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Welch, MN 55089

March 30, 2020

L-PI-20-004
10 CFR 50.90

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Prairie Island Nuclear Generating Plant, Units 1 and 2
Docket Nos. 50-282 and 50-306
Renewed Facility Operating License Nos. DPR-42 and DPR-60

License Amendment Request to Revise Technical Specifications (TS) to Remove Note 1 from Limiting Condition for Operation (LCO) 3.4.12 and LCO 3.4.13

Pursuant to 10 CFR 50.90, Northern States Power Company, a Minnesota corporation, doing business as Xcel Energy (hereafter "NSPM"), hereby requests an amendment to the Technical Specifications (TS) for the Prairie Island Nuclear Generating Plant (PINGP). The proposed changes would remove Note 1 from both Limiting Condition for Operation (LCO) 3.4.12, Low Temperature Overpressure Protection (LTOP) - Reactor Coolant System Cold Leg Temperature (RCSCLT) > Safety Injection (SI) Pump Disable Temperature, and LCO 3.4.13, Low Temperature Overpressure Protection (LTOP) - Reactor Coolant System Cold Leg Temperature (RCSCLT) ≤ Safety Injection (SI) Pump Disable Temperature.

The enclosure provides NSPM's evaluation of the proposed changes. Attachment 1 to the enclosure provides the PINGP TS page mark ups. Attachment 2 to the enclosure provides retyped copies of the PINGP TS pages. Attachment 3 to the enclosure provides the PINGP TS Bases page mark ups, which are being provided for information only.

NSPM has evaluated the proposed changes in this License Amendment Request (LAR) against the standards in 10 CFR 50.92 and concluded that they involve no significant hazards consideration. In accordance with 10 CFR 50.91(b)(1), a copy of this application, with the enclosure, is being provided to the State of Minnesota designated official.

NSPM requests approval of the proposed amendment within 12 months of NRC acceptance, with an implementation period of 90 days.

If there are any questions or if additional information is required, please contact Mr. Jeff Kivi at (612) 330-5788 or Jeffrey.Kivi@xenuclear.com.

Summary of Commitments

This letter makes no new commitments and no revisions to existing commitments.

I declare under penalty of perjury, that the foregoing is true and correct.
Executed on March 30, 2020, 2020.

Scott Sharp
Site Vice President, Prairie Island Nuclear Generating Plant
Northern States Power Company – Minnesota

Enclosure

cc: Administrator, Region III, USNRC
Project Manager, Prairie Island, USNRC
Resident Inspector, Prairie Island, USNRC
State of Minnesota

ENCLOSURE

PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNITS 1 AND 2

Evaluation of the Proposed Changes

License Amendment Request to Revise Technical Specifications (TS) to Remove Note 1 from Limiting Condition for Operation (LCO) 3.4.12 and LCO 3.4.13

ATTACHMENTS:

1. Technical Specification Pages (Mark Up)
2. Technical Specification Pages (Retyped)
3. Technical Specification Bases Pages (Mark Up – for information only)

License Amendment Request

License Amendment Request to Revise Technical Specifications (TS) to Remove Note 1 from Limiting Condition for Operation (LCO) 3.4.12 and LCO 3.4.13

1.0 SUMMARY DESCRIPTION

Pursuant to 10 CFR 50.90, Northern States Power Company, a Minnesota corporation, doing business as Xcel Energy (hereafter "NSPM"), hereby requests an amendment to the Technical Specifications (TS) for the Prairie Island Nuclear Generating Plant (PINGP), Units 1 and 2, Renewed Facility Operating License Nos. DPR-42 and DPR-60. The proposed changes would remove Note 1 from both Limiting Condition for Operation (LCO) 3.4.12, Low Temperature Overpressure Protection (LTOP) - Reactor Coolant System Cold Leg Temperature (RCSCLT) > Safety Injection (SI) Pump Disable Temperature, and LCO 3.4.13, Low Temperature Overpressure Protection (LTOP) - Reactor Coolant System Cold Leg Temperature (RCSCLT) ≤ Safety Injection (SI) Pump Disable Temperature.

2.0 DETAILED DESCRIPTION

2.1 System Design and Operation

The PINGP Updated Safety Analysis Report (USAR) section 4.4.3.3, Low Temperature Overpressure Mitigation, (Reference 1) provides the details regarding the design, analysis, and operation of the LTOP function. This section addresses design and operation of the LTOP and section 2.2 addresses the LTOP analysis.

PINGP Units 1 and 2 each have an LTOP function that limits RCS pressure at low temperatures so the integrity of the reactor coolant pressure boundary (RCPB) is not compromised by violating the pressure and temperature (P/T) limits of 10 CFR 50, Appendix G, "Fracture Toughness Requirements". The reactor vessel is the limiting RCPB component for demonstrating such protection. The Over Pressure Protection System (OPPS) provides the actuation setpoints for the pressurizer power operated relief valves (PORVs) for the LTOP function. The Pressure and Temperature Limits Report (PTLR) provides the maximum allowable OPPS actuation setpoints and the maximum RCS pressure for the existing RCS cold leg temperature during cooldown, shutdown, and heatup to meet 10 CFR 50, Appendix G.

Above the OPPS Enable Temperature, the pressurizer safety valves limit RCS overpressure events to less than 10 percent above design pressure. Below the OPPS Enable Temperature, another method of relieving RCS pressure must be utilized to ensure that the 10 CFR Part 50 Appendix G pressure/temperature limits are not exceeded. This is accomplished by lowering the pressurizer power operated relief valve setpoint. Like the OPPS Enable Temperature, the pressurizer power operated relief valve low pressure setpoint is also determined each time the heatup and cooldown curves are evaluated per 10 CFR Part 50 Appendix G. Pressure transients will be terminated by relief valve operation before exceeding 110% of the pressure/temperature limits established per the requirements of 10 CFR 50, Appendix G. The

OPPS setpoint analysis applied a 10% relaxation of the Appendix G limitations based upon that allowed by ASME Code Case N-514.

The LTOP pressure relief consists of (1) two PORVs with reduced lift settings provided by OPPS, or (2) a depressurized RCS and an RCS vent of sufficient size. Two PORVs are required for redundancy. One PORV has adequate relieving capability to prevent overpressurization for the required coolant input capability.

Once the RCS is depressurized, a vent exposed to the containment atmosphere will maintain the RCS at containment ambient pressure in an RCS overpressure transient, if the relieving requirements of the transient do not exceed the capabilities of the vent. Thus, the vent path must be capable of relieving the flow resulting from the limiting LTOP mass or heat input transient, and maintaining pressure below the P/T limits. The required vent capacity may be provided by one or more vent paths.

2.2 LTOP Analysis

The current PINGP LTOP analysis revision was completed in 2015 to incorporate results of a new analysis of adjusted reference temperatures for Unit 1 and Unit 2 reactor vessel materials at 54 effective full power years. The LTOP analysis is Reference 131 of USAR Section 4 and is based on a Westinghouse analysis that was completed in 2013. Consistent with prior analyses, a special version of LOFTRAN code was used to develop LTOP PORV setpoint overshoots, which were used to determine the maximum allowable LTOP PORV setpoint in accordance with the NRC approved methodology in WCAP-14040-P-A, Revision 2, “Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves”. (Reference 4)

PINGP Technical Specifications, the PTLR, and procedural restrictions result in the Mass Input analysis being completed in three distinct temperature ranges. The temperature ranges include instrument uncertainty margin as described in the PTLR. Per the current PINGP PTLR:

- The SI Pump Disable Temperature analytical limit is 200°F and the SI Pump Disable Temperature is set to 218°F by adding 18°F for indicating instrument channel uncertainty.
- The OPPS Enable Temperature analytical limit is 225°F and the OPPS Enable Temperature is set to 310°F by adding 18°F for indicating instrument channel uncertainty plus additional margin for operational simplicity.

