Inter-Office Memorandum

GPU Service

Date: May 10, 1979

Subject: Long Term Reactor Coolant System Pressure Control

To: R. C. Arnold

Location: Three Mile Island

The current plan is to take the reactor primary system down to a pressure of approximately 300 psi for long term (2 - 4 + months) natural circulation. This pressure is preferred since it does not cause additional gas to be redrawn from the control rod drives and provides ample margin on incore thermocouple T_{sat}. In all probability, the reactor coolant system temperature will also be held at its approximately current value by periodic throttling of the condenser bypass valve.

During the 2 - 4 or more months that the reactor is expected to be on natural circulation cooling, there are five potential options for pressure control. These include:

1. Use of the pressurizer with a normal vapor bubble.

2. Taking the plant solid and controlling through makeup and letdown.

3. The new pressure volume control system.

4. Floating the plant on core flood tanks.

5. Floating the plant on the low pressure injection pump discharge.

The sixth option, letting the system pressure drop to atmospheric, is not viable in the near term. The attached table summarizes some of the pros and cons of the various alternatives.

It is recommended that pressure control be maintained through normal pressurizer heating with a vapor bubble. This recommendation assumes that current efforts to retain/restore heaters will be successful, that solid operation will not show a marked change in system leak rate and that system makeup and letdown can be secured after periodically taking the pressurizer solid and letting the system drift down on leakage. On going solid, Pzr level can be obviously benchmarked.

In the event that unforeseen problems or other restrictions prohibit operating the pressurizer in the normal mode, it is recommended that the first fallback position be to take the plant solid and maintain pressure through normal makeup and letdown (assuming valves, pumps, etc. permit). The second fallback position

should be use of the new pressure volume control system. Floating of the core flood tanks or the low pressure injection pumps should be considered as further fallback positions, although neither of these systems appear to be technically unacceptable.

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LONG TERM REACTOR COOLANT SYSTEM PRESSURE CONTROL

USE OF THE PRESSURIZER WITH A NORMAL VAPOR BUBBLE	TAKING THE PLANT SOLID AND CONTROLLING THROUGH MAKEUP AND LETDOWN	NEW PRESSURE VOLUME CONTROL SYSTEM	FLOATING THE PLANT ON CORE FLOOD TANKS	FLOATING THE PLANT ON THE LOW PRESSURE INJECTION PUMP DISCHARGE END
ADVANTAGES:				
Normal plant operating mode - maximum operator familiarity	System has been demonstrated	System completely redundant	System basically passive except for makeup of flood tank wat.	Uses installed plant equipment
System with vapor bubble is forgiving and has a low time response	Electrical heaters not required	System accessible for maintenance	System is redundant - no modifications required	System is redundant
Leakage rate is probably no worse than any other system	Uses normal plant equipment		Permits adequate boron control	
Has capability of taking pressure upsurge as well as downsurge	Protects against up and down pressure transients			
Low pressurizer level heater alarm circuit and ability to track level lends confidence	No Pzr chemistry problem			
Chemistry control in pressurizer adequate				
DISADVANTAGES:				
Requires some heater capability - probably 200-250 kw	Constant operator attention required	New system, probably a lot of bugs, and will require extensive operator familiarity	Reactor system must be solid	Maximum pressure is approximately 175 psi
Requires active HPI pumps and valves on a periodic basis	Response time required short thrust pressure transients accentuated	System provides protection against pressure loss, but over-pressure protection still by primary and code safeties.	Flood tanks do not provide high pressure over-protection, must still rely on code safeties.	System is active and requires continuous operation of pumps
Large pressure breakdown across valve may cause wear-out unless makeup and letdown periodically secured.	Requires almost continuous operation or cycling of makeup pumps and letdown		Adjustment of system pressure possible but awkward	Decay heat removal train is unavailable
	Active components contaminated, maintenance may be impractical			High recirculation flow required on the pumps.
Secures seal injection flow to reactor coolant pumps	Upsets cause water surging from pressurizer to main coolant loop, may cause natural circulation upsets.		Chemical addition other than boron must be done through makeup pump	
	Same concern with long time reliability due to high pressure breakdown across valve and wear out		Finite possibility of nitrogen injection into the primary coolant system; however, possibility is small in absence of LOCA	