50-237 DRESDEN 2 CEC

APPL FOR AMDT TO OL RE SINGLE LOOP OPERATION WITH THE RECIRCULATION LOOP SUCTION & DISCHARGE VALVES OPEN.

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ATTACHMENT A

DESCRIPTION AND SAFETY ANALYSIS OF PROPOSED CHANGES TO APPENDIX A, TECHNICAL SPECIFICATIONS OF FACILITY OPERATING LICENSES DPR-19, DPR-25, DPR-29 and DPR-30

I. DESCRIPTION OF CHANGES

An amendment to Dresden Units 2 and 3 and Quad Cities Units 1 and 2 Technical Specifications is being proposed to allow single loop operation (SLO) with the recirculation suction valve and the recirculation discharge valve open in the idle recirculation loop (unisolated). Other changes are also proposed to eliminate unnecessary requirements and provide more consistency with the Standard Technical Specifications. A brief summary of these changes is provided below.

- During SLO, the Technical Specifications currently require the suction valve in the idle recirculation loop to be closed and electrically isolated except when the idle loop is being prepared for return to service. The proposed amendment eliminates this requirement.

- A new section requires an idle recirculation pump to be electrically prohibited from starting within 24 hours after initiation of SLO. Provisions for testing and restart of the pump or MG set are also included.

  A section will be added, limiting the temperature difference between the recirculation loop to be started and the reactor coolant when both loops are idle. This temperature differential is not to exceed 50°F. Similarly, when one pump is running, the temperature difference between the idle loop and the active loop must not exceed 50°F. The active loop pump speed must be less than 45% at Quad Cities and 43% at Dresden prior to starting the idle loop.

- A surveillance will be added requiring the temperature differentials and flow rates to be determined to be within the above limits within 15 minutes prior to startup of the idle recirculation loop.

- The proposed amendment also eliminates sections in the Dresden Technical Specifications which address surveillance requirements during SLO upon entrance into instability regions. These requirements were adopted prior to the LaSalle instability event. More conservative procedures (Reference(f)) are currently followed at Commonwealth Edison to meet the requirements of NRC Bulletin 88-07, Supplement 1 (Reference (e)).

- The Dresden Technical Specifications section which limited power operation to 25% of rated power while the unit operates without forced circulation will be deleted. A new section will require reduction to less than 25% power within 2 hours, and to place the unit in Hot Shutdown within 12 hours. This section will also be added to the Quad Cities Technical Specifications in place of a section which currently does not allow operation in natural circulation with the reactor mode switch in either the Startup or Run position.
- A section is removed for Dresden which did not allow operation with the Master Flow Control in Auto during SLO. This change is needed for consistency between Dresden, Quad Cities, and the Standard Technical Specifications.
- The Quad Cities Technical Specifications are changed so that actions required to support SLO will be initiated within 24 hours, instead of the current 12 hour requirement. This reflects the current Dresden and Vermont Yankee Technical Specifications.
- The Dresden and Quad Cities Specifications will be changed to require the active pump to be below 45% at Quad Cities and 43% at Dresden of rated speed respectively, prior to idle loop startup instead of requiring it to be below 65% (at Dresden only) of rated speed prior to startup.

II. BASES FOR ALLOWING UNISOLATED IDLE LOOP DURING SLO

During SLO, Section 3.6.H.3.e. of both the Dresden and Quad Cities Technical Specifications currently requires the closing and electrical isolation of the suction valve of the idle recirculation loop. This requirement is waived when the idle loop is being prepared for return to service. The purpose of this requirement was to prevent the partial loss of Low Pressure Coolant Injection (LPCI) flow through the recirculation pump and into the downcomer region during a Loss-of-Coolant Accident (LOCA). As shown in Figure 1, the LPCI system ties into the recirculation system downstream of the recirculation pump discharge valves. By closing either the recirculation loop suction or discharge valve, the core is reflooded using LCPI flow which is forced through the jet pumps into the lower plenum of the reactor and up through the core. Otherwise, a portion of the flow would be directed through the recirculation pump and into the downcomer region, bypassing the reactor core.

According to GE, closing the suction valve is a redundant action because LPCI is provided with a means by which it selects the intact recirculation loop and automatically closes that recirculation loop's discharge valve (Reference (i) - Attachment E). This ensures reflood capability by directing LPCI flow through the jet pumps and into the lower plenum (see Figure 2 for LPCI Loop Selection Logic Schematic). The LPCI loop select logic performs this function whether one or both recirculation pumps are running.