The Heat Input event is presented as a continuous function since it is a function of initial reactor coolant system temperature at the start of the event. In both cases, the limiting reactor coolant system pressure/temperature limitation curve is the steady state curve due to the fact that overpressure events most likely occur during isothermal conditions. The basic assumptions and reactor coolant system (RCS) temperature ranges for each of the mass input and heat input events are listed below:

I. MASS INPUT EVENT

a. RCS < 200°F (SI Pump Disable Temperature)

Below 218°F, TS 3.4.13 in conjunction with the PTLR requires both SI pumps to be incapable of injecting into the RCS. Therefore, the limiting case is a letdown and residual heat removal system (RHR) isolation with all three charging pumps in service delivering the maximum flow the system is capable of.

b. 200°F ≤ RCS ≤ 310°F

Below 310°F, TS 3.4.12 in conjunction with PTLR requires at least one SI pump to be incapable of injecting into the RCS. Therefore, between 218°F, and 310°F, the limiting case is an unplanned start of one SI pump and all three charging pumps simultaneously. This condition would also be in conjunction with an isolation of both letdown and RHR.

c. RCS > 310°F

There are no restrictions because the pressurizer safety valves would lift to prevent reactor coolant system overpressurization.

II. HEAT INPUT EVENT

The limiting credible heat input event is the starting of a reactor coolant pump in an idle reactor coolant system loop where the steam generator is at a higher temperature than the reactor coolant system. TS 3.4.6, RCS Loops – MODE 4, and TS 3.4.7, RCS Loops – MODE 5, Loops Filled, only allows a reactor coolant pump to be started at reactor coolant system temperatures less than OPPS Enable Temperature if there is a steam or gas bubble in the pressurizer or if the temperature difference between the reactor coolant system and the steam generator in the affected loop is less than 50°F. Therefore, the limiting heat input case is a 50°F temperature difference between a steam generator and the reactor coolant system.

The LTOP analysis of the heat injection transient is included for completeness and is not impacted by the proposed changes to LCO 3.4.12 and LCO 3.4.13.

2.3 Current Technical Specification Requirements

PINGP TS 3.4.12 LCO Note 1 states:

> Both SI pumps may be run for ≤ *1 hour while conducting SI system testing provided there is a steam or gas bubble in the pressurizer and at least one isolation valve between the SI pump and the RCS is shut.*

PINGP TS 3.4.13 LCO Note 1 states:

> *Both safety injection (SI) pumps may be run for ≤ 1 hour while conducting SI system testing provided there is a steam or gas bubble in the pressurizer, the reactor vessel head is on, and at least one isolation valve between the SI pump and the RCS is shut.*

The current bases for Note 1 of LCO 3.4.12 and LCO 3.4.13 state that the combination of a gas bubble in the pressurizer and the isolation of the SI pump from the RCS assure that overpressurization cannot occur. The current bases for TS Surveillance Requirement (SR) 3.4.12.1, SR 3.4.12.2, SR 3.4.13.1, and SR 3.4.13.2 note that the SI pumps are rendered incapable of injecting into the RCS by employing at least two independent means to prevent a pump start such that a single failure or single action will not result in an injection into the RCS.

2.4 Reason for Proposed Changes

The requirement for a pressurizer bubble when running SI pumps was introduced to the PINGP TS in Amendments 38/32 (Reference 3) and was retained in the conversion to improved TS. At the time of ITS conversion, both SI pumps were tested at the same time. Since that time, integrated SI testing has been modified to be performed one train at a time.

Note 1 of LCO 3.4.12 has two conditions for running both SI pumps for testing.

- Steam or gas bubble in the pressurizer. This bubble is not credited in the LTOP analysis, which assumes the RCS is water solid.
- At least one isolation valve between the SI pump and the RCS is shut. For LCO 3.4.12, this condition of Note 1 is more restrictive than LCO 3.4.12 which allows that one SI pump may be capable of injecting to the RCS. However, the applicable LTOP analysis assumes that one SI pump is injecting with the RCS temperature above the SI pump disable temperature; therefore, this condition is not required by the supporting analysis.

Note 1 of LCO 3.4.13 has three conditions for running both SI pumps for testing.

- Steam or gas bubble in the pressurizer. This bubble is not credited in the LTOP analysis, which assumes the RCS is water solid.
- Reactor vessel head is on. The Applicability of LCO 3.4.13 requires that the vessel head is on; therefore, this condition is redundant.
- At least one isolation valve between the SI pump and the RCS is shut. For LCO 3.4.13, this condition is redundant to the LCO requirement that no SI pump is capable of injecting to the RCS when RCS temperature is below the SI pump disable temperature. The applicable LTOP analysis assumes the SI pumps are incapable of injection.

The PINGP LTOP analyses evaluate both the case where one SI pump and three charging pumps are injecting to the RCS for LCO 3.4.12 and the case where no SI pumps and three charging pumps are injecting to the RCS for LCO 3.4.13.

2.5 Description of Proposed Changes

NSPM proposes a revision to TS to remove Note 1 from LCO 3.4.12 and LCO 3.4.13. The specific wording changes to the TS are provided in Attachments 1 and 2 to this enclosure.

The proposed changes maintain the requirement that no single failure or single action will result in an SI injection into the RCS. The proposed changes to the bases provide examples of means by which an LTOP may be prevented. These changes would clarify requirements for running an SI pump for testing or other evolutions when LCO 3.4.12 or LCO 3.4.13 is applicable. The specific wording changes to the TS Bases are provided in Attachment 3 to this enclosure for information only.

3.0 TECHNICAL EVALUATION

The proposed changes remove Note 1 from LCO 3.4.12 and LCO 3.4.13. Note 1 provides an exception for running both SI pumps if additional measures are taken and conditions are met. Specifically, PINGP TS LCO 3.4.12 Note 1 states:

> *Both SI pumps may be run for ≤ 1 hour while conducting SI system testing provided there is a steam or gas bubble in the pressurizer and at least one isolation valve between the SI pump and the RCS is shut.*

PINGP TS LCO 3.4.13 Note 1 states:

> *Both safety injection (SI) pumps may be run for ≤ 1 hour while conducting SI system testing provided there is a steam or gas bubble in the pressurizer, the reactor vessel head is on, and at least one isolation valve between the SI pump and the RCS is shut.*

Looking at these additional measures and conditions individually:

- The bubble in the pressurizer is a defense in depth measure included in PINGP custom TS as of Unit 1 and 2 amendments 38 and 32, respectively. Specifically, the bubble was intended to provide a surge volume in the event one SI pump (in LCO 3.4.13) or both SI pumps (in LCO 3.4.12) were to inject to the RCS to give operators extra time to react to the resulting mass injection event. However, a pressurizer bubble is not assumed in the LTOP analysis.
- With the vessel head on, no protection against an LTOP is provided. This condition is also redundant to the Applicability statement for LCO 3.4.13 (unit in MODE 4, 5, or 6 with the vessel head on). This condition is not part of LCO 3.4.12 Note 1.
- Closing at least one isolation valve between the SI pump discharge and the RCS provides protection against an LTOP, but this requirement of Note 1 is redundant to the LCO 3.4.13 requirement that no SI pump is capable of injecting to the RCS. For LCO 3.4.12, this condition of Note 1 is more restrictive than the LCO (which requires that only a single SI pump is capable of injection). However, the LTOP analysis assumes that one SI pump is injecting with the RCS temperature greater than the SI pump disable

> temperature. Therefore, this condition of LCO 3.4.12 Note 1 is not required to meet the assumptions of the analysis.

