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U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

South Texas Project
Units 1 & 2
Docket Nos. STN 50-498, STN 50-499
Additional information for South Texas Project
<u>Technical Specifications (TAC NOS. M89432 and M89433)</u>

Reference: 1) Letter from HL&P dated April 29, 1994
(ST-HL-AE-4750) TAC No. 89432/89433

In reference 1, Houston Lighting & Power (HL&P) proposed to amend Facility Operating Licenses NPF-76 and NPF-80 for South Texas Project Units 1 and 2 by revising Technical Specification 3.7.1.1, Turbine Cycle - Safety Valves. The purpose of this amendment is the revision of the maximum allowable power range neutron flux high setpoint when one or more Main Steam Safety Valve is inoperable.

The NRC subsequently requested a summary of the calculation used as the basis for proposed Technical Specification Amendment.

Attached is a copy of the requested summary.

If you should have any questions concerning this matter, please contact Mr. A. W. Harrison at (512) 972-7298 or me at (512) 972-7921.

John Groth

J. F. Groth
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JFG/tck

Attachment: 1. Summary of Calculation NC-7104

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c:

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SUMMARY OF CALCULATION NC-7104

POWER RANGE HIGH NEUTRON FLUX HIGH SETPOINT USED IN TECHNICAL SPECIFICATION 3.7.1.1

1.0 PURPOSE

This report determines the safety analysis power range neutron flux high setpoints used in Technical Specification 3.7.1.1. The setpoints have been calculated such that the main steam system will stay below 110% of its design pressure. The methodology used to calculate the setpoint was provided by Westinghouse in letter no. ST–WN–HS–94–205 (Ref. 1).

2.0 INTRODUCTION

In letter ST-WN-HS-94-205 (Ref. 1), Westinghouse identified a potential safety issue, generic to all Westinghouse plants, regarding plant operation within Technical Specification Table 3.7-1. Table 3.7-1 allows plants to operate with decreased number of operable main steam safety valves (MSSVs) at reduced power level, as determined by the neutron flux trip high setpoint.

The analysis for loss of load/ turbine trip (LOL/TT) from full power (UFSAR Sections 15.2.2 & 15.2.3) bounds the case where all MSSVs are operable. The letter states that LOL/TT event may not be bounding for the allowable operating configurations of Table 3.7-1 since the neutron flux trip high setpoint may not be low enough to preclude secondary side overpressurization conditions. The basis of Technical Specification 3.7.1.1 is that the maximum allowable initial power level is a linear function of the available MSSV relief capacity. The correct basis is that the maximum power level allowed for operation with inoperable MSSVs is below the heat removing capability of the operable MSSVs.

This calculation determines the maximum power level allowed for operation with inoperable MSSVs based on the guidelines provided in Reference 1. Technical Specification 3.7.1.1 (Ref. 2) power range neutron flux high setpoint will be set to the power levels calculated for the inoperable MSSVs, using appropriate allowances.

Westinghouse has determined that this issue does not represent a substantial safety hazard and so is not reportable pursuant to the requirements of 10 CFR 21 (Ref. 3) However, this issue does represent a condition which may impact the plant's licensing basis.

3.0 CALCULATION DEVELOPMENT

This section describes the method of analysis, input data, and the assumptions used in this calculation.

3.1 METHOD OF ANALYSIS

The method of analysis to determine plant operation at reduced power levels with inoperable MSSVs was developed by Westinghouse. The method is described in Reference 1 of this calculation.

The governing equation for determining the heat removal capability of the MSSVs is the relationship: $\dot{q} = \dot{m}\,\Delta h$, where $\dot{q}$ is the heat input from the primary side, $\dot{m}$ is the main steam flow rate, and Δh is the heat of vaporization at the steam relief pressure (conservatively assuming no subcooled feedwater). Using this relationship, the total energy removed by all operable MSSVs is determined. The total energy is adjusted for pressure setpoint tolerance and accumulation to determine the power range neutron flux high setpoint for Safety Analysis. This value is further adjusted for instrument and channel uncertainties to obtain the power range neutron flux high setpoint used in the Technical Specifications. This is performed for one to four inoperable MSSVs in one loop.

