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US NUCLEAR REGULATORY COMMISSION
Mail Station P1-137
Washington, DC 20555

Ladies/Gentlemen:

DOCKETS 50-266 AND 50-301
TECHNICAL SPECIFICATION CHANGE REQUEST 194
LOW-TEMPERATURE OVERPRESSURE PROTECTION SYSTEM
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

On July 1,1996, we submitted a request for exemption from the requirements of 10CFR50.60, and on September 19, 1996, we submitted Technical Specification Change Request (TSCR) 194, "Low-Temperature Overpressure Protection System," which requested amendments to Facility Operating Licenses DPR-24 and DPR-27 for Point Beach Nuclear Plant, Units 1 and 2, respectively. The proposed amendments revise the setpoint and limits contained in Technical Specifications 15.3.15 for the Low-Temperature Overpressure Protection System. On November 1, 1996, the NRC staff requested additional information on our submittals. The attachment to this letter provides the information requested in your November 1 letter.

Please contact us should you desire any additional information.

Sincerely,

for
Bob Link
Vice President
Nuclear Power

A001 1/1

JRP
Attachment

cc: NRC Regional Administrator, NRC Resident Inspector, Public Service Commission of Wisconsin

Response to Request for Additional Information on TSCR 194
Low Temperature Overpressure Protection System
and Request for Exemption from the Requirements of 10CFR50.60

1. *Why does operation with administrative controls on one reactor coolant pump (RCP) increase the likelihood of spurious actuation of a power-operated relief valve (PORV)? Why does operation with administrative controls on two RCPs increase the likelihood of spurious actuation of a PORV?*

RESPONSE. The difference in pressure between the reactor vessel midplane (the controlling pressure of concern) and the pressure at the pressure sensing points for actuation of PORVs changes depending upon the number of reactor coolant pumps in operation. When a RCP is secured, the flow induced pressure losses between the reactor vessel midplane and the pressure sensing points are reduced. This causes a increase in the pressure at the pressure sensing points. This pressure increase at the sensor will cause the sensed pressure to become closer to the setpoint for LTOP actuation. Depending on RCS conditions, this increase in pressure at the sensor can reduce margins such that the probability of a spurious actuation of a power-operated relief valve is increased.

In addition, by placing administrative controls on reactor coolant pump operation that are based on the 10CFR50, Appendix G reactor vessel limits, plant operating procedures may require operation in a manner that has increased risk from the standpoint of spurious actuation of LTOP. Therefore, administrative controls on operation of RCPs can cause operational difficulties, such that the probability of spurious power-operated relief valve actuation is increased. For example, a change in the sequence of procedural steps during plant cooldown may require plant operators to secure a RCP at a point where their attention is focused on other evolutions and parameters, such that the probability of a spurious actuation of a power-operated relief valve may be increased.

Is one RCP sufficient to provide adequate pressure to the RCP seals?

RESPONSE: Yes. Satisfactory RCP seal operation is independent of the number of operating RCPs. Seal operation is maintained within a "safe operating range" of seal leakoff rate versus seal differential pressure defined in plant operating procedures. Seal differential pressure is directly measured at the pump seal, therefore correction for one versus two RCP operation is not necessary.

Are pressure surges associated with RCP start included in the evaluation of the expected pressure at the core midplane of 63 psig higher than the pressure at the pressure sensing points?

RESPONSE: "Pressure surges" associated with RCP start are due to energy input transients caused by differences in reactor coolant temperature within the RCS. The design basis energy input transient that was analyzed in the licensed LTOP methodology for Point Beach is the limiting credible transient.

Our evaluation of the design basis energy input transient conservatively includes consideration of the steady state pressure bias due to two RCPs operating. This is done by correcting the maximum allowable pressure at the pressure instrument for the pressure bias due to two RCPs operating. This pressure bias correction is conservative because the maximum location

pressure bias is not achieved until two reactor coolant pumps reach steady state flow conditions, whereas the limiting energy input transient occurs following the start of the first RCP.

