ATTACHMENT 2

Consumers Power Company
Palisades Plant
Docket 50-255

PROPOSED PORV TECHNICAL SPECIFICATIONS

Proposed Pages

June 25, 1993

9 Pages

3.1.8 POWER OPERATED RELIEF VALVES (PORVs)

Specifications

3.1.8.1 Two PORV flow paths, each consisting of an OPERABLE PORV and an OPERABLE block valve, shall be OPERABLE.

Applicability

Specification 3.1.8.1 is applicable when the temperature of all PCS cold legs is ≥ 430°F.

Action

a. With one PORV flow path inoperable:

1. For each inoperable block valve, place the associated PORV control in the "CLOSE" position within 1 hour.

2. For each inoperable PORV, close the associated block valve within 1 hour.

3. Restore both PORV flow paths to OPERABLE status within 72 hours.

b. With two PORV flow paths inoperable:

1. For each inoperable block valve, place the associated PORV control in the "CLOSE" position within 1 hour.

2. For each inoperable PORV, close the associated block valve within 1 hour.

3. Restore one PORV flow path to OPERABLE status within 2 hours.

c. If any action required by 3.1.8.1 is not met AND the associated completion time has expired, the reactor shall be placed in HOT SHUTDOWN within 12 hours.

Amendment No. ~~51~~, ~~72~~, ~~117~~, ~~131~~,

3.1.8 POWER OPERATED RELIEF VALVES (PORVs)

Specification

3.1.8.2 Two PORV flow paths, each consisting of an OPERABLE PORV, with a lift pressure less than specified in Figure 3-4, shall be OPERABLE.

Note: The provisions of Specification 3.0.4 are not applicable.

Applicability

Specification 3.1.8.2 is applicable when the temperature of any of the PCS cold legs is < 430°F, unless the reactor vessel head is removed.

Action

a. With one PORV flow path inoperable, restore both PORV flow paths to OPERABLE status:

   1. within 24 hours with pressurizer water level > 57%, or

   2. within 7 days with pressurizer water level ≤ 57%.

b. With two PORV flow paths inoperable, or if action required by 3.1.8.2a is not met and the associated completion time has expired: depressurize and vent the PCS through a vent path capable of relieving 167 gpm at a PCS pressure of 315 psia within 8 hours, and

   1. When the pathway is through any valve that is not locked, sealed, or otherwise secured in the open position, verify the vent pathway is open at least once per 12 hours, or

   2. Otherwise, verify that the vent pathway is open at least once per 31 days.

3.1.8 POWER OPERATED RELIEF VALVES (PORVs)

Basis 3.1.8

Specification 3.1.8 assures that the PORVs are available as a pressure relief path for the PCS. Specification 3.1.8.1 applies when the PCS is above 430°F, to assure the PORVs would be available to reduce PCS pressure in the event of the loss of normal means of PCS pressure control, or to provide an alternate path for removal of decay heat in the event of the loss of all normal methods. With the PCS above 430°F automatic PORV operation for Low Temperature Overpressure Protection (LTOP) is no longer required. Specification 3.1.8.2 applies when the temperature of either PCS cold leg is below 430°F, where excessive addition of either mass or energy could result in significant PCS pressure increases.

If an inoperable PORV flow path cannot be repaired within the specified completion time, Specification 3.1.8.1 requires the plant to be placed in HOT SHUTDOWN. It does not require a cooldown, which would place the plant in a condition where the PORVs provide the required automatic pressure protection. Time is allowed for repair of the valve, if possible, or to plan a cooldown with limited overpressure protection available. If a cooldown must be made to repair an inoperable valve, the specified completion times of 3.1.8.2 allow a slow, controlled evolution to occur.

Each completion time starts when it is discovered that the particular action statement applies. The specified actions and completion times are based on those in the model Technical Specifications provided in Generic Letter 90-06.

