2.0 LIMITING CONDITIONS FOR OPERATION

2.1 Reactor Coolant System (Continued)

2.1.4 Reactor Coolant System Leakage Limits

Applicability

Applies to the leakage rates of the reactor coolant system whenever the reactor coolant temperature (T_{cold}) is greater than 210 °F.

Objective

To specify limiting conditions of the reactor coolant system leakage rates.

Specifications

To assure safe reactor operation, the following limiting conditions of the reactor coolant system leakage rates must be met:

(1) RCS operational LEAKAGE shall be limited to:

a. No Pressure Boundary LEAKAGE,
b. 1 gpm unidentified LEAKAGE,
c. 10 gpm identified LEAKAGE,
d. 150 gallons per day primary to secondary LEAKAGE through any one SG.

(2) If RCS LEAKAGE limits of (1), above, are not met for reasons other than Pressure Boundary LEAKAGE, then reduce LEAKAGE to meet limits within 4 hours.

(3) If the Required Action and associated completion time of (2), above, is not met, OR Pressure Boundary LEAKAGE exists, then be in MODE 3, Hot Shutdown, within 6 hours AND be in MODE 4, Cold Shutdown, within 36 hours.

(4) To determine leakage to the containment, a containment atmosphere radiation monitor (gaseous or particulate) or dew point instrument, and a containment sump level instrument must be operable.

a. With no containment sump level instrument operable, verify that a containment atmosphere radiation monitor is operable, and restore the containment sump level instrument to operable status within 30 days.

b. With no containment atmosphere radiation monitor and no dewpoint instrument operable, restore either a radiation monitor or dewpoint instrument to operable status within 30 days.

c. With only the dewpoint instrument operable, or with no operable instruments, enter Specification 2.0.1 immediately.

2.0 **LIMITING CONDITIONS FOR OPERATION**
2.1 Reactor Coolant System (Continued)
2.1.4 Reactor Coolant System Leakage Limits (Continued)

(5) To determine leakage to the secondary system one of the following must be operable:

a. Steam Generator Blow Down Radiation Sample Instrument
b. Condenser Off Gas Radiation Monitor
c. Periodic Secondary Samples Analyzed for Activity

Basis

Background

Components that contain or transport the coolant to or from the reactor core make up the RCS. Component joints are made by welding, bolting, rolling, or pressure loading, and valves isolate connecting systems from the RCS.

During plant life, the joint and valve interfaces can produce varying amounts of reactor coolant LEAKAGE, through either normal operational wear or mechanical deterioration. The purpose of the RCS Operational LEAKAGE LCO is to limit system operation in the presence of LEAKAGE from these sources to amounts that do not compromise safety. This LCO specifies the types and amounts of LEAKAGE.

FCS Design Criteria (Ref. 2), requires means for detecting and, to the extent practical, identifying the source of reactor coolant LEAKAGE.

The safety significance of RCS LEAKAGE varies widely depending on its source, rate and duration. Therefore, detecting and monitoring reactor coolant LEAKAGE into the containment area is necessary. Quickly separating the identified LEAKAGE from the unidentified LEAKAGE is necessary to provide quantitative information to the operators, allowing them to take corrective action should a leak occur detrimental to the safety of the facility and the public.

A limited amount of leakage inside containment is expected from auxiliary systems that can not be made 100% leaktight. Leakage from these systems should be detected, located and isolated from the containment atmosphere, if possible, to not interfere with RCS LEAKAGE detection.

This LCO deals with protection of the reactor coolant pressure boundary (RCPB) from degradation and the core from inadequate cooling, in addition to preventing the accident analysis radiation release assumptions from being exceeded. The consequences of violating this LCO include the possibility of a loss of coolant accident (LOCA).