2. *No instrument uncertainty (pressure or temperature) is accounted for in the low-temperature overpressure (LTOP) setpoints or limits. Be sure to include a discussion of the effects of temperature uncertainty on the enable temperature, bolt-up temperature, and RCP lockout temperature.*

   RESPONSE: We have performed an evaluation of LTOP setpoints and limits with pressure and temperature uncertainties considered, and determined that acceptable LTOP setpoints and limits can be established with the application of ASME Code Case N-514. Code Case N-514 is consistent with guidelines developed by the ASME Working Group on Operating Plant Criteria to define pressure limits during LTOP events that avoid certain unnecessary operational restrictions, provide adequate margins against failure of the reactor pressure vessel, and reduce the potential for unnecessary actuation of pressure relieving devices used for LTOP. Therefore, an exemption from 10CFR50.60 to allow the use of Code Case N-514 will allow acceptable LTOP setpoints and limits to be maintained for plant operation and provide adequate margins against failure of the reactor pressure vessel, while accounting for instrument uncertainties. Due to our desire to implement our proposed Technical Specifications for restart from our current outage scheduled for mid-December, we request that an exemption from 10CFR50.60 to allow the use of Code Case N-514 be granted as soon as possible.

   The effects of instrument uncertainty on the LTOP setpoint, enable temperature, and RCP lockout temperature for operation with more than one RCP were not considered in our submittal of September 19. It was determined that inclusion of instrument uncertainties in our evaluation would reduce the LTOP setpoint, increase the LTOP enable temperature, and unnecessarily place burden and difficulty on plant operations above those required to safely operate Point Beach.

   Because of the conservatisms included in the requirements of ASME Code Section XI, Appendix G, the inclusion of additional margin to account for instrument uncertainties is not necessary to protect the reactor pressure vessel from damage. ASME Code Appendix G requires that the pressure-temperature limits be calculated:

   a) using a safety factor of two on the principal membrane (pressure) stresses;
   b) assuming a flaw at the surface with a depth of one-quarter (1/4) of the vessel wall thickness and a length of six (6) times its depth;
   c) using a conservative fracture toughness curve that is based on the lower bound of static, dynamic, and crack arrest fracture toughness tests on material similar to the Point Beach reactor vessel material; and
   d) applying a 2-sigma margin in the determination the adjusted reference temperature.

   These conservatisms exceed the magnitude of uncertainty which is associated with the Point Beach pressure and temperature instruments.

The measurement of bolt-up temperature for Point Beach Units 1 and 2 is unrelated to LTOP system operation. Prior to tensioning of the reactor vessel studs, plant procedures require the metal temperature of reactor vessel materials in the closure flange region to be verified. The materials in the closure flange region are verified to be above the 10CFR50, Appendix G limit for pressurization to twenty percent of the preservice system hydrostatic test pressure with the reactor core not critical. Direct measurements of the metal temperature are made using a digital pyrometer, with instrument accuracy and other measurement uncertainties taken into account administratively.

3. *Does the instrument bias discussed on Sheet 2 of the calculation include the static elevation pressure bias in addition to the dynamic effects of the RCPs running?*

RESPONSE: Yes, the instrument bias discussed on Sheet 2 of the calculation includes static elevation pressure bias in addition to the dynamic effects of the RCPs running.

Additionally, there is some effect of having one or more residual heat removal (RHR) pumps running, please provide your evaluation of the effects of running RHR pumps.

RESPONSE: The bias value that was used in our evaluation of LTOP setpoints and limits was determined with the assumption that no RHR pumps were running. Wisconsin Electric has contacted Westinghouse to have a plant-specific pressure bias term calculated for Point Beach that accounts for the effects of having RHR pumps in operation. This plant-specific location bias term will be available in approximately two weeks. We will provide this additional information to you at that time.

There is no discussion justifying that the pressure bias values chosen for Point Beach are conservative. Please provide the basis for choosing the values used. For example, are the values generic or plant-specific and what assumptions were made?

RESPONSE: As stated above, a plant-specific pressure bias term will be calculated and provided to the NRC. However, the pressure bias values presently used in the calculation were developed by Westinghouse based upon a conservative set of assumptions for Westinghouse 2-loop plants and were included in Westinghouse Nuclear Safety Advisory Letter, NSAL-93-005, "Cold Overpressure Mitigation System (COMS) Nonconservatism."