3.1.8.1

When PCS temperature is at or above 430°F, the maximum allowable PCS pressure is the Safety Limit of 2750 psia. The pressurizer safety valves, required by Specification 3.1.7, prevent exceeding this pressure. The PORVs are required to be OPERABLE above 430°F to support Emergency Procedure operation in case of the need for reducing PCS pressure or for Once-Through-Cooling. The PORVs are not assumed to function by the plant safety analyses.

Since the pressurizer safety valves provide the necessary automatic protection against excessive pressure when the PCS is above 430°F, automatic actuation of the PORVs is not required to be OPERABLE.

The PORVs and their block valves must provide two safety functions; maintenance of PCS integrity and PCS pressure control capability. If either of these safety functions is unavailable, corrective action must be taken.

Basis 3.1.8.1 (continued)

Normally, during operation at HOT STANDBY and above, the PORV controls are in the CLOSE position, and the block valves are closed. The PORVs, block valves, and the associated manual controls must be operable. If either valve in a PORV flow path is inoperable, the other valve in the flow path must provide PCS integrity assurance. When a PORV is inoperable, the block valve must be closed; when a block valve is inoperable, the PORV must have its control in the "CLOSE" position.

If the inoperable valves cannot be restored to OPERABLE status within the specified completion time, the plant must be placed in HOT SHUTDOWN. The completion times allow the required action to be accomplished without undue haste, yet allow less time when more equipment is inoperable.

3.1.8.2

When PCS is below 430°F with the reactor vessel head installed, two PORVs are required to be operable to avoid pressures which might lead to failure of the reactor vessel. Pressure increases could be caused by sudden additions (or imbalances) of either mass or energy.

The allowable pressure limits are determined in accordance with 10 CFR 50, Appendix G, and are referred to as "Low Temperature Overpressure Protection" (LTOP) limits. The variable setpoint of the LTOP system is programmed and calibrated to ensure opening of the pressurizer PORVs when the PCS pressure is above the limit in Figure 3-4. The pressure limit for each temperature is developed from the heating or cooling limits for the PCS.

The limit in Figure 3-4 includes an allowance for pressure overshoot during the interval between the time pressurizer pressure reaches the limit, and the time a PORV opens enough to terminate the pressure rise.

LTOP is provided by two independent channels each consisting of measurement, control, actuation, and valves. Either channel is capable of providing full protection. The actual setpoint of PORV actuation for LTOP will be below the limit in Figure 3-4 to allow for potential instrument inaccuracies, and drift. This will ensure that at no time between calibration intervals will the PCS pressure exceed the limit of Figure 3-4 without PORV actuation.

Mass additions could come from the starting of pumps or from opening a Safety Injection Tank isolation valve. Only the charging pumps or high pressure safety injection pumps could cause the PCS pressure to exceed its limits. Neither the shutoff head of the low pressure safety injection nor the operating pressure of the safety injection tanks is above the cold PCS pressure limit. Specification 3.3.2g places limits on HPSI pump operability when the PCS is below 260°F to assure inadvertent starting does not cause overpressurization of the PCS.

Basis 3.1.8.2 (continued)

Energy additions could come from either the steam generators or from the reactor core. Small energy addition could come from operation of the pressurizer heaters. Energy addition from the steam generators could occur if a primary coolant pump was started when the steam generator secondary temperature was significantly above the PCS temperature. Specification 3.1.1.h places limits on the starting of primary coolant pumps to avoid undesired energy additions from the steam generators. Energy addition from the reactor core could occur due to an inadvertent criticality or to an imbalance in decay heat removal. Specification 3.10.1 places limits on shutdown margin to avoid a rod withdrawal event causing a criticality and to provide sufficient time for operator action to terminate a dilution event prior to criticality.

