SUPPLEMENT 1 FOR MONTICELLO RELOAD 6
SIMMER MARGIN EVALUATION

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1. INTRODUCTION AND SUMMARY

One event that has a significant impact on boiling water reactor (BWR) availability is the spurious opening or failure to reclose of the dual function safety/relief valves. As described in Reference 1, the event from a safety standpoint has a relatively minor effect on the reactor core and reactor coolant pressure boundary. The event does result in a significant maintenance outage since the reactor must be shutdown, depressurized, and the valve repaired or replaced before the plant can be restarted and continue with power operation.

The cause of the majority of these spurious openings or failures to reclose of safety/relief valves is excessive leakage around the setpoint pilot valve. Other causes of valve failures have been identified and corrective action has been taken. Operating data demonstrate that an increase in valve simmer margin (the differential pressure between the valve setpoint and normal system operating pressure at the valve) will reduce the probability of valve failure due to pilot leakage. A study was performed for Reload 6 of Monticello Nuclear Generating Plant, to determine if the simmer margin of the safety/relief valve could be increased without imposing additional restrictions on plant operation.

This supplement provides the results of these evaluations. As demonstrated in Section 2, the operating limits derived in NEDO-24133 are still valid for a 28 psi increase in safety/relief valve setpoint. Therefore, additional safety/relief valve reliability can be obtained for the next operating cycle without the imposition of any new limits on the plant.

2. SAFETY ANALYSIS

2.1 Introduction

The safety analysis for Reload 6 is provided in NEDO-24133. The raising of the safety/relief valve setpoints only affects those events which result in valve

operation to limit system pressure. The limiting events which require reanalysis are the most severe pressurization transient (turbine trip with failure of the bypass valve), vessel overpressure protection analysis (closure of all main steamline isolation valve - flux scram) and loss-of-coolant accident (small break). In addition, the capability of the reactor core isolation cooling (RCIC) and high pressure coolant injection (HPCI) systems were re-evaluated for the higher safety/relief valve setpoints. The results of the analysis which demonstrate the acceptability of the increased simmer margin are given below.

All analyses were performed using the same input parameters as used in NEDO-24133 with the exception of safety/relief valve setpoint and capacity. The nominal safety/relief valve setpoint assumed was 1108 psig +1% using seven safety/relief valves. The capacity of the safety/relief valves at their setpoint was 83.2% of rated steam flow. The increase in safety/relief valve capacity is due to the increase in mass flow rate as a result of the higher pressure at the valve setpoint, and seven safety/relief valves are used instead of six.

2.2 Turbine trip With Failure of the Bypass Valves

This transient produces the most severe reactor isolation. The primary characteristic of this transient is a pressure increase due to the obstruction of steam flow by the turbine stop valves. The pressure increase causes a significant void reduction, which yields a pronounced positive void reactivity effect. The net reactivity is sharply positive and causes a rapid increase in neutron flux until the net reactivity is forced negative by a scram initiated from position switches on the turbine stop valves and by a void increase after the safety/relief valves have automatically opened on high pressure. The results of these analyses are given in Table 1 and shown in Figure 1.

The change in critical power ratio caused by the change in setpoint is insignificant (0.002 ΔCPR). However, this change was enough to affect the roundoff of the third significant figure, so that the ΔCPR for turbine trip without bypass with increased simmer margin is 0.26. Therefore, the MCPR Operating Limit with increased simmer margin is 1.33 for both 8x8 and 8x8R fuel.

2.3 Vessel Overpressure Protection Analysis

The pressure relief system must prevent excessive overpressurization of the primary system process barrier and the pressure vessel to preclude an uncontrolled release of fission products.

The Monticello pressure relief system includes eight dual function safety/relief valves located on the main steamlines within the drywell between the reactor vessel and the first isolation valve. These valves provide the capacity to limit nuclear system overpressurization (analysis assumes 7 S/RV's).

The ASME Boiler and Pressure Vessel Code requires that each vessel designed to meet Section III be protected from the consequences of pressure in excess of the vessel design pressure:

(a) A peak allowable pressure of 110% of the vessel design pressure is allowed (1375 psig for a vessel with a design pressure of 1250 psig).

(b) The lowest qualified safety/relief valve setpoint must be at or below vessel design pressure.

(c) The highest safety/relief valve setpoint must not be greater than 105% of vessel design pressure (1313 psig for a 1250 psig vessel).

Monticello's safety/relief valves will be set to self-actuate at a nominal setpoint of 1108 psig, thereby satisfying (b) and (c) above. Requirement (a) is evaluated by considering the most severe isolation event with indirect scram. The code does not require failure of reactor protective systems; however, General Electric provides a conservative analysis for licensing purposes which take credit only for reactor protective signals which are indirectly derived.