Based on the discussions above, the proposed change provides a clarification of the TS LCO 3.4.12 and LCO 3.4.13 requirements that is consistent with the intent of existing Bases and the PINGP design. It preserves the applicable PINGP USAR LTOP analysis. Therefore, the proposed change will not adversely affect the PINGP LTOP System capability to perform required safety function. The proposed bases changes reflect the configuration requirements necessary to ensure that LCO 3.4.12 and LCO 3.4.13 are met, particularly during SI testing. Therefore, NSPM proposes to remove Note 1 from LCO 3.4.12 and LCO 3.4.13, as shown in Attachments 1 and 2, and clarify their bases, as shown in Attachments 3.

4.0 REGULATORY ANALYSIS

4.1 Applicable Regulatory Requirements/Criteria

Title 10 Code of Federal Regulations (10 CFR) 50.36(c)(2)
The regulations at Title 10 Code of Federal Regulations (10 CFR) Part 50.36, “Technical specifications”, establish the requirements related to the content of the TS. Section 50.36(c)(2) states:

> Limiting conditions for operation are the lowest functional capability or performance levels of equipment required for safe operation of the facility. When a limiting condition for operation of a nuclear reactor is not met, the licensee shall shut down the reactor or follow any remedial action permitted by the technical specifications until the condition can be met.

10 CFR 50.36 sets the regulatory requirements for the content of TS as quoted above. 10 CFR 50.36(c)(2) requires, in part, that the TS contain LCOs, and that remedial actions are prescribed for when a nuclear power plant fails to meet an LCO. The proposed changes remove a note that describes additional conditions for an exception to LCO 3.4.12 and LCO 3.4.13 that allows running both SI pumps for testing. The note to be removed includes conditions that are either not included in the assumptions of the LTOP analysis or that are redundant to the LCO and Applicability. Therefore, 10 CFR 50.36(c)(2) will continue to be met.

10 CFR 50, Appendix G
10 CFR 50, Appendices G, “Fracture Toughness Requirements”, imposes fracture toughness requirements for the reactor coolant pressure boundary. The proposed changes do not alter the pressure-temperature limits for the reactor coolant pressure boundary, does not affect the fracture toughness requirements or testing requirements, and does not change the PINPG reactor vessel material surveillance program.

General Design Criteria (GDC)
PINGP was designed and constructed to comply with NSPM’s understanding of the intent of the AEC GDC for Nuclear Power Plant Construction Permits, as proposed on July 11, 1967.

Therefore, the PINGP Licensing Basis requires conformance to the AEC GDC, as reflected in the PINGP Updated Safety Analysis Report (USAR) Section 1.2. The following AEC GDC are applicable to the proposed changes:

> CRITERION 9 – REACTOR COOLANT PRESSURE BOUNDARY
> The reactor coolant pressure boundary shall be designed, fabricated and constructed so as to have an exceedingly low probability of gross rupture or significant uncontrolled leakage throughout its design lifetime.

The Reactor Coolant System in conjunction with its control and protective provisions is designed to accommodate the system pressures and temperatures attained under all expected modes of plant operation or anticipated system interactions, and maintain the stresses within applicable code stress limits.

The proposed changes have no effect on the design, fabrication or construction of the RCPB.

> CRITERION 34 – REACTOR COOLANT PRESSURE BOUNDARY RAPID PROPOGATION FAILURE PREVENTION
> The reactor coolant pressure boundary shall be designed and operated to reduce to an acceptable level the probability of rapidly propagating type failure. Consideration is given (a) to the provisions for control over service temperature and irradiation effects which may require operational restrictions, (b) to the design and construction of the reactor pressure vessel in accordance with applicable codes, including those which establish requirements for absorption of energy within the elastic strain energy range and for absorption of energy by plastic deformation and (c) to the design and construction of reactor coolant pressure boundary piping and equipment in accordance with applicable codes.

The ability of the large steel pressure vessel containing the reactor core and its primary coolant to resist fracture constitutes an important factor in insuring safety in the nuclear industry. The beltline region of the reactor pressure vessel is the most critical region of the vessel because it is subjected to significant fast neutron bombardment. The overall effects of fast neutron irradiation on the mechanical properties of low alloy ferritic pressure vessel steels such as SA508 Class 3 (base material of the Prairie Island Units 1 and 2 reactor pressure vessel beltlines) are well documented in the literature. Generally, low alloy ferritic materials show an increase in hardness and tensile properties and decrease in ductility and toughness under certain conditions of irradiation.

The Reactor Vessel Material Surveillance Program monitors the effects of radiation on reactor vessel materials, and establishes operating limits to assure that brittle fracture of the reactor vessel will not occur. The program is in accordance with ASTM E185, Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels. The special case of low temperature overpressurizations has been addressed by installing the LTOP.

The proposed changes do not affect plant compliance with these regulations or criteria and will ensure that the lowest functional capabilities or performance levels of equipment required for safe operation are met.

4.2 No Significant Hazards Consideration Determination

In accordance with the requirements of 10 CFR 50.90, Northern States Power Company, a Minnesota corporation, doing business as Xcel Energy (hereafter "NSPM"), requests an amendment to the Technical Specifications (TS) for the Prairie Island Nuclear Generating Plant (PINGP), Units 1 and 2, Renewed Facility Operating License Nos. DPR-42 and DPR-60. The proposed changes would remove Note 1 from the LCO for both TS 3.4.12, LTOP - RCSCLT > SI Pump Disable Temperature, and TS 3.4.13, LTOP – RCSCLT ≤ SI Pump Disable Temperature.

NSPM has evaluated the proposed amendment against the standards in 10 CFR 50.92 and has determined that the operation of the PINGP in accordance with the proposed amendment presents no significant hazards. NSPM's evaluation against each of the criteria in 10 CFR 50.92 follows.

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No

   The proposed TS changes do not involve a significant increase in the probability or consequences of an accident previously evaluated. The LTOP analysis will be unchanged as a result of the proposed changes since a pressurizer bubble is not assumed in the LTOP analysis. Consequently, the probability of an accident previously evaluated is not affected and there is no increase in the consequences of any accident previously evaluated.

   Therefore, the proposed changes do not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: No

   The proposed changes revise the TS for the purpose of eliminating a Note from TS. The Note allowed operation of two SI pumps for testing, which is no longer necessary. The proposed changes do not involve a physical alteration of the plant (i.e., no new or different type of equipment will be installed). The proposed changes will continue to require that no single failure or single action can result in an LTOP event. Further, the proposed changes do not introduce new accident initiators.

Therefore, the proposed changes do not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does the proposed change involve a significant reduction a margin of safety?

Response: No

The proposed changes revise the TS to eliminate a Note from TS. The associated LTOP analysis that supports both LCOs assumes the pressurizer is solid (no bubble). The proposed changes do not alter the manner in which safety limits, limiting safety system settings, or limiting conditions for operation are determined. The safety analysis assumptions and acceptance criteria are not affected by the proposed changes.

Therefore, the proposed changes do not involve a significant reduction in a margin of safety.

Based on the above evaluation, NSPM concludes that the proposed amendment does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and accordingly, a finding of “no significant hazards consideration” is justified.

4.3 Conclusions

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission’s regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

5.0 ENVIRONMENTAL CONSIDERATION

NSPM has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

6.0 REFERENCES

1. PINGP USAR Section 4.4.3.3, Low Temperature Overpressurization Mitigation

2. NUREG-1431, “Standard Technical Specifications – Westinghouse Plants”, Revision 1, dated April 1995, (Agencywide Document Access and Management System (ADAMS) Accession No. ML13196A405).

3. Letter from A. Schwencer (U.S. NRC) to L. O. Mayer (Northern States Power), PINGP Units 1 and 2 License Amendments 38 and 32, dated August 3, 1979. (ADAMS Accession No. ML022170501).

