ATTACHMENT 2 TO AEP:NRC:1213A

EXISTING TECHNICAL SPECIFICATION
PAGES MARKED TO REFLECT PROPOSED CHANGES

3/4.7 PLANT SYSTEMS

3/4.7.1 TURBINE CYCLE

SAFETY VALVES

LIMITING CONDITION FOR OPERATION

3.7.1.1 All main steam line code safety valves associated with each steam generator shall be OPERABLE.

APPLICABILITY: Modes 1, 2 and 3.

ACTION:

MODES 1&2:

a. With 4 reactor coolant loops and associated steam generators in operation, and with one or more main steam line code safety valves inoperable, operation ~~in MODES 1, 2 and 3~~ may proceed provided that within 4 hours, either the inoperable ~~valve is~~ valve(s) are restored to OPERABLE status, or the Power Range Neutron Flux High Setpoint trip is reduced per Table 3.7-1; otherwise, be in ~~at least~~ HOT STANDBY within the next 6 hours and ~~in COLD SHUTDOWN within the following 30 hours~~. Comply with action statement b.

MODE 3:

b. With a minimum of 3 reactor coolant loops and associated steam generators in operation, and with one or more main steam line code safety valves associated with an operating loop inoperable, operation ~~in MODE 3~~ may proceed provided that within 4 hours, either the inoperable ~~valve is~~ valve(s) are restored to OPERABLE status, or the reactor trip breakers are opened; otherwise, be in ~~COLD~~ HOT SHUTDOWN within the next 30 hours.

c. The provisions of Specification 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.7.1.1 Each main steam line code safety valve shall be demonstrated OPERABLE in accordance with Specification 4.0.5 and with lift settings as shown in Table 4.7-1. The safety valve shall be reset to the nominal value ±1% whenever found outside the ±1% tolerance.

4.7.1.2 The provisions of Specification 4.0.4 are not applicable for entry into MODE 3.

TABLE 3.7-1

MAXIMUM ALLOWABLE POWER RANGE NEUTRON FLUX HIGH SETPOINT WITH INOPERABLE STEAM LINE SAFETY VALVES DURING 4 LOOP OPERATION

Maximum Number of Inoperable Safety Valves on Any Operating Steam Generator	Maximum Allowable Power Range Neutron Flux High Setpoint (Percent of RATED THERMAL POWER)
1	~~87.2~~ 65.1
2	~~66.4~~ 46.5
3	~~43.6~~ 28.0

3/4.7 PLANT SYSTEMS

BASES

3/4.7.1 TURBINE CYCLE

3/4.7.1.1 SAFETY VALVES

The OPERABILITY of the main steam line code safety valves ensures that the secondary system pressure will be limited to within its design pressure of 1085 psig during the most severe anticipated system operational transient. The maximum relieving capacity is associated with a turbine trip from 100% RATED THERMAL POWER coincident with an assumed loss of condenser heat sink (i.e., no steam bypass to the condenser).

The specified valve lift settings and relieving capacities are in accordance with the requirements of Section III of the ASME Boiler and Pressure Code, 1971 Edition. The total relieving capacity for all valves on all of the steam lines is 17,153,800 lbs/hr which is approximately 121 percent of the total secondary steam flow of 14,120,000 lbs/hr at 100% RATED THERMAL POWER. A minimum of 2 OPERABLE safety valves per operable steam generator ensures that sufficient relieving capacity is available for the allowable THERMAL POWER restriction in Table 3.7-1.

STARTUP and/or POWER OPERATION is allowable with safety valves inoperable within the limitations of the ACTION requirements on the basis of the reduction in secondary system steam flow and THERMAL POWER required by the reduced reactor trip settings of the Power Range Neutron Flux channels. The reactor trip setpoint reductions are derived on the following bases:

For 4 loop operation

$$SP = \frac{(X) - (Y)(V)}{X} \times (109)$$

Replace with attached text

Where:

SP = reduced reactor trip setpoint in percent of RATED THERMAL POWER

V = maximum number of inoperable safety valves per steam line = 1, 2 or 3.