2.0 **LIMITING CONDITIONS FOR OPERATION**
2.1 Reactor Coolant System (Continued)
2.1.4 Reactor Coolant System Leakage Limits (Continued)

Applicable Safety Analysis

Except for primary to secondary LEAKAGE, the safety analyses do not address operational LEAKAGE. However, other operational LEAKAGE is related to the safety analyses for LOCA; the amount of leakage can affect the probability of such an event. The safety analysis for an event resulting in steam discharge to the atmosphere assumes a 1 gpm primary to secondary LEAKAGE as the initial condition.

Primary to secondary LEAKAGE is a factor in the dose releases outside containment resulting from a steam line break (SLB) accident. To a lesser extent, other accidents or transients involve secondary steam release to the atmosphere, such as a steam generator tube rupture (SGTR). The leakage contaminates the secondary fluid.

The safety analysis assumes a 1 gpm primary to secondary leak as the initial condition. The Technical Specification requirement to limit primary to secondary leakage through any one steam generator to less than 150 gallons per day is significantly less than the initial condition for the safety analysis.

RCS operational LEAKAGE satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

LCO

RCS operational LEAKAGE shall be limited to:

a. Pressure Boundary LEAKAGE

No pressure boundary LEAKAGE is allowed, being indicative of material deterioration. LEAKAGE of this type is unacceptable as the leak itself could cause further deterioration, resulting in higher LEAKAGE. Violation of this LCO could result in continued degradation of the RCPB. LEAKAGE past seals and gaskets is not pressure boundary LEAKAGE.

b. Unidentified LEAKAGE

One gallon per minute (gpm) of unidentified LEAKAGE is allowed as a reasonable minimum detectable amount that the containment air monitoring and containment sump level monitoring equipment can detect within a reasonable time period. Violation of this LCO could result in continued degradation of the RCPB, if the LEAKAGE is from the pressure boundary.

2.0 **LIMITING CONDITIONS FOR OPERATION**
2.1 Reactor Coolant System (Continued)
2.1.4 Reactor Coolant System Leakage Limits (Continued)

c. Identified LEAKAGE

Up to 10 gpm of identified LEAKAGE is considered allowable because LEAKAGE is from known sources that do not interfere with detection of unidentified LEAKAGE and is well within the capability of the RCS makeup system. Identified LEAKAGE includes LEAKAGE to the containment from specifically known and located sources, but does not include pressure boundary LEAKAGE or controlled reactor coolant pump (RCP) seal leakoff (a normal function not considered LEAKAGE). Violation of this LCO could result in continued degradation of a component or system.

d. Primary to Secondary LEAKAGE through Any One SG

The 150 gallon per day limit on primary to secondary LEAKAGE through any one SG is based upon guidance in NEI 97-06, Steam Generator Program Guidelines.

APPLICABILITY

The potential for RCPB LEAKAGE is greatest when the RCS is pressurized, that is, when the reactor coolant temperature (T_{cold}) is greater than 210°F.

In MODES 4 and 5, LEAKAGE limits are not required because the reactor coolant pressure is far lower, resulting in lower stresses and reduced potentials for LEAKAGE.

REQUIRED ACTIONS (2).
Unidentified LEAKAGE, identified LEAKAGE, or primary to secondary LEAKAGE in excess of the LCO limits must be reduced to meet limits within 4 hours. This Completion Time allows time to verify leakage rates and either identify unidentified LEAKAGE or reduce LEAKAGE to within limits before the reactor must be shut down. This action is necessary to prevent further deterioration of the RCPB.

REQUIRED ACTIONS (3)
If any pressure boundary LEAKAGE exists or if unidentified, identified, or primary to secondary LEAKAGE cannot be reduced to meet limits within 4 hours, the reactor must be brought to lower pressure conditions to reduce the severity of the LEAKAGE and its potential consequences. The reactor must be brought to MODE 3, Hot Shutdown, within 6 hours and to MODE 4, Cold Shutdown, within 36 hours. This action reduces the LEAKAGE and also reduces the factors that tend to degrade the pressure boundary.

The allowed Completion Times are reasonable, based on operating experience, to reach the required conditions from full power conditions in an orderly manner and without challenging plant systems. In MODE 4, the pressure stresses acting on the RCPB are much lower, and further deterioration is much less likely.

