ATTACHMENT A

REVISED PAGES FOR THE

SEFOR TECHNICAL SPECIFICATIONS

Proposed Change No. 1

TABLE 2.2-1

SCRAM FUNCTION

FUNCTION		SAFETY SYSTEM SETTINGS
High Flux, Wide Range Monitor	≤	105% of Rated Flux
Low Level, Reactor Sodium	≤	4 inches below lip of operating level overflow pipe
High Temperature, Core Outlet-Upper Region	≤	900°F
Low Flow, Main Primary	≤	20% below the operating flow set point*
High Temperature, Reflector Region	≤	350°F for thermocouples on the reflector guide structure inner diameter and radial web.
	≤	275°F for thermocouples on the reflector guide structure, outer diameter.
	≤	450°F for thermocouples in the lower end of the reflector segments.

*The operating flow set points shall be specified in written procedures.

Bases

The limiting safety system setting (LSSS) of 105% of rated flux provides a 5% margin below the safety limit of 110%. This will assure protection of the safety limit for normal reactor operation. The actual safety system setting will generally be less than 105% of rated flux since a large percentage of the plant operating time will be spent at power levels below 20MWt where the trip setting would normally be reduced a corresponding amount. (Only a limited number of experiments will be conducted at rated flux.)[1]

The LSSS for reactor vessel sodium level provides assurance of reactor scram in the event that reactor cooling capability should be jeopardized because of a leak in the coolant system and consequent loss of sodium from the reactor vessel. Normal operation of the pump-around loop and overflow nozzle in the vessel will maintain the sodium at a constant level in the vessel. A loss of about 15 gallons of sodium from the reactor vessel will cause the level to fall below the level trip probe and scram the reactor. The level trip probes are two inches below the overflow nozzle, providing margin with respect to the LSSS of four inches.

The core outlet sodium high temperature trip at 900°F provides a 150°F margin to prevent the sodium temperature from reaching the safety limit. Analyses presented in the FDSAR[2] show that the coolant temperature will not approach the safety limit for accident conditions except for extreme assumptions involving failure to scram or failure of both main primary pump flywheels.

The low flow trip for the main primary coolant system provides assurance that the coolant temperature will not approach the safety limit due to loss of coolant flow. If the main primary coolant flow rate decreased to 80% of the set point value, the temperature rise across the vessel would increase less than 25% (to a vessel outlet temperature of 830°F) before the safety system would receive the scram signal and shut down the reactor. Thus, the low flow trip provides the earliest trip in the event of sudden reduction in coolant flow.

Adequate cooling of the reflector guide structure, segments, and neutron flux monitors, is required to assure operability of the reflectors and the neutron monitors. Thermocouples installed in the reflector guide structure and segments are monitored by the safety system to provide this assurance. The guide structure temperatures at the positions monitored are predicted to range in value from

200°F to 250°F with all reflector segments raised and a reactor power level of 20 MWt. The variations depend on whether the thermocouples are located in the inner or outer web of the guide structure. If one segment is lowered, the guide structure temperature levels in that region will increase by about 25°F. The actual trip level used for the safety system will be set a maximum of 135°F above the temperature readings observed at power for thermocouples on the inner diameter and radial web, and 80°F above the readings for thermocouples on the outer diameter of the guide structure. If the operating temperatures in the reflector region were to increase by these amounts (135°F or 80°F), a cooling flow reduction of less than 50% would be implied.

Calculations have been made to show that stresses and deflections due to thermal distortion and mechanical tolerances are acceptable for the design condition.(3) Extrapolation of these calculations shows that these stresses and deflections are also acceptable for conditions corresponding to a cooling flow reduction of 50%. At 50% coolant flow, the relative expansion between the reflector segment and guide structure would cause less than 60 mils compression of the T-pad spring in the segment, which is well within the demonstrated capability of the system.(4)

The limiting safety system settings of 350°F for thermocouples on the inner diameter and 275°F for thermocouples on the outer diameter may be more restrictive for operation at rated power than the values described above. The values are also safely below the temperature (400°F) at which the properties of the aluminum used in the guide structure begin to change significantly.

Thermocouples installed in the reflector segments can also be monitored by the safety system to provide assurance of proper cooling. The temperature of each segment thermocouple is expected to be 340°F at 20 MW, based on the maximum predicted heat generation in the reflector and guide structure. If the temperature at 20 MW is lower than 340°F due to lower heat generation rates, the safety system trip level will be correspondingly reduced to keep the trip level no more than 110°F above the actual 20 MW operating temperature so that a safety system trip will occur if cooling flow is reduced to about 60% of the normal value.

If the segment temperature at the thermocouple location increased to the LSSS of 450°F, the maximum aluminum guide structure temperature would be about 300 to 315°F, which is well below the temperature (about 400°F) at which the properties of aluminum used in the guide structure begin to change significantly.

The ten reflector region thermocouples used by the safety system can be chosen from any of the applicable thermocouples listed in Table 2.2-1, since a different trip level can be set for each thermocouple. The choice of the ten thermocouples to be used for the safety system will be made so as to monitor temperatures in each of the ten reflector bays.

A safety system trip at 50% to 60% of the normal coolant flow rate also provides assurance that the temperature of the neutron monitors will remain below the manufacturer's certified operating temperature of 300°F.

References

(1) GEAP 5576, "Final Specification for the SEFOR Experimental Program", January, 1968.
(2) SEFOR FDSAR, Volume II, Section 16.3, pp 16-10, ff.
(3) SEFOR FDSAR, Supplement 11, Appendix A and B.
(4) SEFOR FDSAR, Supplement 11, p 7-20.
(5) SEFOR FDSAR, Supplement 17, p G-5.