The potential causes of a sudden PCS pressure increase which the LTOP system must be able to mitigate are imbalance in charging and letdown flow, starting of the HPSI pumps when above 260°F, and in an imbalance in decay heat (and pressurizer heat) addition and removal. A Safety Injection Signal (SIS) could both initiate flow from two HPSI pumps (when above 260°F) and three charging pumps, and isolate letdown. The PCS heatup from a loss of shutdown cooling event occurring 24 hours after shutdown from a continuous full power run would generate less additional coolant volume than the starting of three charging pumps (Reference 5). The limiting event for the LTOP system would be an inadvertent SIS occurring during an established PCS heatup.

Analysis (Reference 1) has concluded that an SIS occurring, during a PCS and pressurizer heatup at the maximum allowable rates, either between 260°F and 430°F with the HPSI pumps, or below 260°F without the HPSI pumps, would not cause PCS pressure to exceed the Appendix G limit if either PORV opens when the set pressure is reached. With the PCS above 430°F, the pressurizer safety valves, required by Specification 3.1.7, provide adequate overpressure protection. Both PORVs are required to be operable to allow for a single failure.

If a PORV becomes inoperable when it is required for LTOP, it must be restored to operable status, or the plant must be cooled down, depressurized, and vented through a vent path with sufficient capacity to provide the necessary protection. Since the pressure response to a transient is greater if the pressurizer steam space is small or if PCS is solid, the allowed outage time for a PORV flow path out of service is shorter. The maximum pressurizer level at which credit can be taken for having a bubble (57%, which provides about 700 cubic feet of steam space) is based on judgement rather than on analyses. This level provides the same steam volume to dampen pressure transients as would be available at full power. This steam volume provides time for operator action, if the PORVs failed to operate, between an inadvertent SIS and PCS pressure reaching the 10 CFR 50 Appendix G pressure limit. The time available for action would depend upon the existing pressure and temperature when the inadvertent SIS occurred.

Basis 3.1.8.2 (continued)

Reference 1 has determined that any vent path capable of relieving 167 gpm at a PCS pressure of 315 psia is acceptable. The 167 gpm flow rate is based on an assumed charging imbalance due to interruption of letdown flow with three charging pumps operating, a 40°F per hour PCS heatup rate, a 60°F per hour pressurizer heatup rate, and an initially depressurized and vented PCS. The PCS heatup rate is limited to 40°F per hour by Specification 3.1.2a; the pressurizer heatup rate is limited to 60°F per hour by Specification 3.1.2c. Neither HPSI pump nor PCP starts need to be assumed with the PCS initially depressurized, because Specification 3.3.2g requires both HPSI pumps to be inoperable and operating procedures prohibit PCP operation.

The pressure relieving ability of a vent path depends not only upon the area of the vent opening, but also upon the configuration of the piping connecting the vent opening to the PCS. A long, or restrictive piping connection may prevent a larger vent opening from providing adequate flow, while a smaller opening immediately adjacent to the PCS would be adequate. The areas of multiple vent paths cannot simply be added to determine the necessary vent area.

The following vent path examples are acceptable:

1. Removal of the reactor vessel head,
2. Removal of a steam generator primary manway,
3. Removal of the pressurizer manway,
4. Removal of a PORV or pressurizer safety valve,
5. Both PORVs and associated block valves open,
6. Opening of both PCS vent valves PC-514 and PC-515.

Reference 2 determined that venting the PCS through PC-514 and PC-515 provided adequate flow area. The other listed examples provide greater flow areas with less piping restriction and are therefore acceptable. Other vent paths shown to provide adequate capacity could also be used. One open PORV provides sufficient flow area to prevent excessive PCS pressure. However, if the PORVs are elected as the vent path, both valves must be used to meet the single failure criterion, since the PORVs are held open against spring pressure by energizing the operating solenoid.

When the shutdown cooling system is in service with MO-3015 and MO-3016 are open, additional overpressure protection is provided by the relief valves on the shutdown cooling system. References 3 and 4 show that this relief capacity will prevent the PCS pressure from exceeding its pressure limits during any of the above mentioned events.