X = Total relieving capacity of all safety valves per steam line = 4,288,450 lbs/hour.

Y = Maximum relieving capacity of any one safety valve = 857,690 lbs/hour.

(109) = Power Range Neutron Flux-High Trip Setpoint for 4 loop operation.

Replacement text for 3/4.7.1.1 Bases

$$Hi\Phi = (100/Q)\frac{(4w_s h_{fg})}{K}$$

where:

Hi Φ = Safety Analysis power range high neutron flux setpoint in percent

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

K = Conversion factor, 947.82 $\frac{\text{(Btu/Sec)}}{\text{Mwt}}$

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 lb/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.

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

4 = Number of loops in plant

The values calculated from this algorithm are then adjusted lower for use in Technical Specification 3.7.1.1 to account for instrument and channel uncertainties by 9%. This reduces the maximum plant operating power level so that it is lower than the reactor protection system setpoint by an appropriate operating margin.

3/4.7 PLANT SYSTEMS

3/4.7.1 TURBINE CYCLE

SAFETY VALVES

LIMITING CONDITION FOR OPERATION

3.7.1.1 All main steam line code safety valves associated with each steam generator shall be OPERABLE.

APPLICABILITY: Modes 1, 2 and 3.

ACTION:

MODES 1&2:

a. With 4 reactor coolant loops and associated steam generators in operation, and with one or more main steam line code safety valves inoperable, operation ~~in MODES 1, 2 and 3~~ may proceed provided that within 4 hours, either the inoperable ~~valve is~~ valve(s) are restored to OPERABLE status, or the Power Range Neutron Flux High ~~trip~~ Setpoint is reduced per Table 3.7-1; otherwise, be in ~~at least~~ HOT STANDBY within the next 6 hours and ~~in COLD SHUTDOWN within the following 30 hours~~. comply with action statement b.

MODE 3:

b. With a minimum of 3 reactor coolant loops and associated steam generators in operation, and with one or more main steam line code safety valves associated with an operating loop inoperable, operation ~~in MODE 3~~ may proceed provided that within 4 hours, either the inoperable valve(s) are ~~valve is~~ restored to OPERABLE status, or the reactor trip breakers are opened; otherwise, be in ~~COLD~~ HOT SHUTDOWN within the next 30 hours.

c. The provisions of Specification 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.7.1.1 Each main steam line code safety valve shall be demonstrated OPERABLE in accordance with Specification 4.0.5 and with lift settings as shown in Table 4.7-1. The safety valve shall be reset to the nominal value ±1% whenever found outside the ±1% tolerance.

4.7.1.2 The Provisions of Specification 4.0.4 are not applicable for entry into MODE 3.

TABLE 3.7-1

MAXIMUM ALLOWABLE POWER RANGE NEUTRON FLUX HIGH SETPOINT WITH INOPERABLE STEAM LINE SAFETY VALVES DURING 4 LOOP OPERATION

Maximum Number of Inoperable Safety Valves on Any Operating Steam Generator	Maximum Allowable Power Range Neutron Flux High Setpoint (Percent of RATED THERMAL POWER)
1	~~87.2~~ 61.6
2	~~65.4~~ 43.9
3	~~43.6~~ 26.2

3/4.7 PLANT SYSTEMS

BASES

3/4.7.1 TURBINE CYCLE

3/4.7.1.1 SAFETY VALVES

The OPERABILITY of the main steam line code safety valves ensures that the secondary system pressure will be limited to within 110% of its design pressure of 1085 psig during the most severe anticipated system operational transient. The maximum relieving capacity is associated with a turbine trip from 100% RATED THERMAL POWER coincident with an assumed loss of condenser heat sink (i.e., no steam bypass to the condenser).