4. WCAP-14040-P-A, Revision 2, “Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves”, January 1996.

ENCLOSURE, ATTACHMENT 1

PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNITS 1 AND 2

License Amendment Request to Revise Technical Specifications (TS) to Remove Note 1 from Limiting Condition for Operation (LCO) 3.4.12 and LCO 3.4.13

TECHNICAL SPECIFICATION PAGES (Mark Up)

(2 pages follow)

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.12 Low Temperature Overpressure Protection (LTOP) –Reactor Coolant System Cold Leg Temperature (RCSCLT) > Safety Injection (SI) Pump Disable Temperature

LCO 3.4.12 LTOP shall be provided with:

a. A maximum of one SI pump capable of injecting into the RCS;

b. The emergency core cooling system (ECCS) accumulators isolated;

c. An OPERABLE Over Pressure Protection System (OPPS) with lift setting within the limits specified in the PTLR; and

d. Two OPERABLE pressurizer power operated relief valves (PORVs).

----------NOTES----------

~~1.~~ ~~Both SI pumps may be run for ≤ 1 hour while conducting SI system testing providing there is a steam or gas bubble in the pressurizer and at least one isolation valve between the SI pump and the RCS is shut.~~

1

~~2.~~ ECCS accumulator may be unisolated when accumulator pressure is less than the maximum RCS pressure for the existing RCS cold leg temperature allowed by the P/T limit curves provided in the PTLR.

APPLICABILITY: MODE 4 when any RCS cold leg temperature is ≤ the OPPS enable temperature specified in the PTLR and > the SI pump disable temperature specified in the PTLR.

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.13 Low Temperature Overpressure Protection (LTOP) – Reactor Coolant System Cold Leg Temperature (RCSCLT) ≤ Safety Injection (SI) Pump Disable Temperature

LCO 3.4.13 LTOP shall be provided with: 1) no SI Pumps capable of injecting into the RCS; 2) the emergency core cooling system (ECCS) accumulators isolated; and 3) one of the following pressure relief capabilities:

a. An Over Pressure Protection System (OPPS) shall be OPERABLE with two pressurizer power operated relief valves (PORVs) with lift settings within the limits specified in the PTLR; or

b. The RCS depressurized and an RCS vent of ≥ 3 square inches.

----------NOTES----------

~~1.~~ ~~Both safety injection (SI) pumps may be run for ≤ 1 hour while conducting SI system testing provided there is a steam or gas bubble in the pressurizer, the reactor vessel head is on, and at least one isolation valve between the SI pump and the RCS is shut.~~

1

~~2~~. During reduced inventory conditions an SI pump may be run as required to maintain adequate core cooling and RCS inventory.

2

~~3~~. ECCS accumulator may be unisolated when ECCS accumulator pressure is less than the maximum RCS pressure for the existing RCS cold leg temperature allowed by the P/T limit curves provided in the PTLR.

APPLICABILITY: MODE 4 when any RCS cold leg temperature is ≤ the SI Pump disable temperature specified in the PTLR,
MODE 5 when the steam generator (SG) primary system manway and pressurizer manway are closed and secured in position,
MODE 6 when the reactor vessel head is on and the SG primary system manway and pressurizer manways are closed and secured in position.

ENCLOSURE, ATTACHMENT 2

PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNITS 1 AND 2

License Amendment Request to Revise Technical Specifications (TS) to Remove Note 1 from Limiting Condition for Operation (LCO) 3.4.12 and LCO 3.4.13

TECHNICAL SPECIFICATION PAGES (Retyped)

(2 pages follow)

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.12 Low Temperature Overpressure Protection (LTOP) –Reactor Coolant System Cold Leg Temperature (RCSCLT) > Safety Injection (SI) Pump Disable Temperature

LCO 3.4.12 LTOP shall be provided with:

a. A maximum of one SI pump capable of injecting into the RCS;

b. The emergency core cooling system (ECCS) accumulators isolated;

c. An OPERABLE Over Pressure Protection System (OPPS) with lift setting within the limits specified in the PTLR; and

d. Two OPERABLE pressurizer power operated relief valves (PORVs).

----------NOTE----------
1. ECCS accumulator may be unisolated when accumulator pressure is less than the maximum RCS pressure for the existing RCS cold leg temperature allowed by the P/T limit curves provided in the PTLR.

APPLICABILITY: MODE 4 when any RCS cold leg temperature is $\leq$ the OPPS enable temperature specified in the PTLR and > the SI pump disable temperature specified in the PTLR.

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.13 Low Temperature Overpressure Protection (LTOP) – Reactor Coolant System Cold Leg Temperature (RCSCLT) ≤ Safety Injection (SI) Pump Disable Temperature

LCO 3.4.13 LTOP shall be provided with: 1) no SI Pumps capable of injecting into the RCS; 2) the emergency core cooling system (ECCS) accumulators isolated; and 3) one of the following pressure relief capabilities:

a. An Over Pressure Protection System (OPPS) shall be OPERABLE with two pressurizer power operated relief valves (PORVs) with lift settings within the limits specified in the PTLR; or

b. The RCS depressurized and an RCS vent of ≥ 3 square inches.

----------NOTES----------

1. During reduced inventory conditions an SI pump may be run as required to maintain adequate core cooling and RCS inventory.

2. ECCS accumulator may be unisolated when ECCS accumulator pressure is less than the maximum RCS pressure for the existing RCS cold leg temperature allowed by the P/T limit curves provided in the PTLR.

APPLICABILITY: MODE 4 when any RCS cold leg temperature is ≤ the SI Pump disable temperature specified in the PTLR,
MODE 5 when the steam generator (SG) primary system manway and pressurizer manway are closed and secured in position,
MODE 6 when the reactor vessel head is on and the SG primary system manway and pressurizer manways are closed and secured in position.

ENCLOSURE, ATTACHMENT 3

PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNITS 1 AND 2

License Amendment Request to Revise Technical Specifications (TS) to Remove Note 1 from Limiting Condition for Operation (LCO) 3.4.12 and LCO 3.4.13

TECHNICAL SPECIFICATION BASES PAGES (Mark Up)
(Provided for Information Only)

(25 pages follow)

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.12 Low Temperature Overpressure Protection (LTOP) – Reactor Coolant System Cold Leg Temperature (RCSCLT) > Safety Injection (SI) Pump Disable Temperature

BASES

BACKGROUND

The LTOP function limits RCS pressure at low temperatures so the integrity of the reactor coolant pressure boundary (RCPB) is not compromised by violating the pressure and temperature (P/T) limits of 10 CFR 50, Appendix G (Ref. 1). The reactor vessel is the limiting RCPB component for demonstrating such protection. The Over Pressure Protection System (OPPS) and the pressurizer power operated relief valves (PORVs) provide the LTOP function (Ref. 2). The PTLR provides the maximum allowable OPPS actuation setpoints for the PORVs and the maximum RCS pressure for the existing RCS cold leg temperature during cooldown, shutdown, and heatup to meet the Reference 1 requirements during the LTOP MODES. The LTOP MODES are the MODES as defined in the Applicability statement of LCO 3.4.12 and LCO 3.4.13.

The pressurizer safety valves and PORVs at their normal setpoints do not provide overpressure protection for certain low temperature operational transients. Inadvertent pressurization of the RCS at temperatures below the OPPS enable temperature specified in the PTLR could result in exceeding the ASME Appendix G (Ref. 3) brittle fracture P/T limits. Exceeding the RCS P/T limits by a significant amount could cause brittle cracking of the reactor vessel. LCO 3.4.3, “RCS Pressure and Temperature (P/T) Limits,” requires administrative control of RCS pressure and temperature during heatup and cooldown to prevent exceeding the PTLR limits.