2.0 **LIMITING CONDITIONS FOR OPERATION**
2.1 Reactor Coolant System (Continued)
2.1.4 Reactor Coolant System Leakage Limits (Continued)

References

(1) USAR, Section 11.2.3

(2) USAR, Page G.16-1

2.0 LIMITING CONDITIONS FOR OPERATION

2.1 Reactor Coolant System (Continued)

2.1.5 Maximum Reactor Coolant Oxygen and Halogens Concentrations

Applicability

Applied to the reactor coolant oxygen and halogens concentrations.

Objective

To specify the maximum oxygen and halogens concentrations of the reactor coolant system for safe reactor operation.

Specifications

Maximum limits of oxygen and halogens concentrations are as follows:

(1) If the concentration of oxygen in the reactor coolant exceeds 0.1 ppm during power operation, corrective action shall be initiated within 8 hours to return oxygen levels to $\leq$0. 1 ppm.

(2) If the concentration of chloride in the reactor coolant exceeds 0.15 ppm during power operation, corrective action shall be initiated within 8 hours to return chloride levels to $\leq$0.15 ppm.

(3) If the concentration of fluorides in the reactor coolant exceeds 0.10 ppm following modifications or repair to the reactor coolant system involving welding, corrective action shall be initiated within 8 hours to return fluoride levels to $\leq$0.10 ppm.

(4) If the oxygen concentration and the chloride or fluoride concentration of the reactor coolant simultaneously exceed the limits given in (1), (2) and (3), respectively, corrective action is to be taken immediately to return the system to within normal operation specifications.

(5) If the concentration limits of oxygen and chloride or fluoride given in (1), (2) and (3) above are not restored within 24 hours, the reactor shall be placed in a hot shutdown condition within 12 hours thereafter. If the normal operational limits are not restored within an additional 24-hour period, the reactor shall be placed in a cold shutdown condition within 24 hours thereafter.

Basis

By maintaining the oxygen, chloride and fluoride concentrations in the reactor coolant within the limits specified, the integrity of the reactor coolant system materials in contact with the coolant [1] are protected against potential stress corrosion attack. [2]

2.0 **LIMITING CONDITIONS FOR OPERATION**
2.1 Reactor Coolant System (Continued)
2.1.5 Maximum Reactor Coolant Oxygen and Halogens Concentration (Continued)

If these limits are exceeded, measures can be taken to correct the conditions (e.g., replacement of ion exchange resin or adjustment of the hydrogen concentration in the volume control tank) and further, because of the time-dependent nature of any adverse effects arising from the oxygen or halogens concentration in excess of the limits, it is unnecessary to shutdown immediately since the condition can be corrected.

The oxygen and halogen limits specified are at least an order of magnitude below concentrations which could result in damage to the materials found in the reactor coolant system even if maintained for an extended period of time.[3] Thus, the period of 8 hours to initiate corrective action to restore individual concentrations within the limits or 24 hours to restore both concentrations has been established. If the corrective action has not been effective at the end of the 24-hour period, then the reactor will be brought to the hot shutdown condition and the corrective action will continue. If, at the end of a further 24-hour period, the corrective action has not been effective, long-term corrective action could be required and the reactor will be brought to the cold shutdown condition.

References

(1) FSAR, Section 4.3.11

(2) FSAR, Section 4.4.3

(3) Corrosion and Wear Handbook, O.J. DePaul, Editor

2.0 **LIMITING CONDITIONS FOR OPERATION**
2.1 Reactor Coolant System (continued)
2.1.6 Pressurizer and Main Steam Safety Valves

Applicability
Applies to the status of the pressurizer and main steam safety valves.

Objective
To specify minimum requirements pertaining to the pressurizer and main steam safety valves.

Specifications
To provide adequate overpressure protection for the reactor coolant system and steam system, the following safety valve requirements shall be met:

(1) Two pressurizer safety valves shall be OPERABLE in MODES 1 and 2, with lift settings of 2485 psig +1%/-3% and 2530 psig +1%/-3% respectively.