The specified valve lift settings and relieving capacities are in accordance with the requirements of Section III of the ASME Boiler and Pressure Code, 1971 Edition. The total relieving capacity of all safety valves on all of the steam lines is 17,153,800 lbs/hr which is at least 105 percent of the maximum secondary steam flow rate at 100% RATED THERMAL POWER. A minimum of 2 OPERABLE safety valves per steam generator ensures that sufficient relieving capacity is available for the allowable THERMAL POWER restriction in Table 3.7-1.

STARTUP and/or POWER OPERATION is allowable with safety valves inoperable within the limitations of the ACTION requirements on the basis of the reduction in secondary system steam flow and THERMAL POWER required by the reduced reactor trip settings of the Power Range Neutron Flux channels. The reactor trip setpoint reductions are derived on the following bases:

~~For 4 loop operation~~

$$SP = \frac{(X) - (Y)(V)}{X} \times (109)$$

~~Where:~~

~~SP = reduced reactor trip setpoint in percent of RATED THERMAL POWER~~

~~V = maximum number of inoperable safety valves per steam line~~

~~X = total relieving capacity of all safety valves per steam line in lbs./hours = 4,288,450~~

~~Y = maximum relieving capacity of any one safety valve in lbs./hour = 857,690~~

~~109 = Power Range Neutron Flux-High Trip Setpoint for 4 loop operation~~

Replace with attached text

Replacement text for 3/4.7.1.1 Bases

$$Hi\Phi = (100/Q)\frac{(4w_s h_{fg})}{K}$$

where:

Hi Φ = Safety Analysis power range high neutron flux setpoint in percent

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

K = Conversion factor, 947.82 $\frac{(Btu/Sec)}{Mwt}$

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 lb/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.

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

4 = Number of loops in plant

The values calculated from this algorithm are then adjusted lower for use in Technical Specification 3.7.1.1 to account for instrument and channel uncertainties by 9%. This reduces the maximum plant operating power level so that it is lower than the reactor protection system setpoint by an appropriate operating margin.

ATTACHMENT 3 TO AEP:NRC:1213A

PROPOSED REVISED
TECHNICAL SPECIFICATION PAGES

3/4.7.1 TURBINE CYCLE

SAFETY VALVES

LIMITING CONDITION FOR OPERATION

3.7.1.1 All main steam line code safety valves associated with each steam generator shall be OPERABLE.

APPLICABILITY: MODES 1, 2 and 3.

ACTION:

a. MODES 1 & 2: With 4 reactor coolant loops and associated steam generators in operation, and with one or more main steam line code safety valves inoperable, operation may proceed provided that within 4 hours, either the inoperable valve(s) are restored to OPERABLE status, or the Power Range Neutron Flux High Setpoint trip is reduced per Table 3.7-1; otherwise, be in HOT STANDBY within the next 6 hours and comply with action statement b.

b. MODE 3: With a minimum of 3 reactor coolant loops and associated steam generators in operation, and with one or more main steam line code safety valves associated with an operating loop inoperable, operation may proceed provided that within 4 hours, either the inoperable valve(s) are restored to OPERABLE status, or the reactor trip breakers are opened; otherwise, be in HOT SHUTDOWN within the next 30 hours.

c. The provisions of Specification 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.7.1.1 Each main steam line code safety valve shall be demonstrated OPERABLE in accordance with Specification 4.0.5 and with lift settings as shown in Table 4.7-1. The safety valve shall be reset to the nominal value ±1% whenever found outside the ±1% tolerance.

4.7.1.2 The provisions of Specification 4.0.4 are not applicable for entry into MODE 3.

TABLE 3.7-1

MAXIMUM ALLOWABLE POWER RANGE NEUTRON FLUX HIGH SETPOINT WITH INOPERABLE STEAM LINE SAFETY VALVES DURING 4 LOOP OPERATION

Maximum Number of Inoperable Safety Valves on Any Operating Steam Generator	Maximum Allowable Power Range Neutron Flux High Setpoint (Percent of RATED THERMAL POWER)
1	65.1
2	46.5
3	28.0

3/4.7.1 TURBINE CYCLE

3/4.7.1.1 SAFETY VALVES

The OPERABILITY of the main steam line code safety valves ensures that the secondary system pressure will be limited to within 110% of its design pressure of 1085 psig during the most severe anticipated system operational transient. The maximum relieving capacity is associated with a turbine trip from 100% RATED THERMAL POWER coincident with an assumed loss of condenser heat sink (i.e., no steam bypass to the condenser).

