MISSISSIPPI POWER & LIGHT COMPANY
Helping Build Mississippi
P. O. BOX 1640, JACKSON, MISSISSIPPI 39205

NUCLEAR LICENSING & SAFETY DEPARTMENT

September 11, 1984

U. S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, D. C. 20555

Attention: Mr. Harold R. Denton, Director

Dear Mr. Denton:

SUBJECT: Grand Gulf Nuclear Station
Units 1 and 2
Docket Nos. 50-416 and 50-417
License No. NPF-13
File: 0025/L-860.0
Response to Generic Letter 83-28, Item 4.5
AECM-84/0349

Generic Letter 83-28 requested conformance to several NRC positions derived from an evaluation of the Salem ATWS events. Attached find the MP&L response to Action 4.5 of the generic letter. This item deals with the enhanced reliability of the reactor trip system provided by functional testing.

Functional testing of the scram pilot valves and initiating circuitry is provided at GGNS. On-line testing of the backup scram valves is not performed due to the unnecessary challenge to plant safety systems posed by such testing. The evaluation of test intervals requested in item 4.5.3 will be addressed as part of a generic effort being developed by the BWROG. The general approach of BWROG program was presented to members of the NRC staff on April 6, 1984. The results of this effort are scheduled for completion in the first quarter of 1985.

Yours truly,

SHHobby

for L. F. Dale
Director

FGB/SHH:rg
Attachment

cc: See next page

8409170252 840911
PDR ADOCK 05000416
P PDR

A055
1/1

cc: Mr. J. B. Richard (w/a)
Mr. R. B. McGehee (w/o)
Mr. N. S. Reynolds (w/o)
Mr. G. B. Taylor (w/o)

Mr. Richard C. DeYoung, Director (w/a)
Office of Inspection & Enforcement
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Mr. J. P. O'Reilly, Regional Administrator (w/a)
U.S. Nuclear Regulatory Commission
Region II
101 Marietta St., N.W., Suite 2900
Atlanta, Georgia 30323

4.5 REACTOR TRIP SYSTEM RELIABILITY (SYSTEM FUNCTIONAL TESTING)

POSITION

On-line functional testing of the reactor trip system, including independent testing of the diverse trip features, shall be performed on all plants.

1. The diverse trip features to be tested include the breaker undervoltage and shunt trip features on Westinghouse, B&W (see Action 4.3 above) and CE plants; the circuitry used for power interruption with the silicon controlled rectifiers on B&W plants (see Action 4.4 above); and the scram pilot valve and backup scram valves (including all initiating circuitry) on GE plants.

2. Plants not currently designed to permit periodic on-line testing shall justify not making modifications to permit such testing. Alternatives to on-line testing proposed by licensees will be considered where special circumstances exist and where the objective of high reliability can be met in another way.

3. Existing intervals for on-line functional testing required by Technical Specifications shall be reviewed to determine that the intervals are consistent with achieving high reactor trip system availability when accounting for considerations such as:

    1. uncertainties in component failure rates
    2. uncertainty in common mode failure rates
    3. reduced redundancy during testing
    4. operator errors during testing
    5. component "wear-out" caused by the testing

Licensees currently not performing periodic on-line testing shall determine appropriate test intervals as described above. Changes to existing required intervals for on-line testing as well as the intervals to be determined by licensees currently not performing on-line testing shall be justified by information on the sensitivity of reactor trip system availability to parameters such as the test intervals, component failure rates, and common mode failure rates.

RESPONSE TO 4.5.1 AND 4.5.2

I. Scram System

Five systems contribute to the reactor trip function for the Grand Gulf Nuclear Station (GGNS). The primary systems are the Reactor Protection System (RPS) and the Control Rod Drive System (CRDS). Sensors from three other systems, the Neutron Monitoring System, the Nuclear Boiler System and the Process Radiation Monitoring System provide information about the conditions of plant operation. These inputs cause the initiation of the scram function when established limits are met. On-line functional testing of the sensor trips which comprise the RPS instrumentation, which includes the sensors described above, is performed in accordance with the GGNS Technical Specifications. In addition, the Technical Specifications require regular operability and scram insertion time testing of the Control Rod Drive System as well as functional testing of the Electrical Protection Assemblies (EPAs). These tests and surveillances assure that failures which could affect the reactor trip function are detected.

Channel functional tests are performed on-line for the following sensor trips:

- o Reactor Vessel Dome Pressure-High
- o Reactor Vessel Water Level-Low
- o Main Steam Line Isolation Valve-Closure
- o Main Steam Line Radiation-High
- o Drywell Pressure-High
- o Turbine Control Valve Fast Closure, Control Oil Pressure-Low
- o Turbine Stop Valve-Closure
- o Reactor Vessel Water Level-High
- o Scram Discharge Volume Water Level-High
- o Manual Scram

On-line channel functional tests are also performed for APRMs and IRMs. Another channel functional test is the test of the reactor mode switch in the shutdown position every refueling. This test can only be conducted during a reactor shutdown.

Each sensor channel functional test includes full actuation of the associated logic, the two output scram contactors in each channel and the individual CRD scram air pilot valve solenoid for the associated logic division (solenoids from both logic Division A and B are required for scram initiation).