The calculation of this value assumed that two reactor coolant pumps were in operation, however, no residual heat removal pumps were considered to be operating. The calculation considered the following factors in determining the total pressure differential between the reactor vessel beltline and the pressure instrument locations: velocity head difference; elevation head difference; pressure drop though reactor vessel and across the reactor core; and flow losses through RCS piping.

4. *The Westinghouse methodology that is being used to verify the setpoints is not provided. Has the methodology been used in a topical report? If so, please provide the report number and date of the safety evaluation.*

RESPONSE: We are not aware if the methodology was previously reviewed by the NRC as a topical report. However, it was previously submitted in plant-specific submittals for Point Beach (dated July 28, 1977, and October 28, 1977) and reviewed by the NRC. The NRC issued a Safety Evaluation, dated May 20, 1980, for LTOP system operation to Point Beach that is based on the methodology contained in this report. The methodology is part of the current design and licensing basis for the Point Beach LTOP system.

The report and its supplement are unnumbered and entitled "Pressure Mitigating Systems Transient Analysis Results" and "Supplement to the July 1977 Report, Pressure Mitigating Systems Transient Analysis Results," prepared by Westinghouse Electric Corporation for the Westinghouse Owners Group on Reactor Coolant System Overpressurization, dated July 1977 and September 1977, respectively.

If not, please provide the methodology used to calculate the pressure overshoot for both the mass and energy addition transients.

RESPONSE: Not applicable.

Additionally for these calculations, please provide the basis for the selection of inputs (i.e., initial reactor coolant system temperature, pressure, steam generator surface area, injection flow rate, PORV flow area, inlet and outlet piping geometries, flow resistances, time delays in valve response and actuation logic) to assure the results will be conservative or limiting.

RESPONSE: The basis for selection of inputs used in the development of the LTOP methodology is provided in the 1977 Westinghouse Report. The basis for selection of inputs to the Point Beach LTOP evaluation are provided below. These inputs are consistent with the inputs used in the current design and licensing basis for the Point Beach LTOP system, as documented in our letters to the NRC dated July 28, 1977, and October 28, 1977. The analyses provided in our 1977 submittals were performed using the conservative bounding input parameters of the Westinghouse Report, and corrected to provide results applicable to the plant-specific Point Beach configuration.

Initial reactor coolant system temperature: The initial reactor coolant temperature selected for use in the analyses was based on a review of the credible operating conditions which are expected in a plant when in a low-temperature, low-pressure water solid condition. For all of the mass input cases analyzed in the LTOP methodology, the reactor coolant was considered to be at a cold shutdown temperature of 100°F and the pressurizer filled solid with water at 100°F.

The energy input cases were studied with various values of initial coolant temperature from 100°F to 250°F, the maximum range of temperature which might be expected for operation in a water solid condition. Over this range, the energy input transients became more severe with the higher initial temperature. However, at coolant temperatures greater than 180°F the allowable reactor coolant system pressure determined in accordance with ASME Code, Appendix G, increases exponentially at a rate greater than the linear increase in reactor coolant pressure due to the energy input transient.

Initial reactor coolant system pressure: For the mass input cases, two initial reactor coolant pressures were considered. However, it was found that for the particular cases studied, the pressure transient was well defined at the time the relief valve setpoint was reached and there was a negligible effect on the relief valve performance due to the difference in starting pressure. Therefore, for conservatism, the majority of the mass input cases were started from a coolant pressure of 50 psig to ensure that the mass input mechanism was always well established before the mitigating relief valve came into operation.

An initial pressure of 300 psig is assumed in all energy input transient cases analyzed in the LTOP methodology report. The energy input cases were restricted to a minimum initial pressure of 300 psig because of a pump shaft seal requirement. This minimum pressure was used in all analyses to ensure that the pressure transient was allowed to become well established before the mitigating relief valve was brought into operation.

Steam generator surface area: The steam generator surface area used in the evaluation of the energy addition transient is the surface area of the current steam generators as documented in the Point Beach Final Safety Analysis Report. It was determined that following replacement of the Point Beach Unit 2 steam generators, the heat transfer area of the replacement steam generators will be increased to 47,500 square feet. However, because of the lower heat transfer coefficient of the tubing in the replacement steam generators, the total heat transfer is essentially equivalent to the old steam generators.