The specified valve lift settings and relieving capacities are in accordance with the requirements of Section III of the ASME Boiler and Pressure Code, 1971 Edition. The safety valve is OPERABLE with a lift setting of ±3% about the nominal value. However, the safety valve shall be reset to the nominal value ±1% whenever found outside the ±1% tolerance. The total relieving capacity for all valves on all of the steam lines is 17,153,800 lbs/hr which is approximately 121 percent of the total secondary steam flow of 14,120,000 lbs/hr at 100% RATED THERMAL POWER. A minimum of 2 OPERABLE safety valves per operable steam generator ensures that sufficient relieving capacity is available for the allowable THERMAL POWER restriction in Table 3.7-1.

STARTUP and/or POWER OPERATION is allowable with safety valves inoperable within the limitations of the ACTION requirements on the basis of the reduction in secondary system steam flow and THERMAL POWER required by the reduced reactor trip settings of the Power Range Neutron Flux channels. The reactor trip setpoint reductions are derived on the following bases:

$$Hi\Phi = (100/Q)\,\frac{(4 w_s h_{fg})}{K}$$

where:

Hi Φ = Safety Analysis power range high neutron flux setpoint in percent

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

K = Conversion factor, 947.82 $\frac{(\text{Btu/Sec})}{\text{Mwt}}$

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 lb/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.

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

4 = Number of loops in plant

The values calculated from this algorithm are then adjusted lower for use in Technical Specification 3.7.1.1 to account for instrument and channel uncertainties by 9%. This reduces the maximum plant operating power level so that it is lower than the reactor protection system setpoint by an appropriate operating margin.

3/4.7.1 TURBINE CYCLE

SAFETY VALVES

LIMITING CONDITION FOR OPERATION

3.7.1.1 All main steam line code safety valves associated with each steam generator shall be OPERABLE.

APPLICABILITY: MODES 1, 2 and 3.

ACTION:

a. MODES 1 & 2: With 4 reactor coolant loops and associated steam generators in operation, and with one or more main steam line code safety valves inoperable, operation may proceed provided that within 4 hours, either the inoperable valve(s) are restored to OPERABLE status, or the Power Range Neutron Flux High Setpoint trip is reduced per Table 3.7-1; otherwise, be in HOT STANDBY within the next 6 hours and comply with action statement b.

b. MODE 3: With a minimum of 3 reactor coolant loops and associated steam generators in operation, and with one or more main steam line code safety valves associated with an operating loop inoperable, operation may proceed provided that within 4 hours, either the inoperable valve(s) are restored to OPERABLE status, or the reactor trip breakers are opened; othbrwise, be in HOT SHUTDOWN within the next 30 hours.

c. The provisions of Specification 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.7.1.1 Each main steam line code safety valve shall be demonstrated OPERABLE in accordance with Specification 4.0.5 and with lift settings as shown in Table 4.7-1. The safety valve shall be reset to the nominal value $\pm 1\%$ whenever found outside the $\pm 1\%$ tolerance.