The impetus for eliminating this requirement is to increase plant reliability. Once a recirculation loop is isolated, flow stagnation causes the loop to cool down to ambient drywell temperature. Temperature differences between the two recirculation loops leads to differential expansion rates, and high stress conditions can occur. Currently, neither Dresden nor Quad Cities can operate in single loop due to the piping stresses produced when the idle loop cools down (the exception is Dresden Unit 3 Loop B, which can remain idle because a plant specific piping stress evaluation was performed, Reference (k)). Removing this requirement from the Technical Specifications would allow the plants to operate with a single loop because the natural circulation in the idle loop would keep its temperature near reactor operating temperatures, and thereby eliminate the differential growth rates and high stress conditions.

Both Siemens Nuclear Power (SNP) and General Electric (GE) have addressed the potential ECCS issues during SLO with the idle loop unisolated. These evaluations are summarized below.

<u>Siemens Nuclear Power -- Dresden</u>

In Reference (a), Siemens Nuclear Power (SNP) has reviewed the SLO LOCA analysis and has determined that leaving the suction valve open during SLO has no impact on the original SLO analysis (Reference (c)). The dominating concern with leaving the recirculation suction or discharge valves open is the partial loss of LPCI flow into the downcomer region. Since the single failure assumed in the SNP SLO LOCA analysis was the failure of the LPCI injection valve to open (LPCI flow is not credited), leaving the idle loop unisolated will have no effect on the SNP analysis.

Historically, SNP has demonstrated that the LPCI injection valve is the limiting single failure at Dresden. Both the LPCI injection valve failure and Diesel Generator (DG) failure have been considered during dual loop operation. SNP has also confirmed that the DG failure also remain non-limiting in SLO. Reference (a) provides a detailed description of the SNP SLO evaluation which is briefly summarized below.

The severity of any single failure scenario (LPCI injection valve failure or DG failure) is based, primarily, on the effectiveness of the available ECCS systems, and is independent of single loop or dual loop operation. For two loop operation, SNP has analytically demonstrated in Reference (h) that the LPCI injection valve failure is the conservative limiting single failure at Dresden. In addition, SNP has indicated that the LOCA blowdown characteristics do not differ significantly between single and dual loop operation. Therefore, within a given operational mode (single or dual loop operation) the relative severity between DG failure and LPCI inject valve failure remains the same. For these reasons, the LPCI injection valve failure, which has been shown to be limiting in dual loop operation, remains limiting in SLO.

SLO LOCA evaluations conservatively assume the limiting break occurs in the running recirculation loop. Under this assumption, no pump coastdown flow is credited. In dual loop operation, the coastdown flow is beneficial because it contributes additional core flow early in the blowdown, lowering PCT's. For this reason, SLO operation is more limiting than dual loop operation. In order to demonstrate compliance to 10 CFR 50.46 requirements, SNP has provided a reduced MAPLHGR multiplier while in SLO. These MAPLHGR multipliers are not affected by the proposed changes because they have been explicity generated under SLO conditions assuming a LPCI injection valve failure.

Note that GE analyses for similar BWRs such as the Quad Cities units also show SLO to be more limiting (Reference (d)); however, MAPLHGR multipliers are not required because SAFER/GESTR methods use an approved best estimate approach and demonstrate sufficient margin to 10 CFR 50.46 requirements. The Reference (d) analysis does not assume the idle loop has been isolated prior to the LOCA event.

General Electric - Quad Cities

General Electric (GE) has also performed an evaluation of SLO with the idle loop unisolated for Dresden Units 2 and 3 and Quad Cities Units 1 and 2 (Reference (i) - Attachment E). The GE analysis concluded that SLO with the idle recirculation loop not isolated is acceptable and consistent with the original safety analysis assumptions for SLO (Reference (b)). GE's conclusion was based upon the following: 1) the recirculation discharge valve remains operable; 2) the logic that automatically closes the recirculation discharge valve upon the occurrence of a LOCA signal remains operable. Provided these considerations are met, there is no need to close and disarm the recirculation suction valve. Current GE LOCA evaluations are performed using the code package SAFER/GESTR and are consistent with these assumptions.

