

ENCLOSURE 5  
SHEARON HARRIS NUCLEAR POWER PLANT  
NRC DOCKET NO. 50-400/LICENSE NO. NPF-63  
REQUEST FOR LICENSE AMENDMENT  
RTD BYPASS MANIFOLD ELIMINATION

TECHNICAL SPECIFICATION PAGES

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TABLE 2.2-1 (Continued)  
TABLE NOTATIONS

NOTE 1: OVERTEMPERATURE  $\Delta T$

$$\Delta T \frac{(1 + \tau_1 S)}{(1 + \tau_2 S)} \frac{(1)}{(1 + \tau_3 S)} \leq \Delta T_0 \{K_1 - K_2 \frac{(1 + \tau_4 S)}{(1 + \tau_5 S)} \left[ T \frac{(1)}{(1 + \tau_6 S)} - T' \right] + K_3(P - P') - f_1(\Delta I)\}$$

Where:  $\Delta T$  = Measured  $\Delta T$  by RTD ~~Manifold~~ Instrumentation;

$\frac{1 + \tau_1 S}{1 + \tau_2 S}$  = Lead-lag compensator on measured  $\Delta T$ ;

$\tau_1, \tau_2$  = Time constants utilized in lead-lag compensator for  $\Delta T$ ,  $\tau_1 = 8$  s,  
 $\tau_2 = 3$  s;

$\frac{1}{1 + \tau_3 S}$  = Lag compensator on measured  $\Delta T$ ;

$\tau_3$  = Time constants utilized in the lag compensator for  $\Delta T$ ,  $\tau_3 = 0$  s;

$\Delta T_0$  = Indicated  $\Delta T$  at RATED THERMAL POWER;

$K_1$  = 1.17;

$K_2$  = 0.0224/ $^{\circ}$ F;

$\frac{1 + \tau_4 S}{1 + \tau_5 S}$  = The function generated by the lead-lag compensator for  $T_{avg}$  dynamic compensation;

$\tau_4, \tau_5$  = Time constants utilized in the lead-lag compensator for  $T_{avg}$ ,  $\tau_4 = 20$  s,  
 $\tau_5 = 4$  s;

$T$  = Average temperature,  $^{\circ}$ F;

$\frac{1}{1 + \tau_6 S}$  = Lag compensator on measured  $T_{avg}$ ;

$\tau_6$  = Time constant utilized in the measured  $T_{avg}$  lag compensator,  $\tau_6 = 0$  s;

## LIMITING SAFETY SYSTEM SETTINGS

### BASES

#### Power Range, Neutron Flux (Continued)

The Low Setpoint trip may be manually blocked above P-10 (a power level of approximately 10% of RATED THERMAL POWER) and is automatically reinstated below the P-10 Setpoint.

#### Power Range, Neutron Flux, High Rates

The Power Range Positive Rate trip provides protection against rapid flux increases which are characteristic of a rupture of a control rod drive housing. Specifically, this trip complements the Power Range Neutron Flux High and Low trips to ensure that the criteria are met for rod ejection from mid-power.

The Power Range Negative Rate trip provides protection for control rod drop accidents. At high power a single or multiple rod drop accident could cause local flux peaking which could cause an unconservative local DNBR to exist. The Power Range Negative Rate trip will prevent this from occurring by tripping the reactor. No credit is taken for operation of the Power Range Negative Rate trip for those control rod drop accidents for which DNBRs will be greater than the design DNBR value.

#### Intermediate and Source Range, Neutron Flux

The Intermediate and Source Range, Neutron Flux trips provide core protection during reactor startup to mitigate the consequences of an uncontrolled rod cluster control assembly bank withdrawal from a subcritical condition. These trips provide redundant protection to the Low Setpoint trip of the Power Range, Neutron Flux channels. The Source Range channels will initiate a Reactor trip at about  $10^5$  counts per second unless manually blocked when P-6 becomes active. The Intermediate Range channels will initiate a Reactor trip at a current level equivalent to approximately 25% of RATED THERMAL POWER unless manually blocked when P-10 becomes active.

#### Overtemperature $\Delta T$

The Overtemperature  $\Delta T$  trip provides core protection to prevent DNB for all combinations of pressure, power, coolant temperature, and axial power distribution, provided that the transient is slow with respect to piping/transit/delays from the core to the temperature detectors (about 4 seconds), and pressure is within the range between the Pressurizer High and Low Pressure trips. The Set-point is automatically varied with: (1) coolant temperature to correct for temperature induced changes in density and heat capacity of water and includes dynamic compensation for piping delays from the core to the loop temperature detectors, (2) pressurizer pressure, and (3) axial power distribution. With normal axial power distribution, this Reactor trip limit is always below the core Safety Limit as shown in Figure 2.1-1. If axial peaks are greater than design, as indicated by the difference between top and bottom power range nuclear detectors, the Reactor trip is automatically reduced according to the notations in Table 2.2-1.