References

1. Consumers Power Company Engineering Analysis, EA-FC-809-13, Rev 1
2. Consumers Power Company Engineering Analysis, EA-TCD-91-01-01.
3. Consumers Power Company Engineering Analysis, EA-PAL-89-040-1
4. Consumers Power Company Corrective Action Document, A-PAL-91-011
5. Consumers Power Company Engineering Analysis, EA-AG-93-02

Table 3.17.4 (Cont'd)

No	Functional Unit	Minimum Operable Channels	Minimum Degree of Redundancy	Permissible Bypass Conditions
8.	Pressurizer Wide Range Water Level Indication	2 [m, p, q]	None	Not required in Cold or Refueling Shutdown
9.	Pressurizer Code Safety Relief Valves Position Indication (Acoustic Monitor or Temperature Indication)	1 per Valve	None	Not Required below 325°F
10.	Power Operated Relief Valves (Acoustic Monitor or Temperature Indication)	1 per Valve	None	Not required when PORV isolation valve is closed and its indication system is operable
11.	PORV Block Valve Position Indication	1 per Valve	None	Not required when reactor is depressurized and vented in accordance with Specification 3.1.8
12.	Subcooling Margin Monitor	1	None	Not required below 325°F
13.	Auxiliary Feed Flow Rate Indication	1 per flow[h] Control Valve	None	Not required below 325°F
14.	Auxiliary Feedwater Actuation System Sensor Channels	2 per steam generator[e]	1	Not required below 325°F
15.	Auxiliary Feedwater Actuation System Actuation Channels	2[f]	1	Not required below 325°F
16.	Excore Detector Deviation Alarms	1[g]	None	Not Required Below 25% of Rated Power
17.	Axial Shape Index Alarm	2[i]	1	Not Required Below 25% of Rated Power
18.	Reactor Vessel Water Level	2[j,k,l,m]	None	Not Required Below 325°F
19.	Core Exit Thermocouples	4/core Quadrant [p, q, r]	None	Not required below 300°F

Amendment No. ~~67~~, ~~68~~, ~~96~~, ~~115~~, ~~118~~, ~~129~~, ~~147~~,

4.1 INSTRUMENTATION AND CONTROL

Applicability

Applies to the reactor protective system and other critical instrumentation and controls.

Objective

To specify the minimum frequency and type of surveillance to be applied to critical plant instrumentation and controls.

Specifications

Calibration, testing, and checking of instrument channels, reactor protective system and engineered safeguards system logic channels and miscellaneous instrument systems and controls shall be performed as specified in 4.1.1 and in Tables 4.1.1 to 4.1.3.

4.1.1 PORVs and Overpressure Protection System Tests

In addition to the requirements of Specification 4.0.5, each PORV flow path shall be demonstrated OPERABLE by:

1. Testing the PORVs in accordance with the inservice inspection requirements for ASME Boiler and Pressure Vessel Code, Section XI, Section IWV, Category B valves.

2. Performance of a CHANNEL CALIBRATION on the PORV actuation channel at least once per 18 months.

3. When the PORV flow path is required to be OPERABLE by Specification 3.1.8.1:

   (a) Performing a complete cycle of the PORV with the plant above COLD SHUTDOWN at least once per 18 months.

   (b) Performing a complete cycle of the block valve prior to heatup from COLD SHUTDOWN, if not cycled within 92 days.

4. When the PORV flow path is required to be OPERABLE by Specification 3.1.8.2:

   (a) Performance of a CHANNEL FUNCTIONAL TEST on the PORV actuation channel, but excluding valve operation, at least once per 31 days.

   (b) Verifying the associated block valve is open at least once per 72 hours.

Basis 4.1

Failures such as blown instrument fuses, defective indicators, and faulted amplifiers which result in "upscale" or "downscale" indication can be easily recognized by simple observation of the functioning of an instrument or system. Furthermore, such failures are, in many cases, revealed by alarm or annunciator action and a check supplements this type of built-in surveillance.