3.2 INPUT DATA

- 1. Equation for determining maximum power level allowed for operation with inoperable MSSVs from Ref. 1.
- 2. Nominal NSSS power rating, including reactor coolant pump heat = 3817 MWt (Ref. 4, p. 6)
- 3. MSSV highest operating pressure = 1325 psig (Ref. 5).
- 4. MSSV design flow = 1,032,645 lbm/hr at 110% of design pressure (Ref. 5).
- 5. Total number of MSSVs on each SG loop = 5 (Ref. 6, Section 3.2.5.6).
- 6. Instrument and channel uncertainties, Ui = ±8.4% (Ref. 7). Reference 7 recommends using a conservative value of Ui = ±9.0%. These uncertainties are to be used for determining the power range setpoint.
- 7. Main Steam System design pressure = 1285 psig (Sec. 3.2.5.1 of Ref. 6).

3.3 ASSUMPTIONS

- 1. If one MSSV is inoperable in one loop, this calculation assumes one MSSV is inoperable in each of the four loops, for a total of four inoperable MSSV. This is conservative, since this reduces the power range neutron flux high setpoint. This is consistent with the current Technical Specification Basis.

- 2. This calculation assumes no cooling effect due to feedwater flow. This is consistent with LOL/TT safety analysis where main feedwater flow is lost at the time of turbine trip. This increases the heat load for the MSSVs, thereby resulting in a lower power range setpoint.

- 3. No credit has been taken for the availability of Steam Generator Power Operated Relief Valves.

- 4. No credit has been taken for the availability of Steam Dump System.

4.0 CALCULATION

Section 4.1 determines the power range neutron flux high setpoint based on the stamped capacity of the MSSVs at 110% of the design pressure.

4.1 POWER RANGE NEUTRON FLUX HIGH SETPOINT

The equation determining the revised Technical Specification Table 3.7-1 power setpoint is (from Input #1):

$$\text{Hi } \Phi = (100/Q)\ (w_s\ h_{fg}\ N)/K$$

where:

$\text{Hi } \Phi$ = Safety analysis power range neutron flux high setpoint, percent

Q = Nominal NSSS power rating of the plant (including reactor coolant pump heat), MWt

K = Engineering Units conversion factor, 947.82 Btu/MW-sec

w_s = Minimum total steam flow rate capability of the operable MSSVs on any one steam generator at the highest MSSV opening pressure, including tolerance and accumulation, as appropriate, in lbm/sec. For example, if the maximum number of inoperable MSSVs on any one steam generator is one, then w_s should be a summation of the capacity of the operable MSSVs at the highest operable MSSV operating pressure, excluding the highest capacity MSSV. If the maximum number of inoperable MSSVs per steam generator is three, then w_s should be a summation of the capacity of the operable MSSVs at the highest operable MSSV operating pressure, excluding the three highest capacity MSSVs.

NOTE: ***The highest operable MSSV pressure is 110% of the main steam system design pressure, i.e., 110% of 1285 psig = 1413.5 psig = 1428.2 psia. By assuming 110% overpressure, the acceptance limit for Condition II events, such as loss of load/turbine trip, is not exceeded. Therefore, the tolerance and accumulation need not be considered since the 110% overpressure sets the highest steam line pressure.***

h_{fg} = Heat of vaporization for steam at the highest MSSV operating pressure including tolerance and accumulation, as appropriate, Btu/lbm

NOTE: ***The h_{fg} is based on the highest MSSV operating pressure of 1428.2 psia (110% of the design pressure). A higher safety valve pressure conservatively decreases h_{fg}.***

N = Number of loops in the plant

The values calculated from the above equation must then be adjusted lower for use in Technical Specification 3.7.1.1, to account for instrument and channel uncertainties. The maximum plant operating power level would then be lower than the Safety Analysis reactor protection system setpoint by an appropriate operating margin. This is the Technical Specification setpoint and is calculated as follows:

$\text{Hi } \Phi_s = \text{Hi } \Phi - \text{Ui}$

Where,

$\text{Hi } \Phi_s$ = Technical Specification power range neutron flux high setpoint, percent
Ui = Instrument and channel uncertainties, percent

From Input #2, Q = 3817 MWt.
From Input #3, the highest MSSV operating pressure is 1325 psig.
From Input #4, w_s = 1,032,645 lbm/hr at the stamped capacity. The stamped capacity is achieved at a pressure of 1285 psig + 10% overpressure, which is:
1285 * 1.10 = 1413.5 psig = 1428.2 psia.

