SAFETY EVALUATION REPORT FOR D. C. COOK, UNIT 2

ON REDUCTION OF POWER AND TEMPERATURE

The Indiana and Michigan Electric Company which is the licensee for the D.C. Cook Nuclear Plant plans to operate Unit 2 at 80% power with a reactor system temperature that is reduced 13°F below the normal operating value for 80% power. This mode of operation is designed to reduce wear to the steam generator tubes. Even though no technical specification changes are required, the licensee has provided the staff with a safety analysis report for the proposed operation for consideration and concurrence.

The effect of lowering either power or reactor coolant temperature is to increase thermal margins. The combined effect of operating at reduced power and reduced temperature is to increase the margin to the DNBR limit by 37% and to reduce the peak fuel centerline temperature by about 600°F. The licensee will implement administrative controls to ensure that increased margins are maintained during anticipated transients or in the event of a design basis accident. This will be accomplished by the following:

1. Reducing the power range neutron flux trip from 109% of rated power to 109% of 80% power.

2. Reducing the maximum local peaking factor at 80% power to the allowable value for 100% power operation.

3. Reducing the differential temperature and average temperature inputs to the overtemperature $\Delta T$ and overpower $\Delta T$ trips corresponding to 80% power and the reduced T average.

The licensee evaluated the effect on the consequences of the FSAR transients and accidents with the revised setpoints and determined that acceptable margins would be maintained.

The staff recently approved cycle 6 operation of D.C. Cook Unit 2 for 100% power with EXXON fuel based on transient and accident analysis described in Topical Report XN-NF-85-64(P) Revision 1.* These analyses assumed that the reactor was operating up to the licensed full power level. The licensee evaluated the effect of reduced power and temperature on the calculated consequences for each of these events to ensure that the analyzed safety limits will not be exceeded during the proposed operations. Only the consequences of events at power would be affected. The initial condition inputs for events at low power and at shutdown would remain unchanged.

For overcooling transients while at power, the reactor is protected from minimum DNBR by the overtemperature and high power trips. Since the setpoints will be reduced for these trips, the core will be adequately protected. Overcooling transients include increases in steam or feedwater flow which increase steam generator heat removal.

Events leading to reactor system undercooling and heatup will also be less severe at the reduced power level. Undercooling events include turbine trip, loss of normal feedwater and feedwater line break accidents. The principal concern evaluated was reactor system overpressure. Reactor system pressure would rise from the initial heat flow mismatch and then decrease after reactor trip. The reactor would be tripped on an anticipatory signal, high reactor system pressure, low steam generator level, overtemperature $\Delta T$ or high pressurizer level. The rate of pressure increase would be less if the event were to occur at 80% power than from 100% power and the amount of pressure overshoot after the trip would be less for the 80% power case.

Following reactor trip, auxiliary feedwater is actuated for decay heat removal. Following a feedwater line break, the licensee postulates that up to 10 minutes would be required to align auxiliary feedwater flow to the intact steam generators. During this period secondary system temperature would increase in the intact steam generators as the pressure increased following the turbine trip. The pressure increase in the secondary system is limited by the setpoints of

*XN-NF-85-64(P) Revision 1, "Plant Transient Analysis for D.C. Cook Unit 2 with 10% Steam Generator Tube Plugging," March 1986.

the secondary relief/safety valves. The differential increase in secondary pressure/temperature would be greater from the 80% power condition since the initial values would be lower. The primary system temperature must remain above the secondary system temperature for heat transfer to occur. The total primary system temperature increase and, hence, insurge into the pressurizer would be greater for an initially lower reactor power level. The rate of surge flow after reactor trip is well within the capacity of the pressurizer safety valves. For the 80% power case, the licensee calculated that the pressurizer may fill so that some water relief would occur through the safety valves. The required relief flow would be a small fraction of the valve capacity so that excessive reactor system overpressure would not occur. This is acceptable.

For reactor coolant pump trip or shaft failure events, minimum DNBR was evaluated. The reactor is assumed to trip on a low reactor coolant flow for these events. Since the margin to DNBR is enhanced by reducing power and reactor system temperature, the consequences from these events will remain acceptable.

For reactivity insertions while at power, minimum DNBR was also evaluated. The reactor would be tripped by excessive nuclear power or overtemperature $\Delta T$. Both these setpoints have been lowered so that the thermal margin would be in excess of that already accepted for cycle 6 operation.

In the case of a loss of coolant accident, the rate of blowdown would be increased as a result of the lower coolant temperature. For a large break LOCA, the peak cladding temperature would be increased slightly by the earlier blowdown. This would be more than offset by the reduction in power to 80%, which would reduce the peak calculated temperature by several hundred degrees. The staff concludes that the cycle 6 reload analysis remains bounding for the licensee's proposed 80% power operation with reduced temperature.