This LCO provides RCS overpressure protection by restricting coolant input capability and ensuring adequate pressure relief capacity. In MODE 4, when any RCS cold leg temperature is $\leq$ the OPPS enable temperature specified in the PTLR, and above the safety injection (SI) pump disable temperature, limiting coolant input capability requires one (SI) pump incapable of injection into the RCS and isolating the emergency core cooling system (ECCS)

BASES

BACKGROUND (continued)

accumulators. In MODE 4, when any RCS cold leg temperature is ≤ the OPPS enable temperature specified in the PTLR, and above SI pump disable temperature, one PORV is the overpressure protection device that acts to terminate an increasing pressure event.

Limiting coolant input capability reduces the ability to provide core coolant addition. The LCO does not require the makeup control system deactivated or the SI actuation circuits blocked. Due to the lower pressures in the LTOP MODES and the expected core decay heat levels, the charging system can provide adequate flow. If conditions require the use of more than one SI pump for makeup in the event of loss of inventory, then pumps can be made available through manual actions.

In MODE 4, above the SI pump disable temperature, pressure relief consists of two PORVs with reduced lift settings provided by OPPS. Two PORVs are required for redundancy. One PORV has adequate relieving capability to prevent overpressurization for the required coolant input capability.

As designed for the LTOP function, each PORV is signaled to open by OPPS if the RCS pressure approaches the lift setpoint provided when OPPS is enabled. The OPPS monitors both RCS temperature and RCS pressure and indicates when a condition not acceptable in the PTLR limits is approached. The wide range RCS temperature setpoints indicate conditions requiring enabling OPPS.

The PTLR presents the OPPS setpoints for LTOP.

APPLICABLE SAFETY ANALYSES

Safety analyses (Ref. 2) demonstrate that the reactor vessel is adequately protected against exceeding the Reference 1 P/T limits. In MODES 1, 2, and 3, and in MODE 4 with RCS cold leg temperature exceeding the OPPS enable temperature specified in the PTLR, the pressurizer safety valves will prevent RCS pressure from exceeding the Reference 1 limits. At about the OPPS enable

BASES

APPLICABLE SAFETY ANALYSES (continued)

temperature specified in the PTLR and below, overpressure prevention falls to two OPERABLE PORVs or to a depressurized RCS and a sufficiently sized RCS vent. Each of these means has a limited overpressure relief capability. LCO 3.4.13, "LTOP – RCSCLT $\leq$ SI Pump Disable Temperature," provides the requirements for overpressure prevention at the lower temperatures.

The actual temperature at which the pressure in the P/T limit curve falls below the pressurizer safety valve setpoint increases as the reactor vessel material toughness decreases due to neutron embrittlement. Each time the PTLR curves are revised, LTOP must be re-evaluated to ensure its functional requirements can still be met using the PORV method.

The PTLR contains the acceptance limits that define the LTOP requirements. Any change to the RCS must be evaluated against the Reference 2 analyses to determine the impact of the change on the LTOP acceptance limits.

Transients that are capable of overpressurizing the RCS are categorized as either mass or heat input transients. The bounding mass input transient is inadvertent safety injection with injection from one SI pump and three charging pumps, and letdown isolated. The bounding heat input transient is reactor coolant pump (RCP) startup with temperature asymmetry within the RCS or between the RCS and steam generators.

The following limitations are required during the Applicability of this Specification to ensure that mass and heat input transients in excess of analysis assumptions do not occur:

a. Rendering one SI pump incapable of injection;

b. Deactivating the ECCS accumulator discharge isolation valves in their closed positions; and

BASES

APPLICABLE SAFETY ANALYSES (continued)

c. Disallowing start of an RCP if secondary temperature is above primary temperature in any one loop. LCO 3.4.6, "RCS Loops - MODE 4," provides this protection.

The Reference 2 analyses demonstrate that one PORV can maintain RCS pressure below limits when only one SI pump and all charging pumps are actuated. Thus, the LCO allows only one SI pump OPERABLE during the Applicability of this Specification.

Since one PORV cannot handle the pressure transient resulting from ECCS accumulator injection, when RCS temperature is low, the LCO also requires ECCS accumulator isolation when ECCS accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed in the PTLR.

The isolated ECCS accumulators must have their discharge valves closed and the valve power supply breakers fixed in their open positions.

Fracture mechanics analyses established the temperature of LTOP Applicability at the OPPS enable temperature specified in the PTLR.

The consequences of a small break loss of coolant accident (LOCA) in LTOP MODE 4 , when any RCS cold leg temperature is $\leq$ the OPPS enable temperature specified in the PTLR, and above the SI Pump disable temperature conform to 10 CFR 50.46 and 10 CFR 50, Appendix K, requirements by having a maximum of one SI pump OPERABLE and SI actuation enabled.

The fracture mechanics analyses show that the vessel is protected when the PORVs are set to open at or below the limit shown in the PTLR. The OPPS setpoints are derived by analyses that model the performance of the system, assuming the limiting LTOP transient of one SI pump and all charging pumps injecting into the RCS. These analyses consider pressure overshoot and undershoot beyond the PORV opening and closing, resulting from signal processing and

BASES

APPLICABLE SAFETY ANALYSES (continued)

valve stroke times. The OPPS setpoints at or below the derived limit ensures the Reference 1 P/T limits will be met.

The OPPS setpoints in the PTLR will be updated when the revised P/T limits conflict with the LTOP analysis limits. The P/T limits are periodically modified as the reactor vessel material toughness decreases due to neutron embrittlement caused by neutron projections and the results of examinations of the reactor vessel material irradiation surveillance specimens. The Bases for LCO 3.4.3, "RCS Pressure and Temperature (P/T) Limits," discuss these examinations.

The LTOP function satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

LCO

This LCO requires that LTOP be provided, by limiting coolant input capability and by OPERABLE pressure relief capability. Violation of this LCO could lead to the loss of low temperature overpressure mitigation and violation of the Reference 1 limits as a result of an operational transient.

To limit the coolant input capability, the LCO requires that a maximum of one SI pump be capable of injecting into the RCS, and all ECCS accumulator discharge isolation valves be closed and de-energized (when ECCS accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed in the PTLR).

a Note

The LCO is modified by ~~two Notes~~. Note 1 ~~allows operation of both SI pumps for ≤ 1 hour for conducting SI system testing providing there is a steam or gas bubble in the pressurizer and at least one isolation valve between the SI pump and the RCS is shut. The purpose of this Note is to permit the conduct of the integrated SI test and other SI system tests and operations that may be performed in MODE 4. In this case, pressurizer level is maintained at less than 50% and a positive means of isolation is provided between the SI pumps and the RCS to prevent fluid injection to the RCS. This~~

BASES

LCO (continued)

~~isolation is accomplished by either a closed manual valve or motor operated valve with the power removed. This combination of conditions under strict administrative control assure that overpressurization cannot occur. Note 2~~ states that ECCS accumulator isolation is only required when the ECCS accumulator pressure is more than or at the maximum RCS pressure for the existing RCS cold leg temperature allowed by the P/T limit curves provided in the PTLR (less allowance for instrument uncertainty). This Note permits the ECCS accumulator discharge isolation valve Surveillance to be performed only under these pressure and temperature conditions.

To provide low temperature overpressure mitigation through pressure relief, the LCO requires an OPERABLE OPPS with two pressurizer PORVs. A PORV is OPERABLE for LTOP when its block valve is open, its low pressure lift setpoint has been selected (OPPS enabled), and the backup air supply is charged.

APPLICABILITY

This LCO is applicable in MODE 4 when any RCS cold leg temperature is ≤ the OPPS enable temperature specified in the PTLR and > the SI Pump disable temperature specified in the PTLR. The pressurizer safety valves provide overpressure protection that meets the Reference 1 P/T limits above the OPPS enable temperature specified in the PTLR.

LCO 3.4.3 provides the operational P/T limits for all MODES. LCO 3.4.10, “Pressurizer Safety Valves,” requires the OPERABILITY of the pressurizer safety valves that provide overpressure protection during MODES 1, 2, and 3, and MODE 4 above the OPPS enable temperature specified in the PTLR. LCO 3.4.13 provides the LTOP requirements in MODE 4 ≤ SI pump disable temperature and in MODES 5 and 6.

