REACTOR STEPBACK

INTRODUCTION

Although the Reactor Stepback module is not part of the Reactor Regulation System, since it has a significant role in many events, it is useful to understand it function.

Two reasons can be invoked for Reactor Setback being independent of RRS. Although it resides in each of the control computers, X and Y, the frequency of execution, which is normally every 0.5 seconds, passes to 0.25 seconds, twice as fast as the fast time bandwidth of RRS, once it has been fired. Furthermore, once engaged, the reactor stepback does not control the movement of the MCA's. It cuts the current necessary to hold the MCA's in place; the current necessary to activate the motor moving the adjusters is also cut.

EFFECT ON REACTIVITY DEVICES

When a reactor stepback is in progress, there is first a rapid insertion of the four MCA's in the core by gravity alone. Reactor stepback cuts the electrical current to the clutches holding the pulley on the rotation axis, which lets the MCA's fall freely in the moderator, inside their guide tubes. There is no speed and position control such as that found in the CBS module.

Simultaneously to the current cutting to the MCA clutches, the electrical current to the motors of the adjusters is also cut. The adjusters thus stop their movement, so that they cannot continue their insertion or extraction during a reactor stepback. This will prevent any unwanted power excursions caused by the adjuster movements.

When there is a reactor stepback, the LZC demand valve opening is modified (overruled) such that the LZC fill up at about 30% of their maximum fill rate, up to a maximum level of 95%.

GENERAL APPROACH

Reactor stepback verifies the value of nine parameters at each execution. These are:

- Manual Reactor Stepback
- Reactor Shutdown (SDS1 or SDS2)
- Turbine shutdown
- Primary coolant heat transport pump stopped
- Moderator level
- Steam generator level
- Primary coolant pressure
- Power log rate
- Zonal powers

According to the parameter responsible for the reactor stepback, a power endpoint is established. When this power is reached, the reactor stepback ends. Furthermore, if the cause of the reactor stepback disappears, the stepback ends, and the power will be left at its current value, unlike the reactor setback which always brings the power to the endpoint value.

When a reactor stepback is finished, the MCA clutches are re-engaged, the electric current to the adjuster motors is allowed to circulate, and the LZC valve control returns to normal. The device movements, either LZC, adjusters, and MCA's are then controlled by the normal rules of RRS.

In order to better illustrate the reactor stepback function, we will examine in detail the conditions of zonal powers and log rate.

ZONAL POWERS

The twenty eight Platinum detector readings are read. Recall that these detectors are grouped by two, forming fourteen zonal detector assemblies. The maximum of each of these two detectors of each zone assembly is chosen by reactor stepback, and placed in the fourteen variables, labeled PZ_i. A reactor stepback will be engaged if four or more of these PZ_i are greater than 108% FP. The endpoint power is then 0% in this case.

LOG RATE

The reactor stepback on log rate is engaged when the median of the ion chambers log rate is greater than 8%/second. It will then stay engaged as long as this median value remains greater than 0%/second. It will be cleared when the median becomes negative. The endpoint power is also 0% FP in this case.