4.7.1.2 The provisions of Specification 4.0.4 are not applicable for entry into MODE 3.

TABLE 3.7-1

MAXIMUM ALLOWABLE POWER RANGE NEUTRON FLUX HIGH SETPOINT WITH INOPERABLE STEAM LINE SAFETY VALVES DURING 4 LOOP OPERATION

Maximum Number of Inoperable Safety Valves on Any Operating Steam Generator	Maximum Allowable Power Range Neutron Flux High Setpoint (Percent of RATED THERMAL POWER)
1	61.6
2	43.9
3	26.2

3/4.7.1 TURBINE CYCLE

3/4.7.1.1 SAFETY VALVES

The OPERABILITY of the main steam line code safety valves ensures that the secondary system pressure will be limited to within 110% of its design pressure of 1085 psig during the most severe anticipated system operational transient. The maximum relieving capacity is associated with a turbine trip from 100% RATED THERMAL POWER coincident with an assumed loss of condenser heat sink (i.e., no steam bypass to the condenser).

The specified valve lift settings and relieving capacities are in accordance with the requirements of Section III of the ASME Boiler and Pressure Code, 1971 Edition. The safety valve is OPERABLE with a lift setting of ±3% about the nominal value. However, the safety valve shall be reset to the nominal value ±1% whenever found outside the ±1% tolerance. The total relieving capacity of all safety valves on all of the steam lines is 17,153,800 lbs/hr which is at least 105 percent of the maximum secondary steam flow rate at 100% RATED THERMAL POWER. A minimum of 2 OPERABLE safety valves per steam generator ensures that sufficient relieving capacity is available for the allowable THERMAL POWER restriction in Table 3.7-1.

STARTUP and/or POWER OPERATION is allowable with safety valves inoperable within the limitations of the ACTION requirements on the basis of the reduction in secondary system steam flow and THERMAL POWER required by the reduced reactor trip settings of the Power Range Neutron Flux channels. The reactor trip setpoint reductions are derived on the following bases:

$$Hi\Phi = (100/Q)\,\frac{(4w_s h_{fg})}{K}$$

where:

Hi Φ = Safety Analysis power range high neutron flux setpoint in percent

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

K = Conversion factor, 947.82 $\frac{\text{(Btu/Sec)}}{\text{Mwt}}$

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 lb/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.

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

4 = Number of loops in plant

The values calculated from this algorithm are then adjusted lower for use in Technical Specification 3.7.1.1 to account for instrument and channel uncertainties by 9%. This reduces the maximum plant operating power level so that it is lower than the reactor protection system setpoint by an appropriate operating margin.

ATTACHMENT 4 TO AEP:NRC:1213A

WESTINGHOUSE NSAL 94-001
"OPERATION AT REDUCED POWER LEVELS WITH INOPERABLE MSSV'S"

Westinghouse
Energy
Systems
Business
Unit

ESBU

NUCLEAR SAFETY ADVISORY LETTER

THIS IS A NOTIFICATION OF A RECENTLY IDENTIFIED POTENTIAL SAFETY ISSUE PERTAINING TO BASIC COMPONENTS SUPPLIED BY WESTINGHOUSE. THIS INFORMATION IS BEING PROVIDED TO YOU SO THAT A REVIEW OF THIS ISSUE CAN BE CONDUCTED BY YOU TO DETERMINE IF ANY ACTION IS REQUIRED.

P. O. Box 355, Pittsburgh, PA 15230-0355

Subject: Operation at Reduced Power Levels with Inoperable MSSVs	Number: NSAL-94-001
Basic Component: Loss of Load/Turbine Trip Analysis for Plant Licensing Basis	Date: 01/20/94
Plants: See Enclosed List	

Substantial Safety Hazard or Failure to Comply Pursuant to 10 CFR 21.21(a)	Yes ☐	No ☒
Transfer of Information Pursuant to 10 CFR 21.21(b)	Yes ☐	
Advisory Information Pursuant to 10 CFR 21.21(c)(2)	Yes ☐	

SUMMARY

Westinghouse has identified a potential safety issue regarding plant operation within Technical Specification Table 3.7-1. This issue does not represent a substantial safety hazard for your plant pursuant to 10 CFR 21. However, this issue does represent a condition which may impact your plant's licensing basis.