BASES

APPLICABILITY (continued)

Low temperature overpressure prevention is most critical during shutdown when the RCS is water solid, and a mass or heat input transient can cause a very rapid increase in RCS pressure when little or no time allows operator action to mitigate the event.

ACTIONS

A Note prohibits the application of LCO 3.0.4.b when LTOP LCO requirements are not met. There is an increased risk associated with operating in MODE 4 at low temperatures with LTOP LCO requirements not met and the provisions of LCO 3.0.4.b, which allow entry into a MODE or other specified condition in the Applicability with the LCO not met after performance of a risk assessment addressing inoperable systems and components, should not be applied in this circumstance.

A-1

With two SI pumps capable of injecting into the RCS, RCS overpressurization is possible.

To immediately initiate action to restore restricted coolant input capability to the RCS reflects the urgency of removing the RCS from this condition.

B.1, C.1, and C.2

An unisolated ECCS accumulator requires isolation within 1 hour. This is only required when the ECCS accumulator pressure is at or more than the maximum RCS pressure for the existing temperature allowed by the P/T limit curves.

BASES

ACTIONS

B.1, C.1, and C.2 (continued)

If isolation is needed and cannot be accomplished in 1 hour, Required Action C.1 and Required Action C.2 provide two options, either of which must be performed in the next 12 hours. By increasing the RCS temperature to > the OPPS enable temperature specified in the PTLR, an accumulator pressure of 800 psig cannot exceed the LTOP analysis limits if the ECCS accumulators are fully injected. Depressurizing the ECCS accumulators below the LTOP limit from the PTLR also gives this protection.

The Completion Times are based on operating experience that these activities can be accomplished in these time periods and on engineering evaluations indicating that an event requiring LTOP is not likely in the allowed times.

D.1

In MODE 4 when any RCS cold leg temperature is ≤ the OPPS enable temperature specified in the PTLR, with one required PORV inoperable, the PORV must be restored to OPERABLE status within a Completion Time of 7 days. Two PORVs are required to provide low temperature overpressure mitigation while withstanding a single failure of an active component.

The Completion Time considers the facts that only one of the PORVs is required to mitigate an overpressure transient and that the likelihood of an active failure of the remaining valve path during this time period is very low.

BASES

ACTIONS (continued)

E.1

MODE 5 must be entered, the RCS must be depressurized and a vent must be established within 12 hours when:

a. Both PORVs are inoperable; or

b. A Required Action and associated Completion Time of Condition A, C, or D is not met; or

c. The OPPS is inoperable.

The vent must be sized ≥ 3 square inches to ensure that the flow capacity is greater than that required for the worst case mass input transient reasonable during the applicable MODES. The vent opening is based on the cross sectional flow area of a PORV. A PORV maintained in the open position satisfies the vent requirement. This action is needed to protect the RCPB from a low temperature overpressure event and a possible brittle failure of the reactor vessel.

The Completion Time considers the time required to place the plant in this Condition and the relatively low probability of an overpressure event during this time period due to increased operator awareness of administrative control requirements.

SURVEILLANCE REQUIREMENTS

SR 3.4.12.1 and SR 3.4.12.2

To minimize the potential for a low temperature overpressure event by limiting the mass input capability, one SI pump is verified incapable of injecting into the RCS and the ECCS accumulator discharge isolation valves are verified closed and de-energized.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.4.12.1 and SR 3.4.12.2 (continued)

The SI pump is rendered incapable of injecting into the RCS by employing at least two independent means ~~to prevent a pump start~~ such that a single failure or single action will not result in an injection into the RCS. This ~~may be~~ accomplished through the pump control switch being placed in pullout and with a blocking device installed over the control switch that would ~~prevent an unplanned pump start~~.

is normally

render the SI pump incapable of injecting into the RCS

The ECCS accumulator motor operated isolation valves can be verified closed and de-energized by use of control board indication.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.4.12.3

The PORV block valve must be verified open to provide the flow path for each required PORV to perform its function when actuated. The valve can be remotely verified open in the main control room.

The block valve is a remotely controlled, motor operated valve. The power to the valve operator is not required to be removed, and the manual operator is not required to be locked in the inactive position. Thus, the block valve can be closed in the event the PORV develops excessive leakage or does not close (sticks open) after relieving an overpressure situation.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

If an SI pump is to be operated for testing or other evolutions, two independent means must be provided between the SI pump to be started and the RCS to prevent fluid injection to the RCS. This may be accomplished by a blocked and tagged or locked closed manual valve, by a closed motor operated valve with the power removed, or two other independent means.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.12.4

Performance of a COT is required on OPPS to verify and, as necessary, adjust the PORV lift setpoints. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable CHANNEL OPERATIONAL TEST of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications and non-Technical Specification tests at least once per refueling interval with applicable extensions. The COT will verify the setpoints are within the PTLR allowed maximum limits in the PTLR. PORV actuation during this testing could depressurize the RCS and is not required.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

A Note has been added indicating that this SR is required to be performed 12 hours after decreasing RCS cold leg temperature to ≤ the OPPS enable temperature specified in the PTLR. The COT may not have been performed before entry into the LTOP MODES. The 12 hour initial time considers the unlikelihood of a low temperature overpressure event during this time.

SR 3.4.12.5

Performance of a CHANNEL CALIBRATION on OPPS is required to adjust the whole channel so that it responds and the valve opens within the required range and accuracy to known input.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

BASES (continued)

REFERENCES

1. 10 CFR 50, Appendix G.

2. USAR, Section 4.4.

3. ASME, Boiler and Pressure Vessel Code, Section XI, Appendix G, with ASME Code Case N-514.

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.13 Low Temperature Overpressure Protection (LTOP) Reactor Coolant System Cold Leg Temperature (RCSCLT) ≤ Safety Injection (SI) Pump Disable Temperature

BASES

BACKGROUND

The LTOP function limits RCS pressure at low temperatures so the integrity of the reactor coolant pressure boundary (RCPB) is not compromised by violating the pressure and temperature (P/T) limits of 10 CFR 50, Appendix G (Ref. 1). The reactor vessel is the limiting RCPB component for demonstrating such protection. The Over Pressure Protection System (OPPS) provides the actuation setpoints for the pressurizer power operated relief valves (PORVs) for the LTOP function (Ref. 2). The PTLR provides the maximum allowable OPPS actuation setpoints and the maximum RCS pressure for the existing RCS cold leg temperature during cooldown, shutdown, and heatup to meet the Reference 1 requirements during the LTOP MODES. The LTOP MODES are the MODES as defined in the Applicability statement of LCO 3.4.12 and LCO 3.4.13.

The pressurizer safety valves and PORVs at their normal setpoints do not provide overpressure protection for certain low temperature operational transients. Inadvertent pressurization of the RCS at temperatures below the OPPS enable temperature specified in the PTLR could result in exceeding the ASME Appendix G (Ref. 3) brittle fracture P/T limits. Exceeding the RCS P/T limits by a significant amount could cause brittle cracking of the reactor vessel. LCO 3.4.3, "RCS Pressure and Temperature (P/T) Limits," requires administrative control of RCS pressure and temperature during heatup and cooldown to prevent exceeding the PTLR limits.

This LCO provides RCS overpressure protection by restricting coolant input capability and ensuring adequate pressure relief capacity. In MODE 4, at or below the safety injection (SI) pump disable temperature, limiting coolant input capability requires both SI pumps incapable of injection into the RCS and isolating the emergency core cooling system (ECCS) accumulators. The pressure

BASES

BACKGROUND (continued)

relief capacity requires either two redundant PORVs or a depressurized RCS and an RCS vent of sufficient size. One PORV or the open RCS vent is the overpressure protection device that acts to terminate an increasing pressure event.