The event which satisfies this specification is the closure of all main steamline isolation valves with indirect (flux) scram. The initial conditions assumed are those specified in Section 6 of NEDO-24133. Figure 2 graphically illustrates the event. An abrupt pressure and power rise occurs as soon as the reactor is isolated. Neutron flux reaches scram level at about 1.7 seconds, initiating

reactor shutdown. The safety/relief valves open to limit the pressure rise to 1248 psig at the bottom of the vessel. This response provides a 127 psi margin to the vessel code limit of 1375 psig. Thus, requirement (a) is satisfied and adequate overpressure protection is provided by the pressure relief system.

2.4 Loss-of-Coolant Accident Analysis

Analysis of the design basis loss-of-coolant accident demonstrates that the pressure decays during the event, and the change in safety/relief valve setpoints will have no effect on the results. However, for small breaks, the reactor will remain pressurized until the initiation of the automatic depressurization system (assuming the single failure of the HPCI). The change in safety/relief valve setpoint will result in a slight increase in inventory loss of the break during this period.

ECCS analysis predicts a PCT of approximately 1760°F, which is 40°F higher than that for the case of the old SRV setpoint, for the most limiting small recirculation line break of 0.07 ft^2. This small increase in PCT is due primarily to the fact that the higher SRV setpoint results in higher vessel pressure which increases inventory loss and delays ECC systems initiation slightly.

2.5 HPCI and RCIC Capability

One of the design requirements for the HPCI and RCIC systems is that they be capable of providing design flow at the lowest safety/relief valve setpoint. These systems still meet the design requirement with the increase in lowest safety/relief valve setpoint to 1108 psig, the nominal setpoint.

Table 1

EVENT DATA SUMMARY (EOC7)

Event	Power (%)	Core Flow (%)	Peak Neutron Flux (% of Ref)	Peak Surface Heat Flux (% of Ref)	Peak Steamline Pressure (psig)	Peak Vessel Pressure (psig)
Turbine Trip w/o Bypass - Trip Scram	100	100	312	115	1168	1207
MSIV Closure, Flux Scram	100	100	602	127	1199	1248