(2) Whenever there is fuel in the reactor, and the reactor vessel head is installed, a minimum of one OPERABLE safety valve shall be installed on the pressurizer. However, when in at least the COLD SHUTDOWN condition, safety valve nozzles may be open to containment atmosphere during performance of safety valve tests or maintenance to satisfy this specification.

(3) At least four of the five Main Steam Safety Valves (MSSVs) associated with each steam generator shall be OPERABLE in MODES 1 and 2. Lift settings shall be at 985 psig +3/-2%, 1000 psig +3/-2%, 1010 psig +3/-2%, 1025 psig +3/-2%, and 1035 psig +3/-2%.[1]

a. With less than four of the five MSSVs associated with each steam generator OPERABLE, be in at least HOT STANDBY within 6 hours and HOT SHUTDOWN within an additional 6 hours.

(4) Two power-operated relief valves (PORVs) shall be OPERABLE during heatups and cooldowns when the RCS temperature is less than 515°F, and in MODES 4 and 5 whenever the head is on the reactor vessel and the RCS is not vented through a 0.94 square inch or larger vent, to prevent violation of the pressure-temperature limits designated by the P-T limit Figure(s) shown in the PTLR.

a. With one PORV inoperable during heatups and cooldowns when the RCS temperature is less than 515°F, restore the inoperable PORV to OPERABLE within 7 days or be in COLD SHUTDOWN within the next 36 hours and depressurize and vent the RCS through at least a 0.94 square inch or larger vent within the following 36 hours.

b. With both PORVs inoperable during heatups and cooldowns when the RCS temperature is less than 515°F, be in COLD SHUTDOWN within the next 36 hours and depressurize and vent the RCS through at least a 0.94 square inch or larger vent within the following 36 hours.

c. With one PORV inoperable in MODES 4 or 5, within one hour ensure the pressurizer steam space is greater than 50% volume and restore the inoperable PORV to OPERABLE within 7 days. If adequate steam space cannot be established within one hour, then restore the inoperable PORV to OPERABLE within 24 hours. If the PORV cannot be restored in the required time, depressurize and vent the RCS through at least a 0.94 square inch or larger vent within the next 36 hours.

2.0 **LIMITING CONDITIONS FOR OPERATION**
2.1 Reactor Coolant System (continued)
2.1.6 Pressurizer and Main Steam Safety Valves (continued)

d. With both PORVs inoperable in Modes 4 or 5 depressurize and vent the RCS through at least a 0.94 square inch or larger vent within the next 36 hours.

(5) Two power-operated relief valves (PORVs) and their associated block valves shall be operable in Modes 1, 2, and 3.

a. With one or both PORV(s) inoperable because of excessive seat leakage, within 1 hour either restore the PORV(s) to operable status or close the associated block valve(s) with power maintained to the block valve(s); otherwise, be in at least HOT SHUTDOWN within the next 6 hours and in COLD SHUTDOWN within the following 36 hours.

b. With one PORV inoperable due to causes other than excessive seat leakage, within 1 hour either restore PORV to operable status or close its associated block valve and remove power from the block valve; restore the PORV to operable status within the following 72 hours or be in HOT SHUTDOWN within the next 6 hours and in COLD SHUTDOWN with the following 36 hours.

c. With both PORVs inoperable due to causes other than excessive seat leakage, within 1 hour either restore at least one PORV to operable status or close both block valves, remove power from the block valves, and be in HOT SHUTDOWN within the next 6 hours and in COLD SHUTDOWN within the following 36 hours.

d. With one or both block valve(s) inoperable, within 1 hour restore the block valve(s) to operable status or place the associated PORV(s) in the closed position. Restore at least one block valve to operable status within the next hour if both block valves are inoperable; restore the remaining inoperable block valve to operable within 72 hours. Otherwise, be in at least HOT SHUTDOWN within the next 6 hours and in COLD SHUTDOWN within the following 36 hours.