TRANSPORT TO AND RESPONSE TIME OF

TRANSPORT TO AND RESPONSE TIME OF

## LIMITING SAFETY SYSTEM SETTINGS

### BASES

#### Overpower ΔT

The Overpower ΔT trip provides assurance of fuel integrity (e.g., no fuel pellet melting and less than 1% cladding strain) under all possible overpower conditions, limits the required range for Overtemperature ΔT trip, and provides a backup to the High Neutron Flux trip. The Setpoint is automatically varied with: (1) coolant temperature to correct for temperature induced changes in density and heat capacity of water, and (2) rate of change of temperature for dynamic compensation for ~~piping delays from the core to the loop temperature detectors~~, to ensure that the allowable heat generation rate (kW/ft) is not exceeded. The Overpower ΔT trip provides protection to mitigate the consequences of various size steam breaks as reported in WCAP-9226, "Reactor Core Response to Excessive Secondary Steam Releases."

*TRANSPORT TO AND RESPONSE TIME OF*

#### Pressurizer Pressure

In each of the pressurizer pressure channels, there are two independent bistables, each with its own trip setting to provide for a High and Low Pressure trip thus limiting the pressure range in which reactor operation is permitted. The Low Setpoint trip protects against low pressure which could lead to DNB by tripping the reactor in the event of a loss of reactor coolant pressure.

On decreasing power the Low Setpoint trip is automatically blocked by the loss of P-7 (a power level of approximately 10% of RATED THERMAL POWER or turbine impulse chamber pressure at approximately 10% of full power equivalent); and on increasing power, automatically reinstated by P-7.

The High Setpoint trip functions in conjunction with the pressurizer relief and safety valves to protect the Reactor Coolant System against system overpressure.

#### Pressurizer Water Level

The Pressurizer High Water Level trip is provided to prevent water relief through the pressurizer safety valves. On decreasing power the Pressurizer High Water Level trip is automatically blocked by the loss of P-7 (a power level of approximately 10% of RATED THERMAL POWER or a turbine impulse chamber pressure at approximately 10% of full power equivalent); and on increasing power, automatically reinstated by P-7.

#### Reactor Coolant Flow

The Reactor Coolant Low Flow trips provide core protection to prevent DNB by mitigating the consequences of a loss of flow resulting from the loss of one or more reactor coolant pumps.

On increasing power above P-7 (a power level of approximately 10% of RATED THERMAL POWER or a turbine impulse chamber pressure at approximately 10% of full power equivalent), an automatic Reactor trip will occur if the flow in more than one loop drops below 90.5% of nominal full loop flow. Above P-8