General Requirements

The suction valve must be closed during SLO if a significant leak in the pump seal or other malfunction develops which requires isolating the recirculation pump. The suction valve must also be closed if the discharge valve or its automatic closure logic is inoperable. This action will mitigate the loss of LPCI inventory through the recirculation pump into the downcomer region, degrading LPCI performance. This is because the LPCI discharge is upstream of the recirculation suction valve. Administrative controls will be applied at both Dresden and Quad Cities to ensure the suction valve is closed or the reactor is shut down if one or more of these conditions exists.

III. INADVERTENT STARTUP OF IDLE LOOP

Leaving the recirculation suction and discharge valves open during SLO introduces potential concerns regarding the consequence of the inadvertent startup of the idle recirculation loop. This event is very unlikely, since it would presently require two failures, an operator error and an equipment malfunction. Also, the consequences of an inadvertent startup of an isolated loop are minimized because the idle loop will be kept warm. This warmer water would cause less reactivity insertion, should the transient occur.

Presently, system interlocks prevent the recirculation pump from starting with the discharge valve open. Since the loop would be left unisolated, the pump is unable to start unless the discharge valve is first closed. Station procedures also require the discharge valve to be closed prior to starting the recirculation pump.

However, to minimize the potential for this transient, Section 3.6.H.3.e will be added to the Dresden and Quad Cities Technical Specifications. This section requires the idle recirculation pump to be electrically prohibited from starting within 24 hours of initiation of SLO. This requirement is waived when the pump is being prepared for restart. Methods for electrically prohibiting the pump from starting will be administratively controlled at each station. This section provides a third safeguard against the inadvertent startup of the idle loop. First, procedures require the discharge valve to be closed prior to starting the idle recirculation pump. Second, the system interlock prevents the pump from starting unless the discharge valve is closed. Third, the pump will be electrically prohibited from starting. The addition of this section is prudent since it eliminates the possibility of an unanalyzed pump startup event caused by an operator error combined with an equipment failure.

IV. COOL-DOWN OF IDLE LOOP

The primary benefit that would be gained by the proposed Technical Specification change would be an increase in plant reliability. When a recirculation pump is not operating and the loop is isolated, the loop will cool down to ambient drywell temperatures. Differential expansion may cause large stresses to develop at the structural interfaces between the idle loop and other support structures and the reactor vessel. Currently, only Dresden Unit 3, Loop B has the appropriate piping stress analyses to support operation in SLO (Reference (k)). None of the other loops at the Dresden and Quad Cities units have the necessary stress analyses in place to support an idle loop cooldown.

Prior to startup of the idle recirculation pump, the temperature difference between the idle loop and the reactor coolant must not exceed 50°F (Section 3.6.H.5.a). Also, prior to startup of the idle loop, the temperature difference between the two loops must not exceed 50°F and the active loop must be operating at less than 45% at Quad Cities and 43% at Dresden rated pump speed (Section 3.6.H.5.b). This must be verified within 15 minutes prior to startup of the idle loop (Section 4.6.H.5).

V. BASES FOR REMOVING STABILITY MONITORING DURING SLO (DRESDEN ONLY)

The Dresden Technical Specifications currently require stability monitoring during SLO when operating at low flow, high power conditions. CECo has issued instructions outlined in Reference (f) that are more conservative than the NRC Bulletin 88-07, Supplement 1, recommendations (Reference (e)). Presently, if either of Regions A, B, or C in Reference (e) are entered, the procedures in place at Dresden Units 2 and 3 require the unit operator exit the region immediately. CECo's procedures do not allow operation in the stability regions listed in the current Technical Specifications. Therefore, Sections 3.6.H.3.b-c and 4.6.H.3 in the Dresden Technical Specifications are outdated and unnecessary given the current procedures used to implement the NRC requirements.

VI. BASIS FOR CHANGING OR REMOVING ADDITIONAL SECTIONS

The current Dresden Technical Specifications allow operation in natural circulation below 25% power. The new requirement would be to reduce power to less than 25% within 2 hours, and place the unit in Hot Shutdown within 12 hours if both recirculation pumps trip. This change is prudent in light of recent stability concerns. This requirement is also added to the Quad Cities Technical Specifications, but only represents a clarification of the current Technical Specifications which allow natural circulation when the mode switch is not in startup or run.