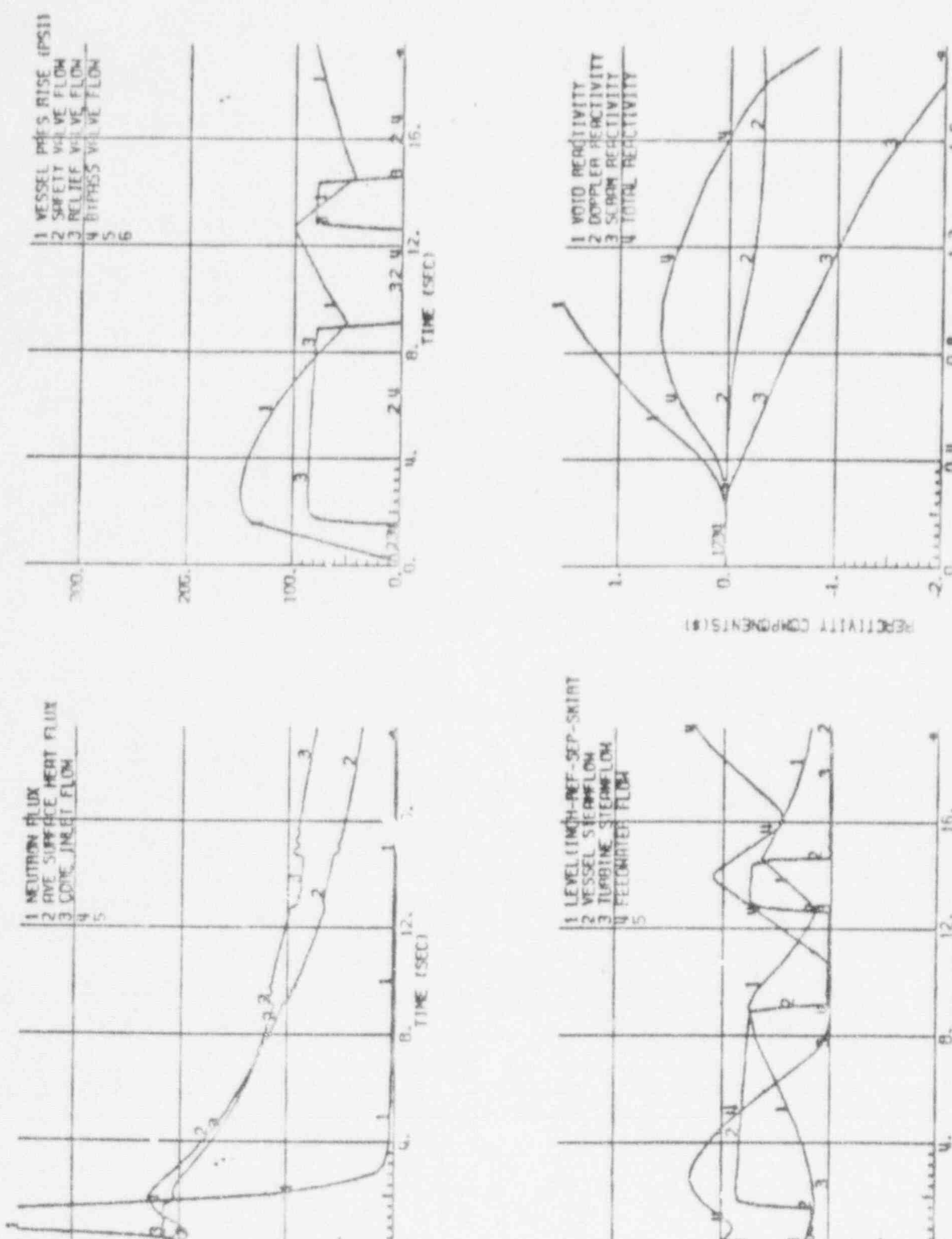

Figure 1. Monticello EOC7 Turbine Trip Without Bypass, Trip Scram, 100.0% Power

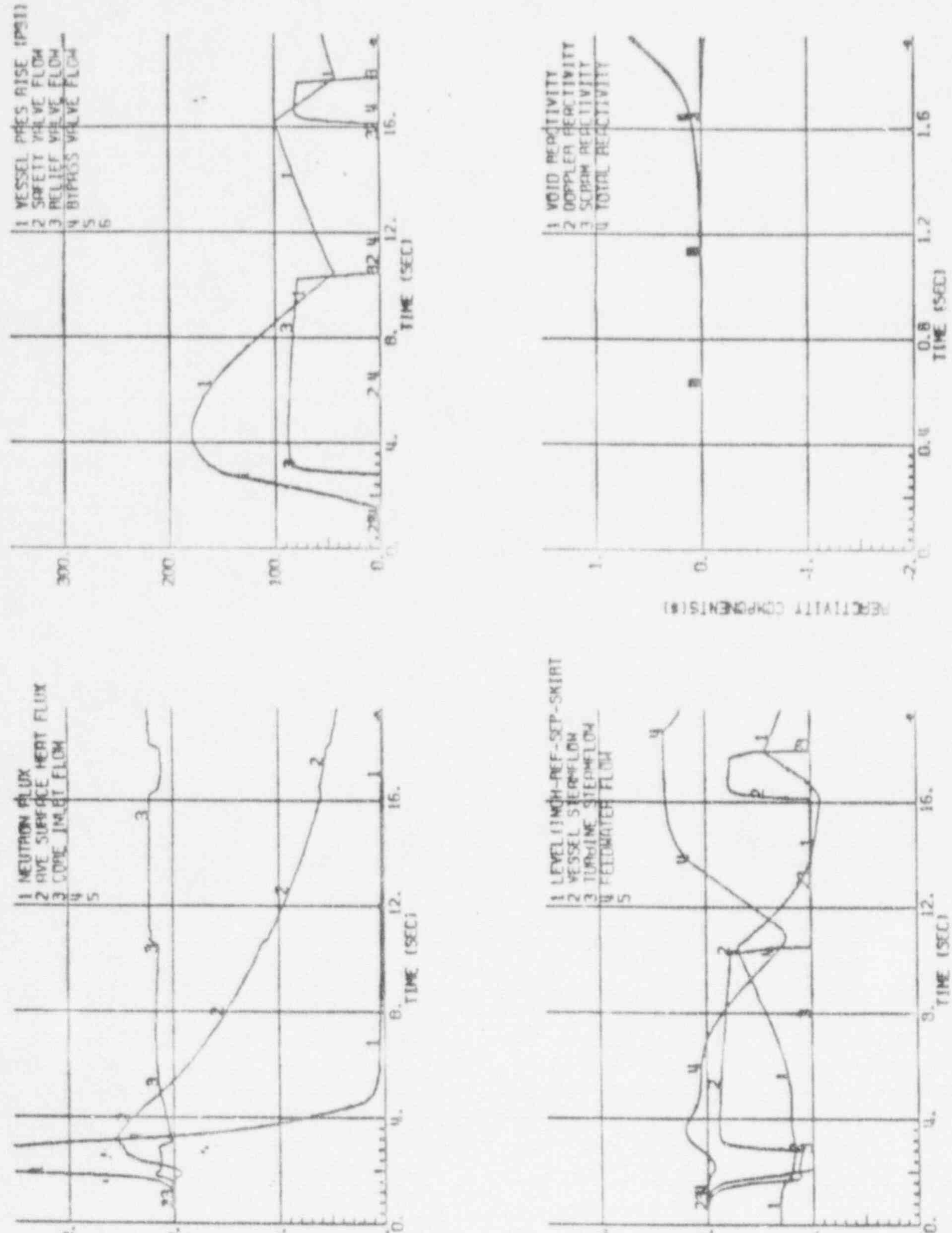

Figure 2. Monticello EOC7 MSIV Closure, Flux Scram

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