As a conservatism, we revised our evaluation of the energy input transient assuming that the total heat transfer of the replacement steam generators is proportionally larger than the old steam generators based on the heat transfer area difference. It was determined that the design basis mass input transient remains more limiting in the determination of the LTOP setpoint and is not dependent on steam generator heat transfer area. We will provide you our revised evaluation when our plant-specific location bias term becomes available in approximately two weeks.

Injection flow rate: The safety injection pump characteristic used as the design basis for the mass input transient (LTOP methodology Figure 2.3.2, Curve C) conservatively envelopes the Point Beach safety injection pump characteristic shown in FSAR Figure 6.2-4.

PORV flow area and inlet and outlet piping geometries: The LTOP methodology models the power operated relief valve as a 2 inch nominal body size globe valve located in a 3 inch line. This is the same as the Point Beach Units 1 and 2 configuration.

Flow resistances: The PORV flow coefficient, C_v, for the reference relief valve in the LTOP methodology is 50. This is the same as the specified flow coefficient for the Point Beach PORVs.

Time delays in valve response and actuation logic: The reference relief valve opening time in the July 1977 LTOP methodology is 3 seconds. A "relief valve opening time factor" is applied in the evaluation of the LTOP setpoint to correct the pressure overshoot to a value corresponding to the Point Beach PORV actuation time of less than or equal to 2 seconds. The Point Beach PORVs are periodically tested as part of the PBNP Inservice Testing Program to ensure that their actuation time is maintained within the 2 second limit.

As discussed above, each of these inputs is based on the actual Point Beach configuration or is a conservative limit for the transient being analyzed. Therefore, the results of the Point Beach LTOP evaluation are conservative and limiting. Other conservatisms in the design basis LTOP methodology for Point Beach are discussed in the referenced July 1977 Westinghouse LTOP methodology report.

For the energy addition transient please provide greater detail why the two cases analyzed (100°F at 300 psi with one RCP initially running and 250°F at 300 psi with one RCP initially running) will bound all the different combinations of initial temperature, pressure, and operating pumps.

RESPONSE: The bounding energy input transient evaluated in the LTOP methodology is initiated by the starting of the first RCP. Therefore, all cases analyzed for the energy addition transient in the LTOP methodology assume that no RCPs are initially running. However, as a conservatism in our evaluation, the location pressure bias corresponding to two RCPs running at steady state conditions was assumed in evaluating the acceptability of the proposed LTOP setpoint. We will provide you our revised evaluation clarifying this assumption when our plant-specific location bias term becomes available in approximately two weeks

An initial pressure of 300 psig is assumed in all energy input transient cases analyzed in the LTOP methodology report. The report states that the energy input cases were restricted to a minimum initial pressure of 300 psig because of a pump shaft seal requirement. This minimum pressure was used, for conservatism, in all analyses to assure that the pressure transient was allowed to become well established before the mitigating relief valve was brought into operation.

In our evaluation, the highest and lowest initial temperatures analyzed for the energy input transient in the LTOP methodology were evaluated. We have subsequently evaluated all (four) initial temperatures analyzed in the LTOP methodology and determined that the proposed LTOP setpoint is acceptable for all energy input transient cases that were analyzed in the methodology. We will provide you our revised evaluation which includes the two additional cases when our plant-specific location bias term becomes available in approximately two weeks.

5 *In the determination of the new enable temperature, NRC Branch Technical Position RSB 5-2 is incorrectly referenced by stating that,*

$$T_{enable} = RT_{NDT} + 90°F.$$

The Branch Technical Position actually defines the enable temperature as the <u>water temperature</u> corresponding to a metal temperature of at least RT_{NDT} + 90°F at the beltline location (1/4t or 3/4t). Please evaluate and account for the temperature difference between the RCS water and the (1/4t or 3/4t) weld location.

