provides acceptable margin to maintaining subcritical operation. Performance of Required Action A.1 shall not preclude completion of movement of a component to a safe position.

ACTIONS (continued)

B.1

With no required source range neutron flux monitor OPERABLE, action to restore a monitor to OPERABLE status shall be initiated immediately. Once initiated, action shall be continued until a source range neutron flux monitor is restored to OPERABLE status.

B.2

With no required source range neutron flux monitor OPERABLE, there are no direct means of detecting changes in core reactivity. However, since CORE ALTERATIONS and positive reactivity additions are not to be made, the core reactivity condition is stabilized until the source range neutron flux monitors are OPERABLE. This stabilized condition is determined by performing SR 3.9.1.1 to ensure that the required boron concentration exists.

The Completion Time of once per 12 hours is sufficient to obtain and analyze a reactor coolant sample for boron concentration and ensures that unplanned changes in boron concentration would be identified. The 12 hour Frequency is reasonable, considering the low probability of a change in core reactivity during this time period.

SURVEILLANCE REQUIREMENTS

SR 3.9.3.1

SR 3.9.3.1 is the performance of a CHANNEL CHECK, which is a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that the two indication channels should be consistent with core conditions. Changes in fuel loading and core geometry can result in significant differences between source range channels, but each channel should be consistent with its local conditions.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.9.3.2

SR 3.9.3.2 is the performance of a CHANNEL CALIBRATION. The CHANNEL CALIBRATION ensures that the monitors are calibrated. This SR is modified by a Note stating that neutron detectors are excluded from the CHANNEL CALIBRATION. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

REFERENCES

1. 10 CFR 50, Appendix A, GDC 13, GDC 26, GDC 28, and GDC 29.

2. UFSAR, Sections 4.2, 15.4.6.

3. 10 CFR 50.36, Technical Specifications, (c)(2)(ii).