Section 3.6.H.3.a is removed from the Dresden Technical Specification as part of an effort to mirror the Standard Technical Specifications. However, operation in SLO above 65% core flow is difficult to achieve because of jet pump vibration concerns. Below 65% core flow, EGC is not allowed according to Section 3.3.G in the Dresden Technical Specifications (recirculation auto flow control is required for EGC operation). For these reasons, operation in the auto flow control mode at Dresden while in SLO will not be allowed.

Section 3.6.H.3.d for Dresden is included in Section 3.6.H.5.b (new), except, the active loop is now required to be at less than 43% rated pump speed prior to startup of the idle loop instead of the previous requirement of 65% rated pump speed. This requirement in the active loop is intended to reduce flow induced jet pump vibrations when starting an idle loop. Since the proposed change reduces the pump speed requirement, the change is conservative.

The requirement for initiation of SLO restrictions will be changed for Quad Cities from within 12 hours to within 24 hours (Section 3.6.H.3). This does not represent a significant change, and will allow sufficient time to implement all of the requirements. The Dresden requirement is currently 24 hours, so the time limit will remain the same, and the section change is merely administrative in nature (Section 3.6.H.3.f).

CONCLUSION

These proposed changes will enhance plant reliability and availability by allowing operation in single loop. SLO has been administratively precluded by the potential for thermally induced stresses to develop at the interfaces between the idle loop and other structural components when the idle loop is isolated as currently required by the Technical Specifications.

Single-loop operation at Dresden Units 2 and 3 and Quad Cities Units 1 and 2 with the idle recirculation loop not isolated is acceptable and consistent with ECCS analysis assumptions. This conclusion is contingent upon the following: 1) the recirculation discharge valve remains operable; 2) the logic that automatically closes the recirculation discharge valve upon a LOCA signal remains operable. Therefore, leaving the idle loop unisolated is recommended for SLO provided there is no significant leak in the pump seal or other malfunction which requires the loop to be isolated or renders the discharge valve inoperable.

The potential for inadvertent startup of an idle recirculation loop has been minimized while the loop is unisolated, because the discharge valve must be closed for the pump to start both by procedure and system interlock. In addition, the pump will be electrically prohibited from starting through the addition of Section 3.6.H.3.e to the Dresden and Quad Cities Technical Specifications.

Removing Sections 3.6.H.b-c and 4.6.H.3 will not adversly affect Dresden Units 2 and 3 since more conservative procedures are currently being followed consistent with NRC Bulletin 88-07, Supplement 1 requirements.

Section 3.6.H.4 of the Dresden Technical Specifications, and Section 2.1.A.4 of the Quad Cities Technical Specifications will be changed for operation without forced recirculation.

Additional sections are removed or changed, because they are not supported by the Standard Technical Specifications in their current forms. They do not represent significant changes to either the Dresden or Quad Cities Technical Specifications.

REFERENCES

(a) U. Fresk letter to R.J. Chin, "Support for Allowing Idle Recirculation Loop Valves to Remain Open During Single Loop Operation for the Dresden Reactors," April 1992.

(b) General Electric Document NEDO-24807, "Dresden Nuclear Power Station Units 2 & 3, Quad Cities Power Station Units 1 & 2, Single Loop Operation," December 1980.

(c) Advanced Nuclear Fuels Document ANF-87-111, "LOCA-ECCS Analysis for Dresden Units During Single Loop Operation with ANF Fuel," September 1987.

(d) General Electric Document NEDO-31345P, Revision 2, "Quad Cities Nuclear Power Station Units 1 & 2, SAFER/GESTR-LOCA, Loss-of-Coolant Accident Analysis," July 1989.

(e) NRC Bulletin No. 88-07, Supplement 1, "Power Oscillations in Boiling Water Reactors," December 1988.

(f) M.H. Richter letter to U.S. Nuclear Regulatory Commission, "Commonwealth Edison Response for Dresden, Quad Cities, and LaSalle Stations to NRC Bulletin 88-07, Supplement 1," March 1989.

(g) General Electric Document NEDE-24011-P-A-10, Section 4.3.1.2.8, "General Electric Standard Application for Reactor Fuel," February 1991.

(h) Advanced Nuclear Fuels Document ANF-88-191, "Dresden Units 2 and 3 LOCA-ECCS Analysis MAPLHGR Results for ANF 9x9 Fuel," December 1988.

(i) M.A. Wrightsman letter to R.H. Mirochna, "Report Justifying Dresden 2 & 3 and Quad Cities 1 & 2 SLO with Inactive Recirculation Loop Not Isolated," March 26, 1990.