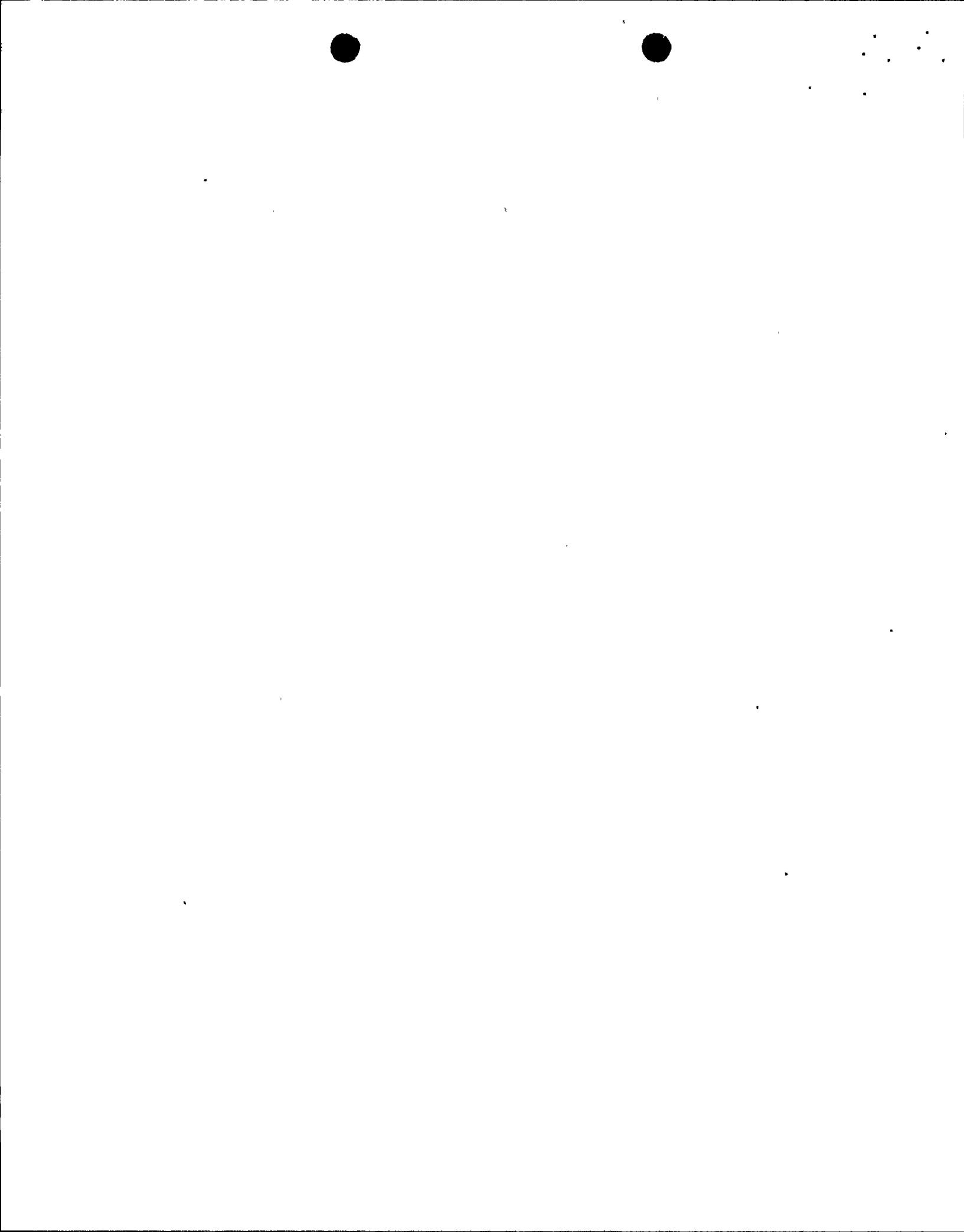


TABLE 4.3-1 (Continued)

TABLE NOTATIONS (Continued)

RESPONSE TIME.

- (11) CHANNEL CALIBRATION shall include the RTD ~~bypass loops flow rate~~.
- (12) Verify that appropriate signals reach the undervoltage and shunt trip relays, for both the main and bypass breakers, from the manual reactor trip switch.

TABLE 2.2-1 (Continued)  
TABLE NOTATIONS

NOTE 1: OVERTEMPERATURE  $\Delta T$

$$\Delta T \frac{(1 + \tau_1 S)}{(1 + \tau_2 S)} \left[ \frac{1}{1 + \tau_3 S} \right] \leq \Delta T_0 \left\{ K_1 - K_2 \frac{(1 + \tau_4 S)}{(1 + \tau_5 S)} \left[ T \left( \frac{1}{1 + \tau_6 S} \right) - T' \right] + K_3 (P - P') - f_1(\Delta I) \right\}$$

Where:  $\Delta T$  = Measured  $\Delta T$  by RTD Instrumentation;

$\frac{1 + \tau_1 S}{1 + \tau_2 S}$  = Lead-lag compensator on measured  $\Delta T$ ;

$\tau_1, \tau_2$  = Time constants utilized in lead-lag compensator for  $\Delta T$ ,  $\tau_1 = 8$  s,  $\tau_2 = 3$  s;

$\frac{1}{1 + \tau_3 S}$  = Lag compensator on measured  $\Delta T$ ;

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$\Delta T_0$  = Indicated  $\Delta T$  at RATED THERMAL POWER;

$K_1$  = 1.17;

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$\frac{1 + \tau_4 S}{1 + \tau_5 S}$  = The function generated by the lead-lag compensator for  $T_{avg}$  dynamic compensation;

$\tau_4, \tau_5$  = Time constants utilized in the lead-lag compensator for  $T_{avg}$ ,  $\tau_4 = 20$  s,  $\tau_5 = 4$  s;

TABLE 2.2-1 (Continued)  
TABLE NOTATIONS

NOTE 1: (Continued)

T = Average temperature, °F;

$\frac{1}{1 + \tau_6 s}$  = Lag compensator on measured  $T_{avg}$ ;

$\tau_6$  = Time constant utilized in the measured  $T_{avg}$  lag compensator,  $\tau_6 = 0$  s;

$T'$  = 588.8°F (Nominal  $T_{avg}$  at RATED THERMAL POWER);

$K_3$  = 0.001072/psig;

P = Pressurizer pressure, psig;

$P'$  = 2235 psig (Nominal RCS operating pressure);

S = Laplace transform operator,  $s^{-1}$ ;

and  $f_1(\Delta I)$  is a function of the indicated difference between top and bottom detectors of the power-range neutron ion chambers; with gains to be selected based on measured instrument response during plant startup tests such that:

- (1) For  $q_t - q_b$  between -21.6% and +6.0%,  $f_1(\Delta I) = 0$ , where  $q_t$  and  $q_b$  are percent RATED THERMAL POWER in the top and bottom halves of the core respectively, and  $q_t + q_b$  is total THERMAL POWER in percent of RATED THERMAL POWER;
- (2) For each percent that the magnitude of  $q_t - q_b$  exceeds -21.6%, the  $\Delta T$  Trip Setpoint shall be automatically reduced by 2.36% of its value at RATED THERMAL POWER; and
- (3) For each percent that the magnitude of  $q_t - q_b$  exceeds +6.0%, the  $\Delta T$  Trip Setpoint shall be automatically reduced by 1.57% of its value at RATED THERMAL POWER.

NOTE 2: The channel's maximum Trip Setpoint shall not exceed its computed Trip Setpoint by more than 2.1%  $\Delta T$  span.

## LIMITING SAFETY SYSTEM SETTINGS

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