From Ref. 8, at 1428.2 psia, h_{fg} = 571.4 Btu/lbm.

From Input #5 there are five main steam safety valves in each SG loop. Since the capacity of all the valves are the same at 10% overpressure (Ref. 5), the equation is solved by adjusting for the number of operable MSSVs.

The **Power Range High Setpoints used in Safety Analysis** for various inoperable MSSVs are:

For 1 inoperable MSSV (4 operable):

$\text{Hi } \Phi = 4 * (100/3817)(1032645/3600)(571.4 * 4)/947.82 = 72.5\%$

For 2 inoperable MSSVs (3 operable):

Hi Φ = 3 * (100/3817) (1032645/3600)(571.4 * 4)/947.82 = 54.4%

For 3 inoperable MSSVs (2 operable):

Hi Φ = 2 * (100/3817) (1032645/3600)(571.4 * 4)/947.82 = 36.2%

For 4 inoperable MSSVs (1 operable):

Hi Φ = 1 * (100/3817) (1032645/3600)(571.4 * 4)/947.82 = 18.1%

Applying conservative instrument and channel uncertainties of Ui = 9.0% (Input #6) to the power range high setpoints obtained for Safety Analysis above give the **Neutron Flux Power Range High Setpoints used in Technical Specifications** for various inoperable MSSVs:

For 1 inoperable MSSV (4 operable):

Hi Φ_s = Hi Φ - Ui = 72.5 - 9.0 = 63.5%

For 2 inoperable MSSVs (3 operable):

Hi Φ_s = Hi Φ - Ui = 54.4 - 9.0 = 45.4%

For 3 inoperable MSSVs (2 operable):

Hi Φ_s = Hi Φ - Ui = 36.2 - 9.0 = 27.2%

For 4 inoperable MSSVs (1 operable):

Hi Φ_s = Hi Φ - Ui = 18.1 - 9.0 = 9.1%

5.0 RESULTS

Table 1 provides a summary of the results. The results may be used in Technical Specification 3.7.1.1. The results show that with one inoperable MSSV in any loop, the power range neutron flux high setpoint should be 63%.

6.0 REFERENCES

1. Letter No. ST-WN-HS-94-205, Operation at Reduced Power Levels With Inoperable MSSVs, from M.A. Sinwell (Westinghouse) to J.J. Sheppard (HL&P), with attachment, dated 1/20/94.

2. STP Technical Specification Section 3.7.1.1, Turbine Cycle, Safety Valves.

3. Code of Federal Regulations, 10 CFR 21, Reporting of Defects and Noncompliance.

4. Design Basis Document 5N079NB1000, Accident Analysis - Index, Revision 0.

5. Document Nos. 4034-01028-BDI and 8034-01027-BDI, Valve Application Report, 4/24/85.

6. Design Basis Document 5S101MB1026, Main Steam System, Revision 0.

7. Letter No. ST-HS-HS-27807, Power Range Instrumentation Uncertainty, from R.F. Carroll to D.A. Leazar, dated 2/9/94.

8. ASME Steam Tables, Fifth Edition, 1983.

7.0 TABLES

TABLE - 1

MAXIMUM ALLOWABLE POWER RANGE NEUTRON FLUX HIGH SETPOINT WITH INOPERABLE MAIN STEAM SAFETY VALVES

MAXIMUM NUMBER OF INOPERABLE MAIN STEAM SAFETY VALVES ON ANY STEAM GENERATOR	MAXIMUM ALLOWABLE POWER RANGE NEUTRON FLUX HIGH SETPOINT (PERCENT OF RATED THERMAL POWER)
1	63
2	45
3	27
4	9