Limiting coolant input capability reduces the ability to provide core coolant addition. The LCO does not require the makeup control system deactivated or the safety injection SI actuation circuits blocked. Due to the lower pressures in the LTOP MODES and the expected core decay heat levels, the charging system can provide adequate flow. If conditions require the use of an SI pump for makeup in the event of loss of inventory, the pump can be made available through manual actions.

The LTOP pressure relief consists of two PORVs with reduced lift settings provided by OPPS or a depressurized RCS and an RCS vent of sufficient size. Two PORVs are required for redundancy. One PORV has adequate relieving capability to prevent overpressurization for the required coolant input capability.

OPPS and PORV Requirements

As designed for the LTOP function, each PORV is signaled to open by OPPS if the RCS pressure approaches the lift setpoint provided when OPPS is enabled. The OPPS monitors both RCS temperature and RCS pressure and indicates when a condition not acceptable in the PTLR limits is approached. The wide range RCS temperature setpoints indicate conditions requiring enabling OPPS. The PTLR presents the OPPS setpoints for LTOP.

RCS Vent Requirements

Once the RCS is depressurized, a vent exposed to the containment atmosphere will maintain the RCS at containment ambient pressure

BASES

BACKGROUND

RCS Vent Requirements (continued)

in an RCS overpressure transient, if the relieving requirements of the transient do not exceed the capabilities of the vent. Thus, the vent path must be capable of relieving the flow resulting from the limiting LTOP mass or heat input transient, and maintaining pressure below the P/T limits. The required vent capacity may be provided by one or more vent paths.

APPLICABLE SAFETY ANALYSES

Safety analyses (Ref. 2) demonstrate that the reactor vessel is adequately protected against exceeding the Reference 1 P/T limits. In MODES 1, 2, and 3, and in MODE 4 with RCS cold leg temperature exceeding the OPPS enable temperature specified in the PTLR, the pressurizer safety valves will prevent RCS pressure from exceeding the Reference 1 limits. At about the OPPS enable temperature specified in the PTLR and below, overpressure prevention falls to two OPERABLE PORVs or to a depressurized RCS and a sufficiently sized RCS vent. Each of these means has a limited overpressure relief capability. LCO 3.4.12, "LTOP – RCSCLT > SI Pump Disable Temperature," provides the requirements for overpressure prevention at temperatures above the SIP disable temperature.

The actual temperature at which the pressure in the P/T limit curve falls below the pressurizer safety valve setpoint increases as the reactor vessel material toughness decreases due to neutron embrittlement. Each time the PTLR curves are revised, LTOP must be re-evaluated to ensure its functional requirements can still be met using the PORV method or the depressurized and vented RCS condition.

The PTLR contains the acceptance limits that define the LTOP requirements. Any change to the RCS must be evaluated against the Reference 2 analyses to determine the impact of the change on the LTOP acceptance limits.

BASES

APPLICABLE SAFETY ANALYSES (continued)

Transients that are capable of overpressurizing the RCS are categorized as either mass or heat input transients. The bounding mass input transient is injection from three charging pumps and letdown isolated. The bounding heat input transient is reactor coolant pump (RCP) startup with temperature asymmetry within the RCS or between the RCS and steam generators.

The following limitations are required during the Applicability of this specification to ensure that mass and heat input transients in excess of analysis assumptions do not occur:

a. Rendering both SI pumps incapable of injection;

b. Deactivating the ECCS accumulator discharge isolation valves in their closed positions; and

c. Disallowing start of an RCP if secondary temperature is more than 50°F above primary temperature in any one loop. LCO 3.4.6, "RCS Loops - MODE 4," provides this protection.

The Reference 2 analyses demonstrate that either one PORV or the depressurized RCS and RCS vent can maintain RCS pressure below limits when all charging pumps are actuated. Neither one PORV nor the RCS vent can handle the pressure transient resulting from inadvertent SI pump or ECCS accumulator injection when the RCS is below the SI Pump disable temperature. Thus, the LCO requires both SI pumps to be ~~disabled~~ incapable of injection below the temperature specified in the PTLR.

The LCO also requires ECCS accumulator isolation when ECCS accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed in the PTLR. The isolated ECCS accumulators must have their discharge valves closed and the valve power supply breakers fixed in their open positions.

BASES

APPLICABLE SAFETY ANALYSES (continued)

Fracture mechanics analyses established the temperature of LTOP Applicability at the OPPS enable temperature specified in the PTLR. The fracture mechanics analyses show that the vessel is protected when the PORVs are set to open at or below the limit shown in the PTLR. The OPPS setpoints are derived by analyses that model the performance of the system, assuming the limiting LTOP transient of all charging pumps injecting into the RCS. These analyses consider pressure overshoot and undershoot beyond the PORV opening and closing, resulting from signal processing and valve stroke times. The OPPS setpoints at or below the derived limit ensures the Reference 1 P/T limits will be met.

The OPPS setpoints in the PTLR will be updated when the revised P/T limits conflict with the LTOP analysis limits. The P/T limits are periodically modified as the reactor vessel material toughness decreases due to neutron embrittlement caused by neutron irradiation. Revised limits are determined using neutron fluence projections and the results of examinations of the reactor vessel material irradiation surveillance specimens. The Bases for LCO 3.4.3, "RCS Pressure and Temperature (P/T) Limits," discuss these examinations.

With the RCS depressurized, analyses show a vent size equivalent to the cross sectional flow area of a PORV is capable of mitigating the allowed LTOP overpressure transient. The capacity of a vent this size is greater than the flow of the limiting transient for the LTOP configuration, both SI pumps ~~disabled~~ and all charging pumps operating when the RCS is below the SI Pump disable temperature, maintaining RCS pressure less than the maximum pressure on the P/T limit curve.

incapable of injection

The RCS vent is passive and is not subject to active failure.

The LTOP function satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

BASES (continued)

LCO

This LCO requires that LTOP be provided, by limiting coolant input capability and by OPERABLE pressure relief capability. Violation of this LCO could lead to the loss of low temperature overpressure mitigation and violation of the Reference 1 limits as a result of an operational transient.

To limit the coolant input capability, the LCO requires both SI pumps be incapable of injecting into the RCS, and all ECCS accumulator discharge isolation valves be closed and deenergized (when ECCS accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed in the PTLR).

two

The LCO is modified by ~~three~~ Notes. Note 1 ~~allows operation of one or both SI pumps for ≤ 1 hour for conducting SI system testing providing there is a steam or gas bubble in the pressurizer and at least one isolation valve between the SI pump and the RCS is shut. The purpose of this note is to permit the conduct of the integrated SI test and other SI system tests and operations that may be performed in MODES 4, 5 or 6. In this case, pressurizer level is maintained at less than 50% and a positive means of isolation is provided between the SI pumps and the RCS to prevent fluid injection to the RCS. This isolation is accomplished by either a closed manual valve or motor operated valve with the power removed. This combination of conditions under strict administrative control assure that overpressurization cannot occur.~~

~~Note 2~~ allows operation of an SI pump during reduced inventory conditions as required to maintain adequate core cooling and RCS inventory. The purpose of this note is to allow use of an SI pump in the event of a loss of other injection capability (e.g., loss of Residual Heat Removal System cooling while in reduced inventory conditions). The operation of an SI pump under such conditions would be controlled by an approved emergency operating procedure.

BASES

LCO (continued)

Note ~~3~~ 2 states that ECCS accumulator isolation is only required when ECCS accumulator pressure is more than or at the maximum RCS pressure for the existing RCS cold leg temperature allowed by the P/T limit curves provided in the PTLR (less allowance for instrument uncertainty). This Note permits the ECCS accumulator discharge isolation valve Surveillance to be performed only under these pressure and temperature conditions.

The elements of the LCO that provide low temperature overpressure mitigation through pressure relief are:

a. An OPERABLE OPPS with two PORVs; or

   A PORV is OPERABLE for LTOP when its block valve is open, its low pressure lift setpoint has been selected (OPPS enabled), and the backup air supply is charged.

b. A depressurized RCS and an RCS vent.

   An RCS vent is OPERABLE when open with an area of ≥ 3.0 square inches. Because the RCS vent opening specification is based on the flow capacity of a PORV, a PORV maintained in the open position may be utilized to meet the RCS vent requirement.

Each of these methods of overpressure prevention is capable of mitigating the limiting LTOP transient.

APPLICABILITY

This LCO is applicable in MODE 4 when any RCS cold leg temperature is ≤ the SI Pump disable temperature specified in the PTLR, in MODE 5, and in MODE 6 when the reactor vessel head is on and the SG primary system manways and pressurizer manway are closed and secured. The pressurizer safety valves provide overpressure protection that meets the Reference 1 P/T limits above the OPPS enable temperature specified in the PTLR. When the reactor vessel head is off, overpressurization cannot occur.

BASES

APPLICABILITY (continued)

LCO 3.4.3 provides the operational P/T limits for all MODES. LCO 3.4.10, "Pressurizer Safety Valves," requires the OPERABILITY of the pressurizer safety valves that provide overpressure protection during MODES 1, 2, and 3, and MODE 4 above the OPPS enable temperature specified in the PTLR. LCO 3.4.12, "Low Temperature Overpressure Protection (LTOP) – Reactor Coolant System Cold Leg Temperature (RCSCLT) ≤ Safety Injection Pump (SI) Pump Disable Temperature," provides the requirements for MODE 4 below the OPPS enable temperature and above the SI Pump disable temperature.

Low temperature overpressure prevention is most critical during shutdown when the RCS is water solid, and a mass or heat input transient can cause a very rapid increase in RCS pressure when little or no time allows operator action to mitigate the event.

ACTIONS

A Note prohibits the application of LCO 3.0.4.b when LTOP LCO requirements are not met. There is an increased risk associated with entering MODE 4 from MODE 5 with LTOP requirements not met and the provisions of LCO 3.0.4.b, which allow entry into a MODE or other specified condition in the Applicability with the LCO not met after performance of a risk assessment addressing inoperable systems and components, should not be applied in this circumstance

A.1

With one or more SI pumps capable of injecting into the RCS, RCS overpressurization is possible.

To immediately initiate action to restore restricted coolant input capability to the RCS reflects the urgency of removing the RCS from this condition.

BASES

ACTIONS (continued)

B.1, C.1, and C.2

An unisolated ECCS accumulator requires isolation within 1 hour. This is only required when the ECCS accumulator pressure is at or more than the maximum RCS pressure for the existing temperature allowed by the P/T limit curves.

If isolation is needed and cannot be accomplished in 1 hour, Required Action C.1 and Required Action C.2 provide two options, either of which must be performed in the next 12 hours. By increasing the RCS temperature to > the OPPS enable temperature specified in the PTLR, an ECCS accumulator pressure of 800 psig cannot exceed the LTOP analysis limits if the ECCS accumulators are fully injected. Depressurizing the ECCS accumulators below the LTOP limit from the PTLR also gives this protection.

The Completion Times are based on operating experience that these activities can be accomplished in these time periods and on engineering evaluations indicating that an event requiring LTOP is not likely in the allowed times.

D.1

The consequences of operational events that will overpressurize the RCS are more severe at lower temperature. Thus, with one PORV inoperable in MODE 4 when any RCS cold leg temperature is ≤ the SI Pump disable temperature specified in the PTLR, MODE 5 or in MODE 6 with the head on, the Completion Time to restore two valves to OPERABLE status is 24 hours. A Note clarifies that Condition D is only applicable when the OPPS and PORVs are being used to satisfy the pressure relief requirements of LCO 3.4.13.a.

BASES

ACTIONS

D.1 (continued)

The Completion Time represents a reasonable time to investigate and repair several types of relief valve failures without exposure to a lengthy period with only one OPERABLE PORV to protect against overpressure events.

E.1

The RCS must be depressurized and a vent must be established within 8 hours when:

a. Both required PORVs are inoperable; or

b. A Required Action and associated Completion Time of Condition A, C, or D is not met; or

c. The OPPS is inoperable.

The vent must be sized ≥ 3 square inches to ensure that the flow capacity is greater than that required for the worst case mass input transient reasonable during the applicable MODES. The vent opening is based on the cross sectional flow area of a PORV. A PORV maintained in the open position satisfies the vent requirement. This action is needed to protect the RCPB from a low temperature overpressure event and a possible brittle failure of the reactor vessel.

The Completion Time considers the time required to place the plant in this Condition and the relatively low probability of an overpressure event during this time period due to increased operator awareness of administrative control requirements.

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.4.13.1 and SR 3.4.13.2

To minimize the potential for a low temperature overpressure event by limiting the mass input capability, both SI pumps are verified incapable of injecting into the RCS and the ECCS accumulator discharge isolation valves are verified closed and deenergized.

is normally

The SI pumps are rendered incapable of injecting into the RCS by employing at least two independent means ~~to prevent a pump start~~ such that a single failure or single action will not result in an injection into the RCS. This ~~may be~~ accomplished through the pump control switch being placed in pullout with a blocking device installed over the control switch that would ~~prevent an unplanned pump start~~.

render the SI pump incapable of injecting into the RCS

The ECCS accumulator motor operated isolation valves can be verified closed and deenergized by use of control board indication.

The Surveillance Frequencies are controlled under the Surveillance Frequency Control Program.

SR 3.4.13.3

The RCS vent of ≥ 3 square inches is proven OPERABLE by verifying its open condition.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

The passive vent path arrangement must only be open when required to be OPERABLE. This Surveillance is required if the vent is being used to satisfy the pressure relief requirements of LCO 3.4.13b.

If an SI pump is to be operated for testing or other evolutions, two independent means must be provided between the SI pump to be started and the RCS to prevent fluid injection to the RCS. This may be accomplished by a blocked and tagged or locked closed manual valve, by a closed motor operated valve with the power removed, or two other independent means.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.13.4

The PORV block valve must be verified open to provide the flow path for each required PORV to perform its function when actuated. The valve may be remotely verified open in the main control room. This Surveillance is performed if the PORV satisfies the LCO.

The block valve is a remotely controlled, motor operated valve. The power to the valve operator is not required to be removed, and the manual operator is not required to be locked in the inactive position. Thus, the block valve can be closed in the event the PORV develops excessive leakage or does not close (sticks open) after relieving an overpressure situation.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.4.13.5

Performance of a COT is required on OPPS to verify and, as necessary, adjust the PORV lift setpoints. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable CHANNEL OPERATIONAL TEST of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications and non-Technical Specifications tests at least once per refueling interval with applicable extensions. The COT will verify the setpoints are within the PTLR allowed maximum limits in the PTLR. PORV actuation during this testing could depressurize the RCS and is not required.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.4.13.5 (continued)

A Note has been added indicating that this SR is not required to be performed until 12 hours after decreasing RCS cold leg temperature to ≤ the OPPS enable temperature specified in the PTLR. The COT may not have been performed before entry into the LTOP MODES. The 12 hour initial time considers the unlikelihood of a low temperature overpressure event during this time.

SR 3.4.13.6

Performance of a CHANNEL CALIBRATION on OPPS is required to adjust the whole channel so that it responds and the valve opens within the required range and accuracy to known input.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

REFERENCES

1. 10 CFR 50, Appendix G.

2. USAR, Section 4.4.

3. ASME, Boiler and Pressure Vessel Code, Section XI, Appendix G, with ASME Code Case N-514.