Basis

The purpose of the two spring-loaded Pressurizer Safety Valves (PSV's) is to provide Reactor Coolant System (RCS) overpressure protection and thereby ensure that the Safety Limit for RCS pressure (i.e., 2750 psia) is not exceeded for analyzed accidents. The maximum RCS pressure transient for an analyzed accident is associated with a Loss of Load event[(2)].

The TS 2.1.6(1) lift settings are determined during Surveillance Testing in accordance with ASME Code test methods. The ASME Code requires that valves in steam service use steam as the test medium for establishing the setpoint. The +1%/-3% tolerance range specified in TS 2.1.6(1) applies to opening pressures determined during Surveillance Testing. When the valves are installed in the system, the presence of a water-filled loop seal at the valve inlets may result in in-situ actuation at a pressure that differs from the actuation pressure with steam at the inlet. Comparative testing and analysis indicates that with a loop seal present, the opening pressure of these valves may be up to 1% lower than the opening pressure under normal test conditions. Opening pressures below the specified setpoints are not a concern with respect to the safety limit for RCS pressure. Analysis of loss of load case involving elevated PSV opening pressures indicated that RCS pressures remained below the 2750 psia Safety Limit with PSV opening pressures upon to 6% above nominal setpoints. The valves are set to a tolerance of ±1% of setpoint using ASME Code test methods before being returned to service after testing. This allows for some setpoint variance over the surveillance interval.

2.0 **LIMITING CONDITIONS FOR OPERATION**
2.1 Reactor Coolant System (continued)
2.1.6 Pressurizer and Main Steam Safety Valves (continued)

The power-operated relief valves (PORVs) operate to relieve RCS pressure below the setting of the pressurizer code safety valves. These relief valves have remotely operated block valves to provide a positive shutoff capability should a relief valve become inoperable. The electrical power for both the relief valves and the block valves is capable of being supplied from an emergency power source to ensure the ability to seal this possible RCS leakage path.

Action statements (5)b. and c. include the removal of power from a closed block valve to preclude any inadvertent opening of the block valve at a time the PORV may not be closed due to maintenance. However, the applicability requirements of the LCO to operate with the block valve(s) closed with power maintained to the block valve(s) are only intended to permit operation of the plant for a limited period of time not to exceed the next refueling shutdown (Mode 5), so that maintenance can be performed on the PORV(s) to eliminate the seat leakage condition.

To determine the maximum steam flow, the only other pressure relieving system assumed operational is the main steam safety valves. Conservative values for all systems parameters, delay times and core moderator coefficients are assumed. Overpressure protection is provided to portions of the reactor coolant system which are at the highest pressure considering pump head, flow pressure drops and elevation heads.

If no residual heat were removed by any of the means available, the amount of steam which could be generated at safety valve lift pressure would be less than half of the capacity of one safety valve. This specification, therefore, provides adequate defense against overpressurization when the reactor is subcritical.

Performance of certain calibration and maintenance procedures on safety valves requires removal from the pressurizer. Should a safety valve be removed, either operability of the other safety valve or maintenance of at least one nozzle open to atmosphere will assure that sufficient relief capacity is available. Use of plastic or other similar material to prevent the entry of foreign material into the open nozzle will not be construed to violate the "open to atmosphere" provision, since the presence of this material would not significantly restrict the discharge of reactor coolant.

The total relief capacity of the ten main steam safety valves is 6.606×10^6 lb/hr. If, following testing, the as found setpoints are outside +/-1% of nominal nameplate values, the valves are set to within the +/-1% tolerance. The main steam safety valves were analyzed for a total loss of main feedwater flow while operating at 1500 MWt[3] to ensure that the peak secondary pressure was less than 1100 psia, the ASME Section III upset pressure limit of 10% greater than the design pressure. At the power of 1500 MWt, sufficient relief valve capacity is available to prevent overpressurization of the steam system on loss-of-load conditions.[4] These analyses are based on a minimum of four-of-five operable main steam safety valves on each main steam header.