In References 1 and 2, it is shown that each of the above plant variables used to initiate a protective function is backed up by a completely different plant variable. In fact, it can be seen from Table 1 that for the most frequent transients, scram is initiated by at least three diverse sensors in all but one case (i.e., regulator failure-primary pressure increase, in which two diverse sensors would initiate a scram). This indicates that adequate redundancy exists in the design to provide protection against multiple independent sensor failures. Also, diversity among sensor types reduces the potential for common cause failures, failures due to human error and increases in failure rate due to wearout. A pictorial representation of the RPS logic configuration is provided in Figure 1.

The most credible failures within the RPS logic will de-energize a set of scram solenoids which causes a half scram, i.e., one of the two scram solenoids required for scram initiation is de-energized at some or all hydraulic control units. These failures would be "SAFE" failures that would increase the probability of plant shutdown. The less credible logic failures which prevent a channel from de-energizing will be detected during channel functional test. The tests described above ensure that an increase in failure rate due to a wearout condition or a common cause failure potential could be detected early and corrective action taken before the failure condition becomes systematic.

Reference 2 concluded that reactor shutdown can be achieved if at least 50% of the control rods in a checkerboard pattern and 69% in a random pattern are inserted in the core. The probability of independent failure of enough rods to prevent shutdown is negligible. The most unlikely type of CRDS failure would be some common cause mechanism that, if undetected over a long period of time, would cause unsafe shutdown. The Technical Specification surveillance requirements adequately ensure that a failure mechanism affecting several individual drives (considered to be very remote) would not go undetected. One of the major features that ensures that several drives do not fail at one time due to wearout or a common cause is the staggered maintenance and overhaul of selected degraded CRDs or Hydraulic Control Units (HCUs) at refueling outages. This ensures a mix of drives by age, component lot, maintenance time and servicing personnel, and testing.

The scram insertion time tests include, in addition to drive timing and insertion capability, a test of operability of the HCU scram insert and discharge valves including associated scram air pilot valves. As stated in the previous paragraph, the required frequency of testing given in the Technical Specification ensures that a systematic failure mechanism in the HCUs would be detected and corrective action taken before the condition becomes a critical failure preventing scram.

II. Backup Scram System

Generic Letter 83-28 Section 4.5 also recommends on-line functional testing of the plant's diverse trip features including the backup scram valves at GE plants. The backup scram valves are implied to be "diverse trip features" comparable to the breaker shunt trip features on other plants. The differences between the GE Reactor Protection System (RPS) and the trip system that initiated Generic Letter 83-28, in our opinion, makes this extension of on-line functional testing unwarranted.

At GGNS, there are two scram valves and one scram pilot valve for each of 193 control rods. There are also two DC powered solenoid operated backup scram valves that control the air supply to all 193 sets of scram valves. This backup scram capability is in case some of the individual pilot valves fail to reposition when their solenoids are deenergized.

However, as noted above only a fraction of the 193 control rods must successfully function in order to shut down the reactor. The currently required functional testing and surveillance activities performed on the RPS instrumentation and CRDS components assure that the probability of independent failure of enough rods to prevent a shutdown is negligible. In addition, the diversity of the logic and the redundancy of the system contribute to high scram reliability.

The backup scram valves were provided to enhance the reliability of the safety-related reactor trip system. They provide no increase in safety margin and are therefore not classified as safety related. The backup scram system is of a different functional design than the scram system. It is DC-powered and energized to operate as compared to the scram system which is AC-powered and deenergized to function. However, it is not truly diverse in that contacts out of the RPS trip systems initiate both the scram and the backup scram function. Furthermore, no credit is taken for these valves in the safety analyses by any regulations.

It is therefore, MP&L's position that on-line functional testing of the backup scram valves is not required for GGNS.

Two additional points which support not testing the backup scram valves are:

1. Functional testing of these valves would result in a reactor scram. This would represent a significant challenge to the plant safety systems with no derived safety benefit. Proper functioning of these valves is not required to produce a scram nor would failure of these valves prevent a scram.

2. Implementation of the ATWS rule will require an alternate rod insertion system. Such a system when installed should be capable of on-line functional testing. And because it would be a diverse scram system, it may replace the backup scram valves.

REFERENCES

1. NEDO-1-189, "An Analysis of Functional Common-Mode Failures in GE BWR Protection and Control Instrumentation," L. G. Frederick, et al, July 1970.

2. "BWR Scram System Reliability Analysis," W. P. Sullivan, et al, September 30, 1976 (Transmitted in letter from E. A. Hughes (GE) to D. F. Ross (NRC), "General Electric Company ATWS Reliability Report," September 30, 1976).

RESPONSE TO 4.5.3

The BWR Owners Group Technical Specification Improvement Committee has expanded its generic efforts to address position 4.5.3 of Generic Letter 83-28. The response is expected to demonstrate the high availability of existing reactor trip systems. Sensitivity studies will be included to address the considerations listed in the letter. The output of this effort, a report for submittal to the NRC is scheduled to be finalized in the first quarter of 1985. A discussion of the results of this effort, as they apply to GGNS, will also be provided with our final response to Generic Letter 83-28 (i.e., to Position 3.2 scheduled for September 27, 1985).

Table 1

SENSOR DIVERSITY FOR MAJOR TRANSIENTS

Transient	Scram Signals - Order of Occurrence							
	Inputs from Pressure or Differential Pressure Transmitters and Trip Units			Inputs From Pressure Position or Micro Switch Contact Opening			Inputs From Neutron Flux or Radiation Sensors	
	Reactor Pressure >1065 PSIG	Reactor Level <Level 3	Reactor Level >Level 8	Turb Cont. