

ENCLOSURE

SAFETY EVALUATION REPORT N=1 LOOP OPERATION
LASALLE COUNTY STATION (LSCS) UNIT 1

1.0 INTRODUCTION

The current LSCS Technical Specifications do not allow plant operation beyond 12 hours if an idle recirculation loop can not be returned to service. The ability to operate at reduced power with a single loop is highly desirable from an availability outage planning standpoint in the event that maintenance or component unavailability rendered one loop inoperable.

By letter dated December 6, 1982 Commonwealth Edison (CEC) (the licensee) requested changes to the Technical Specification for Single Loop Operation of LSCS Unit 1. The requested changes would permit LSCS to operate at up to 50% of rated power with one recirculation loop out of service for unlimited time. While analyses indicate that it may be safe to operate BWRs on a single loop in the range higher than 50% of rated power, the experience (reference letter from L. M. Mills, TVA dated March 17, 1980 to H. Denton, NRC) at Browns Ferry Unit 1 has caused concern about flow and power oscillations. However, because single loop operation at 50% rated power at several plants, including Browns Ferry Unit 1, has shown acceptable flow and power characteristics, we will permit LaSalle to operate at power levels up to 50% of rated with one loop out of service during its initial fuel cycle. We will request from the licensee any additional information required for permanent approval for single loop operation.

If requested, we will also consider operation at a higher power level for LaSalle with one recirculation loop out of service after staff concerns stemming from Browns Ferry Unit 1 single loop operation are satisfied.

2 EVALUATION

2.1 Accidents (Other than Loss of Coolant Accident (LOCA) and Transients Affected by One Recirculation Loop Out of Service

2.1.1 One Pump Seizure Accidents

The licensee states that the one-pump seizure accident is a relatively mild event during two recirculation pump operation. Analyses were performed to determine the impact this accident would have on one recirculation pump operation. These analyses were performed using NRC approved models. The analyses were conservatively conducted from a steady-state operating condition of 78% rated thermal power and 63% core flow. Pump seizure was simulated by setting the single operating pump speed to zero instantaneously.

Results of the analyses indicate that neither pressure nor cladding thermal limits are exceeded during the event. Peak vessel pressure is calculated to be 1031 psig (ASME code limit is 1375 psig) and MCPR is 1.17 (safety limit is 1.06).

2.1.2 Abnormal Operational Transients

The licensee discussed the effects of single loop operation on the course of abnormal operational transients. Pressurization and cold water increase events, as well as rod withdrawal error were addressed.

Flow decrease is covered by the pump seizure accident already described. The results of calculations for the limiting event for each category were also presented. Initial operating conditions were conservatively assumed to be 78% NBR power and 63% core flow.

2.1.2.1 a) Pressurization Events

The limiting pressurization event is the generator load rejection without bypass transient. For single loop operation, the licensee has calculated that the maximum vessel pressure is 1128 psig and the MCPR is 1.29. Each of the values satisfies its respective safety limit.

b) Cold Water Increase

The limiting cold water increase event is the feedwater controller failure to maximum demand transient. The reactor is conservatively assumed to be in single loop operation at 78% NBR power and 63% core flow when failure of the feedwater control system instantaneously increases the feedwater flow to the runout capacity of 160% of rated. The peak pressure is calculated to be 1126 psig and the MCPR is 1.26, each satisfying its respective safety limit.

c) Rod Withdrawal Error

The rod withdrawal error at rated power is given in the FSAP for the initial core and in cycle dependent reload supplemental submittals. These analyses are performed to demonstrate that, even if the operator ignores all instrument indications and the alarms which could occur during the course of the transient, the rod block system will stop rod

withdrawal at a minimum critical power ratio which is higher than the fuel cladding integrity safety limit. Correction of the rod block equation and lower initial power for single-loop operation assures that the MCPR safety limit is not violated.

One-pump operation results in backflow through 10 of the 20 jet pumps while flow is being supplied to the lower plenum from the active jet pumps. Because of this backflow through the inactive jet pumps, present rod-block equation and APRM settings must be modified. The licensee has modified the two-pump rod block equation and APRM settings that exist in the Technical Specification for one-pump operation and the staff has found them acceptable.

The staff finds that one loop transients and accidents other than LOCA, which is discussed below, are bounded by the two loop operation analyses and are therefore acceptable.

2.1.3 MCPR Uncertainties

For single-loop operation, the rated condition steady-state MCPR limit is increased by 0.01 to account for increased uncertainties in the core total flow and Traversing In-core Probe (TIP) readings. The MCPR will vary depending on flow conditions. This leads to the possibility of a large inadvertent flow increase which would cause the MCPR to decrease below the Safety Limit for a low initial MCPR at reduced flow conditions. Therefore, the required MCPR must be increased at reduced core flow by a flow factor K_f . The K_f factors for two loop operation are derived

assuming both recirculation loop controllers fail. This condition maximizes the power increase and hence maximum Δ MCPR for transients initiated from less than rated conditions. When operating on one loop, the flow and power increase will be less than that associated with two loops at full flow. The K_f factors derived from the two-loop assumptions are therefore conservative for single loop operation.

2.2 Loss of Coolant Accident (LOCA)

The licensee has performed analyses of a spectrum of recirculation suction line breaks under single loop operation conditions. The licensee states that evaluation of these calculations which are performed according to the procedure outlined in NEDO-20556-2, Rev.1, indicates that a multiplier of 0.87 should be applied to the MAPLHGR limits for single loop operation of LaSalle. Other plants using 8x8R fuel have been required to use a reduction factor of 0.85. We require that LaSalle likewise reduce its MAPLHGR by 0.85.

3. Thermal Hydraulics

The licensee has confirmed that analysis uncertainties are independent of whether flow is provided by two loops or a single loop. The only exceptions to this are core total flow and TIP reading. The effect of these uncertainties is an increase in the MCPR by .01, which is more than offset by the K_f factor required at low flows. The steady state operating MCPR with single-loop operation will be conservatively established by multiplying the rated flow MCPR limit by the K_f factor.

4. Stability Analysis

As indicated in the applicant's submittal, operating along the minimum forced recirculation line with one pump running at minimum speed is more stable than operating with both pumps operating at minimum speed.

The licensee will be required to operate in master manual to reduce the effects of instabilities due to controller feedback. The staff has accepted previous stability analyses results as evidence that the core can be operated safely while our generic evaluation of BWR stability characteristics and analysis methods continues. The previous stability analysis results include natural circulation conditions and thus bound the single loop operation. In addition, the decay ratio (0.50) predicted for initial cycle for Unit 1 shows margin relative to Browns Ferry #1 (.83) which had the flow noise oscillations during SLO. We conclude that with appropriate limitations to recognize and avoid operating instabilities, that the reactor can be operated safely in the single loop mode. Our evaluation of the flow/power oscillations evidenced in Browns Ferry will continue and any pertinent conclusions resulting from this study will be applied to LaSalle.

5. Summary on Single Loop Operation

1. Steady State Thermal Power Level will not exceed 50%

Operating at 50% power with appropriate TS changes has been approved on a cycle basis for several operating plants. It is concluded for LaSalle for operation at 50% power consistent with the provisions of item 8 below, that transient and accident bounds will not be exceeded.

2. Minimum Critical Power Ratio (MCPR) Safety Limit will be

Increased by 0.01 to 1.07

The MCPR Safety Limit will be increased by 0.01 to account for increased uncertainties in (TIP) readings. The licensee has determined that the change conservatively bounds the uncertainties introduced by single loop operation.

3. Minimum Critical Power Ratio (MCPR) Limiting Condition for Operation (LCO) will be Increased by 0.01

The staff requires that the operating limit MCPR be increased by 0.01 and multiplied by the appropriate two loop K_f factors that are in the LaSalle TS. This will preclude an inadvertent flow increase from causing the MCPR to drop below the safety limit MCPR.

4. The Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) Limits will be Reduced by Appropriate Multipliers

The licensee proposed reducing the TS MAPLHGR by 0.87 for Single Loop Operation. These reductions were based on an analysis method proposed by General Electric in NEDE-20566-2. We require a reduction factor of 0.85 consistent with previous SLO approvals for plants with 8x8R fuel.

5. The APRM Scram and Rod Block Setpoints will be Reduced

The licensee proposed to modify the two loop APRM Scram, Rod Block and Rod Block Monitor (RBM) setpoints to account for back flow through half the jet pumps. These setpoints equations will be changed in the LaSalle TS. The changes are similar to other plant TS changes and are acceptable to the staff.

6. The Recirculation Control will be in Manual Control

The staff requires that the licensee operate the recirculation system in the manual mode to eliminate the need for control system analyses and to reduce the effects of potential flow instabilities.

7. Surveillance Requirements

The staff requires that the licensee perform daily surveillance on the jet pumps to ensure that the pressure drop for one jet pump in a loop does not vary from the mean of all jet pumps in that loop by more than 5%.

8. Provisions to Allow Operation with One Recirculation Loop Out of Service

1. The steady-state thermal power level will not exceed 50% of rated
2. The Minimum Critical Power Ratio (MCPR) Safety Limit will be increased by .01 to 1.07.
3. The MCPR Limiting Condition for Operation (LCO) will be increased by 0.01
4. The Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) Limit will be reduced by 0.85.
5. T.S. 2.2.1 $S \leq 0.66W + 45.7$ (Trip Setpoint)
 $S \leq 0.66W + 48.7$ (Allowable)
- T.S. 3.2.2 $S \leq (0.66W + 45.7)T^*$
 $S_{RB} \leq (0.66W + 36.7)T^*$
- T.S. 3.3.6 APRM Upscale $\leq 0.66W + 36.7$ (Trip Setpoint)

$$\begin{aligned} & \leq 0.66W + 39.7 \text{ (Allowable)} \\ \text{RBM Upscale} & \leq 0.66W + 34.7 \text{ (Trip Setpoint)} \\ & \leq 0.66W + 37.7 \text{ (Allowable)} \end{aligned}$$

T* as defined in T.S. 3.2.2.

6. APRM flux noise will be measured once per shift and the recirculation pump speed will be reduced if the flux noise exceeds 1 psi peak to peak.
7. The core plate delta noise be measured once per shift and the recirculation pump speed will be reduced if the noise exceeds 1 psi peak to peak.

Conclusions

Based upon the above evaluation and a history of successful operation of other BWRs we conclude that single-loop operation of LaSalle up to a power level of 50% and in accordance with the proposed TSs, will not exceed the accident and transient bounds previously found acceptable by the NRC staff and is therefore acceptable.

The approval for single loop operation up to a power level of 50% is authorized during cycle 1.

We have concluded, based on the consideration discussed above, that: (1) because the amendment does not involve a significant increase in the probability or consequences of accidents previously considered or create the possibility of an accident of a type different from any evaluated

previously, and does not involve a significant decrease in a safety margin, the amendment does not involve a significant hazards consideration, (2) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (3) such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.