The power-operated relief valve low setpoint will be adjusted to provide sufficient margin, when used in conjunction with Technical Specification Sections 2.1.1 and 2.3, to prevent the design basis pressure transients from causing an overpressurization incident. Limitation of this requirement to scheduled cooldown ensures that, should emergency conditions dictate rapid cooldown of the reactor coolant system, inoperability of the low temperature overpressure protection system would not prove to be an inhibiting factor. The effective full flow area of an open PORV is 0.94 in^2.

Removal of the reactor vessel head provides sufficient expansion volume to limit any of the design basis pressure transients. Thus, no additional relief capacity is required.

References
(1) Article 9 of the 1968 ASME Boiler and Pressure Vessel Code, Section III
(2) USAR, Section 14.9
(3) USAR, Section 14.10
(4) USAR, Sections 4.3.4, 4.3.9.5

2.0 **LIMITING CONDITIONS FOR OPERATION**
2.1 Reactor Coolant System (Continued)
2.1.7 Pressurizer Operability

Applicability

Applies to the status of the pressurizer and pressurizer heaters.

Objective

To specify minimum requirements pertaining to the pressurizer water volume and availability of heaters for accident conditions.

Specifications

(1) The pressurizer shall be operable with at least 150 KW of pressurizer heaters, and pressurizer inventory shall be maintained in a range of level 40.5% to 69.2%.

a. With the pressurizer inoperable due to an inoperable emergency power supply to the pressurizer heaters either restore the inoperable emergency power supply within 72 hours or be in HOT SHUTDOWN within the following 12 hours. With the pressurizer otherwise inoperable, be in HOT SHUTDOWN within the following 12 hours. This is applicable for Modes 1 and 2.

b. With the pressurizer level outside the above range, either restore the level within the specified limits within 2 hours or be in HOT SHUTDOWN within the following 12 hours. This is applicable for Modes 1 and 2.

Basis

The requirement that 150 KW of pressurizer heaters and their associated controls be capable of being supplied electrical power from an emergency bus provides assurance that these heaters can be energized during a loss of offsite power condition to maintain natural circulation at HOT SHUTDOWN. Either diesel will fulfill the minimum requirements of this specification. The level should be maintained above the lower limit to prevent heater cutoff and the upper limit should not be exceeded to prevent going solid or reducing the effectiveness of the pressurizer sprays by immersion during an RCS swell transient.

2.0 **LIMITING CONDITIONS FOR OPERATION**
2.1 Reactor Coolant System (Continued)
2.1.8 Reactor Coolant System Vents

Applicability

Applies to the status of the reactor coolant gas vent system. This specification is applicable while in modes 1, 2, or 3.

Objective

To ensure capability of venting non-condensible gases from the reactor coolant system, the following gas vent system requirements must be met:

(1) At least one reactor coolant system vent path consisting of at least two valves in series powered from emergency buses shall be OPERABLE and closed at each of the following locations:

a. Reactor vessel head.

b. Pressurizer steam space.

(2) With one of the above reactor coolant system vent paths inoperable, startup and/or power operation may continue provided power is removed from the valve actuators of all the inoperable valves; restore the inoperable vent path to OPERABLE status within 30 days or be in HOT STANDBY within 12 hours and in COLD SHUTDOWN within the following 30 hours.

(3) With both of the above reactor coolant system vent paths inoperable, maintain the inoperable vent path closed with power removed from the valve actuators of all the inoperable valves in the inoperable vent paths and restore at least one of the vent paths to OPERABLE status within 72 hours or be in HOT STANDBY within 12 hours and in COLD SHUTDOWN within the following 30 hours.

Basis

The purpose of this specification is to ensure a method and system is available to remove steam and/or non-condensible gases from the reactor coolant system, which may inhibit core cooling during natural circulation. The Power Operated Relief Valves are not to be considered a vent path for the purpose of this specification.