(j) Advanced Nuclear Fuels Document XN-NF-79-71(P) Revision 2, "Exxon Nuclear Plant Transient Methodology for Boiling Water Reactors," November 1981.

(k) J.L. Smetters letter to J.S. Abel, "Dresden Station - Unit 3 P.O. 327122, NU-124 Design Basis Analysis Update for a New Recirculation System Thermal Operating Mode - Loop B Evaluation Results," April 5, 1990.

FIGURE 1: RECIRCULATION SYSTEM

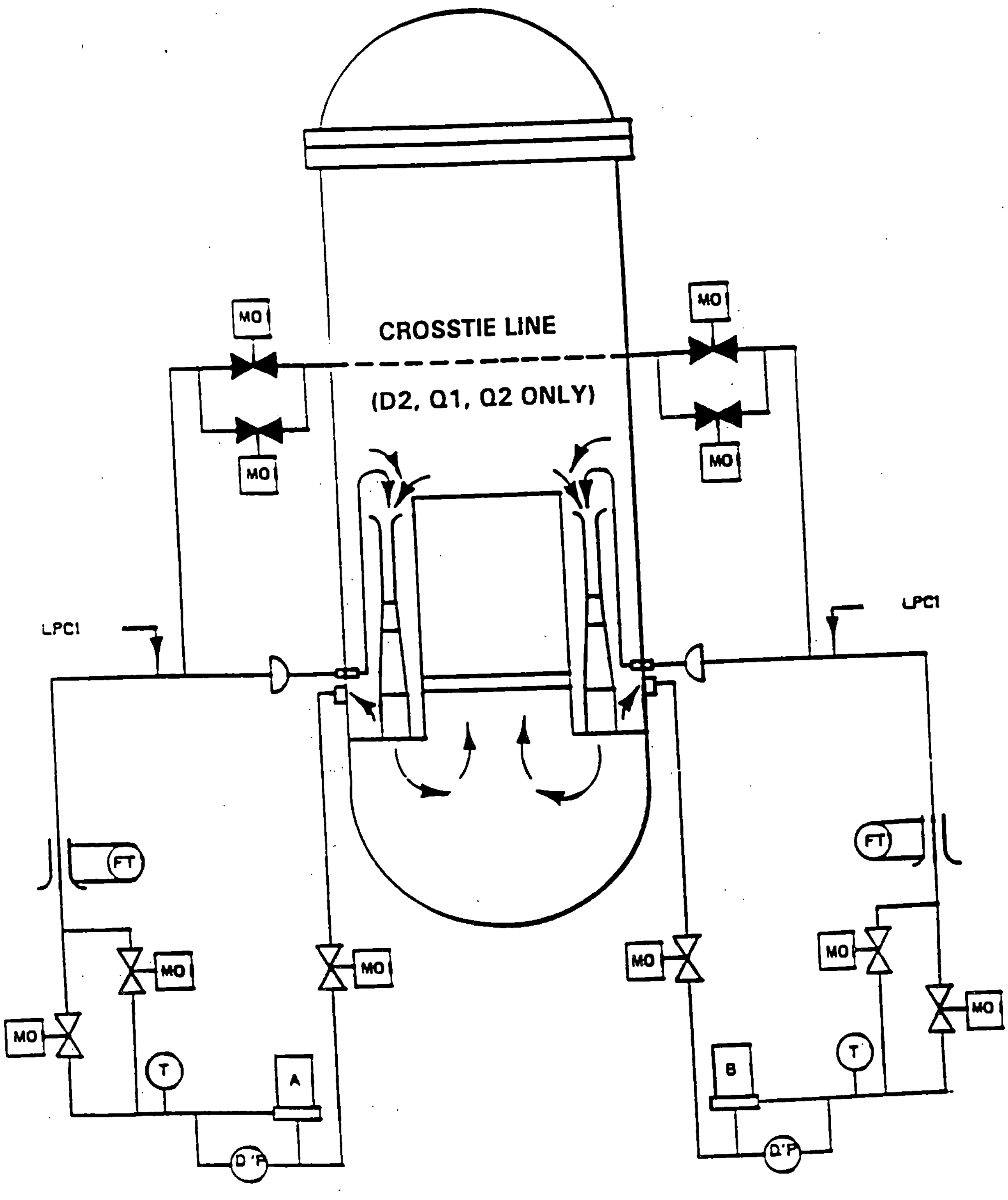
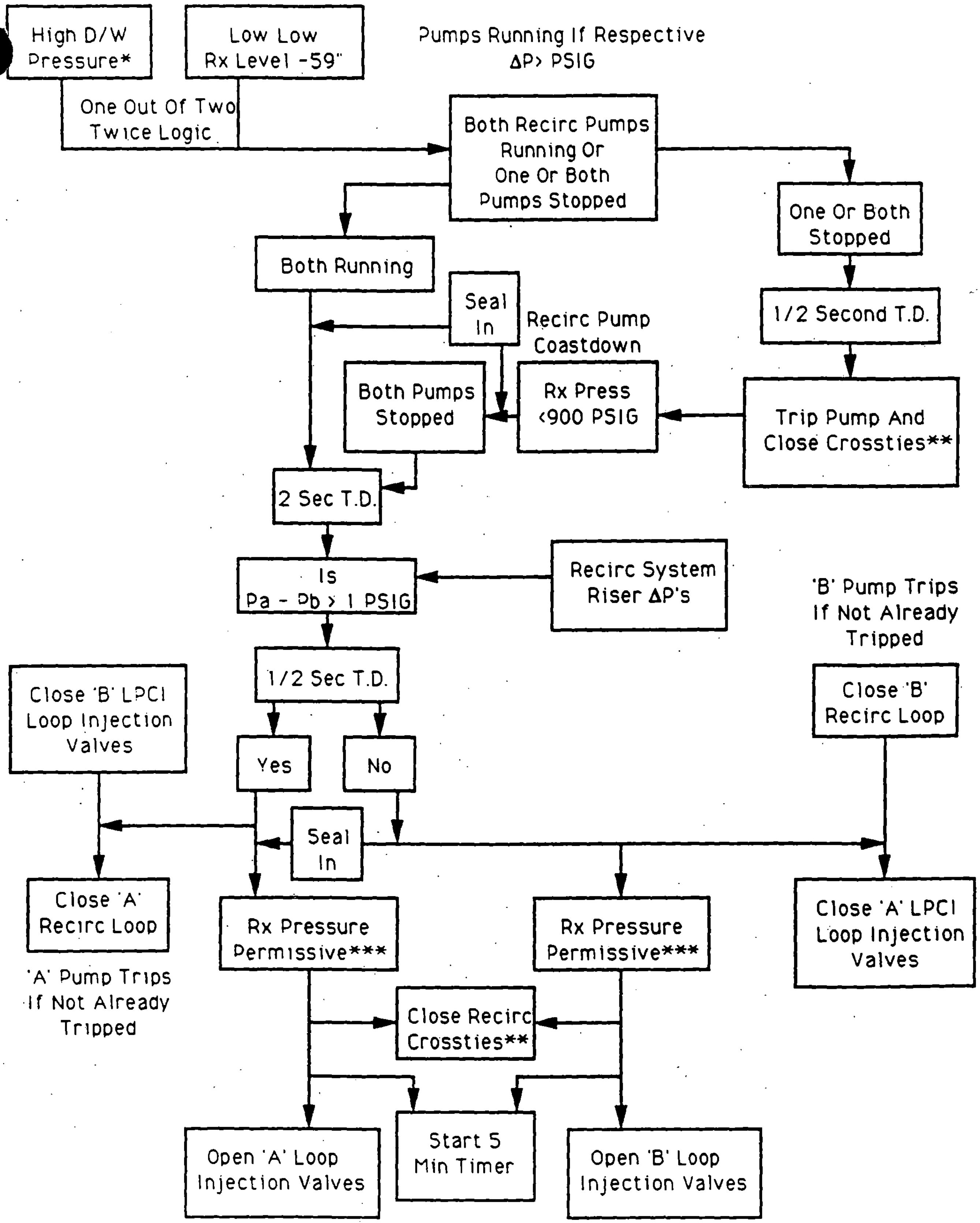


FIGURE 2: LOOP SELECT LOGIC



* For Dresden, D/W Pressure 2.0 PSIG; For Quad Cities, D/W Pressure 2.5 PSIG

** Crosstie valves always remain closed during operation, except at Dresden Unit 3 where the crosstie line has been removed.

*** For Dresden, Rx Pressure <350 PSIG; For Quad Cities, Rx Pressure <325 PSIG