RESPONSE: The design basis for the Point Beach LTOP system takes credit for the fact that overpressure events most likely occur during isothermal conditions in the Reactor Coolant System. Therefore, the metal temperature and water temperature are essentially the same. The assumption of isothermal conditions is further documented in a Westinghouse Owners Group Report, WCAP-14040-NP-A, "Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves," that was accepted for

referencing by the NRC in a letter to the Westinghouse Owners Group dated October 16, 1995.

Our evaluation will be corrected to indicate that the enable temperature is the water temperature corresponding to a metal temperature of at least RT_{NDT} + 90°F at the beltline location (1/4t or 3/4t). However, based on the steady-state assumption, no additional temperature differential will be added in our determination of the enable temperature.

6. *The maximum allowable pressure is calculated for four different temperatures, 70°F, 100°F, 120°F, and 250°F, however, the steady state pressure vs. temperature curves contained in TS Figures 15.3.1-1 and 2 do not appear to correspond to the same values. If this is the case, please describe where these two different sets of limit curves originate.*

RESPONSE: The limits are different. The pressure versus temperature curves contained in TS Figures 15.3.1-1 and 15.3.1-2 were developed using a methodology published by Westinghouse in January 1977 (WCAP-8738 and WCAP-8743). This methodology contains inherent conservatisms over and above the requirements of 10CFR50.60 and Appendix G, and the ASME Boiler and Pressure Vessel Code Section XI, Appendix G, and the guidance of NRC Branch Technical Position RSB 5-2. Even with these inherent conservatisms, the pressure versus temperature curves contained in TS Figures 15.3.1-1 and 15.3.1-2 allow operability for Point Beach Units 1 and 2, at this time. However, use of values from these curves, when combined with the other conservatisms used to determine the LTOP setpoint and limits, would unnecessarily restrict plant operations and would unnecessarily cause the LTOP setpoint to be lowered to a point where plant operation would be difficult.

In addition, the visual interpolation (i.e., "eye-balling") of data points from TS Figures 15.3.1-1 and 15.3.1-2 to determine values for use in calculating LTOP setpoints and limits introduces an additional inaccuracy and uncertainty to the evaluation. Calculating the pressure limit in accordance with ASME Appendix G for a given RCS temperature avoids this inaccuracy. Explicit, point-by-point, calculation of the pressure-temperature limits also allows the iterative process of LTOP setpoint evaluation to be performed in an automated manner using a computer spreadsheet program. Whereas, this would not be possible if the limits were to be visually interpolated from TS Figures 15.3.1-1 and 15.3.1-2.

It is the underlying purpose of the LTOP system to ensure that the 10CFR50, Appendix G limits of the reactor coolant system pressure boundary are not exceeded during any anticipated operational occurrences. Therefore, the LTOP setpoint for Point Beach Units 1 and 2 is calculated in accordance with the requirements of 10CFR50, App. G and ASME Code, Appendix G, without the additional margins included in the methodology of WCAP-8738 and WCAP-8743 being added. The calculation enclosed in our September 19 submittal explicitly derives the pressure-temperature limits for four specific temperatures in accordance with ASME Code Appendix G and the guidance of NRC Branch Technical Position RSB 5-2. This calculation also demonstrates that the proposed LTOP setpoint conservatively ensures that the 10CFR50, Appendix G limits on the reactor pressure vessel will not be exceeded during any anticipated operational occurrences.

Additionally, a new enable temperature is calculated for this submittal, please describe why the limit curves are also not recalculated.

RESPONSE: The enable temperature for the Point Beach LTOP system was recalculated in our submittal because the methodology used to previously establish the enable temperature was not in accordance with current NRC guidance. The enable temperature, as established in the current Point Beach Technical Specifications, is defined as the minimum pressurization temperature for the inservice pressure test. In our September 19 submittal, the enable temperature is determined using the guidance of NRC Branch Technical Position RSB 5-2.

This calculation of the enable temperature is not related to a change in the level of reactor vessel embrittlement from that used in determining the temperature versus pressure limit curves presently contained in the Point Beach Technical Specifications. The proposed LTOP setpoint and limits are determined for the same reactor vessel fluence used to determine TS Figures 15.3.1-1 and 15.3.1-2, therefore, there is no need or basis to recalculate TS Figures 15.3.1-1 and 15.3.1-2.