Table 3.7-1 allows plants to operate with a reduced number of operable MSSVs at a reduced power level, as determined by the high neutron flux trip setpoint. The FSAR loss of load/turbine trip (LOL/TT) analysis from full power bounds the case where all MSSVs are operable. The FSAR (LOL/TT) event may not be bounding for the allowable operating configurations of Table 3.7-1 since the high neutron flux trip setpoint, which is identified in Table 3.7-1 for a corresponding number of inoperable MSSVs, may not be low enough to preclude a secondary side overpressurization condition. As a result, the basis for Table 3.7-1 may not be sufficient to preclude overpressurization of the secondary side of the steam generator.

Therefore, it is recommended that you review the enclosed information to determine the applicability of this issue to your plant. The enclosed information contains a more detailed description of the issue and identifies solutions that you may wish to pursue to address this issue. These solutions include, but are not limited to, a re-evaluation of the LOL/TT analysis and/or a change to Technical Specification Table 3.7-1.

Additional information, if required, may be obtained from the originator. Telephone 412-374-6460.

Originator: J.W. Fasnacht
J. W. Fasnacht
Strategic Licensing Issues

H. A. Sepp, Manager
Strategic Licensing Issues

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Plants Affected

D. C. Cook 1 & 2
J. M. Farley 1 & 2
Byron 1 & 2
Braidwood 1 & 2
V. C. Summer 1
Zion 1 & 2
Shearon Harris 1
W. B. McGuire 1 & 2
Catawba 1 & 2
Beaver Valley 1 & 2
Turkey Point 3 & 4
Vogtle 1 & 2
Indian Point 2 & 3
Seabrook 1
Millstone 3
Diablo Canyon 1 & 2
Wolf Creek
Callaway 1
Comanche Peak 1 & 2
South Texas 1 & 2
Sequoyah 1 & 2
North Anna 1 & 2
Watts Bar 1 & 2
Sizewell B
Kori 1, 2, 3 & 4
Yonggwang 1 & 2
Salem 1 & 2

Issue Description

Westinghouse has identified a deficiency in the basis for Technical Specification 3.7.1.1. This Technical Specification allows the plant to operate at a reduced power level with a reduced number of operable Main Steam Safety Valves (MSSVs). The deficiency is in the assumption that the maximum allowable initial power level is a linear function of the available MSSV relief capacity. The linear function is identified in the Bases Section for Technical Specification 3/4.7.1.1 and is provided as follows:

$$SP = \frac{(X) - (Y)(V)}{X} \times (109)$$

SP	=	Reduced reactor trip setpoint in % of RATED THERMAL POWER
V	=	Maximum number of inoperable safety valves per steam line
X	=	Total relieving capacity of all safety valves per steam line in lbm/hour
Y	=	Maximum relieving capacity of any one safety valve in lbm/hour
(109)	=	Power range neutron flux-high trip setpoint for all loops in operation

Under certain conditions and with typical safety analysis assumptions, a Loss of Load/Turbine Trip transient from part-power conditions may result in overpressurization of the main steam system when operating in accordance with this Technical Specification. The following discussion describes the issue in more detail and provides recommended alternatives for addressing the issue.

Technical Evaluation

The Loss of Load/Turbine Trip (LOL/TT) event is analyzed in the FSAR to show that core protection margins are maintained (DNBR), the RCS will not overpressurize, and the main steam system will not overpressurize. The analysis assumes an immediate loss of steam relieving capability through the turbine and coincident loss of all main feedwater. No credit is taken for the direct reactor trip on turbine trip, since this trip would not be actuated for the case of a loss of steam load. Rather, the transient is terminated by a reactor trip on high pressurizer pressure, overtemperature ΔT, or low steam generator water level. Secondary side overpressure protection is provided by actuation of the Main Steam Safety Valves (MSSVs), which are designed to relieve at least full power nominal steam flow. The analysis verifies that the MSSV capacity is sufficient to prevent secondary side pressure from exceeding 110 percent of the design pressure.