Based on experience in operation of both conventional and nuclear plant systems when the plant is in operation, a checking frequency of once-per-shift is deemed adequate for reactor and steam system instrumentation. Calibrations are performed to insure the presentation and acquisition of accurate information.

The power range safety channels and ΔT power channels are calibrated daily against a heat balance standard to account for errors induced by changing rod patterns and core physics parameters.

Other channels are subject only to the "drift" errors induced within the instrumentation itself and, consequently, can tolerate longer intervals between calibration. Process system instrumentation errors induced by drift can be expected to remain within acceptable tolerances if recalibration is performed at each refueling shutdown interval.

Substantial calibration shifts within a channel (essentially a channel failure) will be revealed during routine checking and testing procedures. Thus, minimum calibration frequencies of one-per-day for the power range safety channels, and once each refueling shutdown for the process system channels, are considered adequate.

The minimum testing frequency for those instrument channels connected to the reactor protective system is based on an estimated average unsafe failure rate of 1.14×10^{-5} failure/hour per channel. This estimation is based on limited operating experience at conventional and nuclear plants. An "unsafe failure" is defined as one which negates channel operability and which, due to its nature, is revealed only when the channel is tested or attempts to respond to a bonafide signal.

ATTACHMENT 3

Consumers Power Company
Palisades Plant
Docket 50-255

PROPOSED PORV TECHNICAL SPECIFICATIONS

Engineering Analysis

June 25, 1993

ATTACHMENT 3

To BNYoung, Palisades

From TCDuffy, Palisades
T.C. Duffy

Date July 1, 1993

Subject Required relief capacity

EXCELLENCE BUILT THROUGH DESIGN

CONSUMERS POWER COMPANY

Internal Correspondence

CC RJGerling Palisades

TCD93*12

The relief capacity required to protect the PCS from a charging letdown imbalance coincident with a 40°F/Hr PCS heat-up and a 200°F/Hr pressurizer heat-up was calculated in EA-FC-809-13, Pg. 10 of 23, to be 167 GPM. This calculation was only a small portion of the engineering analysis so I have repeated it below for ease of review.

The swell due to pressurizer and PCS heat-up is calculated using the following relationship.

$$dV = \frac{V_f - V_{f'}}{V_f} \times \frac{V_{pcs}}{t} \times 7.48 \times 60$$

PCS heat-up

Determine change in volume over a 10°F increment between 180° and 190° and multiply it by 4 to give a 40°F/Hr change.

$V_{f\,@\,180°}$ = .01649 ft^3/lbm $V_{f\,@\,190°}$ = .01656 ft^3/lbm
V_{pcs} = 8808 Ft^3 t = 3600 sec

$$d_V = 4 \times [\frac{.01656 - .01649}{.01649} \times \frac{8808}{3600} \times 7.48 \times 60] = 18\ GPM$$

Pressurizer heat-up

Determine change in volume over a 10°F increment between 180° and 190° and multiply it by 20 to give a 200°F/Hr change.

$V_{f\,@\,180°}$ = .01649 ft^3/lbm $V_{f\,@\,190°}$ = .01656 ft^3/lbm
V_{pzr} = 1503.7 Ft^3 t = 3600 sec

$$d_{Vpzr} = 20 \times [\frac{.01656 - .01649}{.01649} \times \frac{1503.7}{3600} \times 7.48 \times 60] = 16\ GPM$$

Total Relief Capacity required

The maximum charging letdown flow imbalance is 133 GPM. This Totaled with the other two sources above yields a total relief capacity of 167 GPM. The PCS pressure at which this relief capacity must be achieved is 300 psig. This a conservative value used for the 10CFR50 Appendix G pressure limit that must be protected in the operating range of interest (50° to 212°F).