The FSAR only analyzes the LOL/TT transient from the full power initial condition, with cases examining the effects of assuming primary side pressure control and different reactivity feedback conditions. With fully operational MSSVs, it can be demonstrated that overpressure protection is provided for all initial power levels. However, for most plants, Technical Specification 3.7.1.1 allows operation with a reduced number of operable MSSVs at a reduced power level as determined by resetting the power range high neutron flux setpoint. This Technical Specification is not based on a detailed analysis, but rather on the assumption that the maximum allowable initial power level is a linear function of the available MSSV relief capacity. Recently, it has been determined that this assumption is not valid.

The problem is that if main feedwater is lost, a reactor trip is necessary to prevent secondary side overpressurization for all postulated core conditions. At high initial power levels a reactor trip is actuated early in the transient as a result of either high pressurizer pressure or overtemperature ΔT. The reactor trip terminates the transient and the MSSVs maintain steam pressure below 110% of the design value.

At lower initial power levels a reactor trip may not be actuated early in the transient. An overtemperature ΔT trip isn't generated since the core thermal margins are increased at lower power levels. A high pressurizer pressure trip isn't generated if the primary pressure control systems function normally. This results in a longer time during which primary heat is transferred to the secondary side. The reactor eventually trips on low steam generator water level, but this may not occur before steam pressure exceeds 110% of the design value if one or more MSSVs are inoperable in accordance with the Technical Specification.

Due to the wide variety of plant design features that are important to the LOL/TT analysis, it is difficult to perform a generic evaluation to show that the issue does not apply to certain plants. The following key parameters have a significant effect on the secondary side pressure transient:

- MSSV relief capacity
- Moderator Temperature Coefficient (MTC)
- Margin between the MSSV set pressures (including tolerance) and the overpressure limit
- Low-low steam generator water level reactor trip setpoint

Safety Significance

The Technical Specifications for most plants allow operation at a reduced power level with inoperable MSSVs. From a licensing basis perspective, this condition may result in secondary side overpressurization in the event of a LOL/TT transient. The licensing basis for anticipated operational occurrences (ANS Condition II events) typically requires that the secondary side pressure remain below 110% of the design value.

Westinghouse has determined that this issue does not represent a substantial safety hazard. There are several mitigating factors which provide assurance that there is no loss of safety function to the extent that there is a major reduction in the degree of protection provided to the public health and safety. These include, but are not limited to, the following:

1. Adequate overpressure protection is provided at all power levels if all of the MSSVs are operable.

2. If a reactor trip does not occur but main feedwater flow is maintained, operation in accordance with the Technical Specification Table 3.7-1 will not result in an overpressure condition.

3. In any LOL/TT transient, the atmospheric steam dump valves and/or condenser steam dump valves actuate to relieve energy from the steam generators prior to the opening of the MSSVs, and continue to relieve steam if the MSSVs do open. Since it is not a safety-grade function, steam dump is not assumed to operate in the safety analysis; however, in reality it is the first line of defense in protecting the secondary system against overpressurization. It is very improbable that all these components would be inoperable coincident with inoperable MSSVs.

4. Even near the beginning of core life with a positive or zero MTC, the primary coolant heatup resulting from the transient would tend to drive the MTC negative, which would reduce the core power and heat input to the coolant. This would result in a lower required MSSV capacity to prevent secondary overpressurization. The safety analysis does not credit the reduction of MTC during the transient.

<u>NRC Awareness / Reportability</u>

Westinghouse has not notified the NRC of this issue, based upon the determination that it does not represent a substantial safety hazard pursuant to 10 CFR 21. However, Westinghouse will send a copy of this letter to the NRC since this issue impacts information contained in NUREG-1431, "Standard Technical Specifications, Westinghouse Plants".

<u>Recommendations</u>

To address this issue, the following actions may be considered:

(1) Modify Technical Specification 3.7.1.1 (or equivalent) and the associated basis such that the maximum power level allowed for operation with inoperable MSSVs is below the heat removing capability of the operable MSSVs. A conservative way to do this is to set the power range high neutron flux setpoint to this power level, thus ensuring that the actual power level cannot exceed

this value. To calculate this setpoint, the governing equation is the relationship $q = m\ \Delta h$, where q is the heat input from the primary side, m is the steam flow rate and Δh is the heat of vaporization at the steam relief pressure (assuming no subcooled feedwater). Thus, an algorithm for use in defining the revised Technical Specification table setpoint values would be:

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

where:

Hi ϕ	=	Safety Analysis power range high neutron flux setpoint, percent
Q	=	Nominal NSSS power rating of the plant (including reactor coolant pump heat), Mwt
K	=	Conversion factor, 947.82 $\frac{(\text{Btu/sec})}{\text{Mwt}}$
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 lb/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.
h_{fg}	=	heat of vaporization for steam at the highest MSSV opening pressure including tolerance and accumulation, as appropriate, Btu/lbm
N	=	Number of loops in plant

The values calculated from this algorithm must then be adjusted lower for use in Technical Specification 3.7.1.1 to account for instrument and channel uncertainties (typically 9% power). The maximum plant operating power level would then be lower than the reactor protection system setpoint by an appropriate operating margin.

It should be noted that the use of this equation will resolve the issue identified in this letter by enabling you to re-calculate your Technical Specification 3.7.1.1 setpoints without further modifications to the structure of the Technical Specification. The re-calculated setpoints are likely to be lower than those currently allowed by the Technical Specification. However, you should be aware of at least two conservatisms with the equation. You may wish to review these conservatisms to evaluate the use of the equation relative to your plant specific operating objectives. It is possible to relax some of these conservatisms for use in the Technical Specification. However, relaxation of the conservatisms are likely to result in more significant changes to the structure of the Technical Specification.

First, the above equation (and the existing Technical Specification 3.7.1.1) is conservative since it is based on the maximum number of inoperable MSSVs per loop. For example, a representative four loop plant, in accordance with the current Technical Specification, should reduce the neutron flux setpoint to 87% if it has up to one inoperable MSSV on each loop. This means that the plant should use this setpoint whether there are one, two, three or four inoperable MSSVs, as long as there is only one inoperable MSSV per loop. Thus, the existing Technical Specification and the above equation are conservative and bounding. However, any relaxation of this conservatism must be interpreted with care. The reason is that the steam generators must be protected from an overpressurization condition during a loss of load transient. There are several events that could lead to a loss of load, including the inadvertent closure of one or all MSIVs. The affected steam generator must have a sufficient number of operable MSSVs to protect it from an overpressurization condition, if the MSIV (or MSIVs) was inadvertently closed.

Another conservatism in the above equation (and the existing Technical Specification 3.7.1.1) is in w_s, which is the minimum total steam flow rate capability of the operable MSSVs on any one steam generator. This value is conservative since it assumes that if one or more MSSVs are inoperable per loop, the inoperable MSSVs are the largest capacity MSSVs, regardless of whether the largest capacity MSSVs or the smaller capacity MSSVs are inoperable. The assumption has been made so that the above equation is consistent with the current structure of Technical Specification 3.7.1.1.

(2) As an alternative, plant-specific LOL/TT analyses could be performed to maximize the allowable power level for a given number of inoperable MSSVs. Depending on key specific plant parameters, these analyses may be able to justify the continued validity of the current Technical Specification.

(3) Consider modifying, as required, the Bases Section for Technical Specification 3/4.7.1.1 so that it is consistent with the plant safety analysis. The safety analysis criterion for preventing overpressurization of the secondary side is that the pressure does not exceed 110% of the design pressure for anticipated transients. However, in reviewing several plant technical specifications,

it was noted that the bases for some plants state that the safety valves insure that the secondary system pressure will be limited to within 105 or even 100% of design pressure. This is not consistent with the safety analysis basis and should be revised to indicate 110%.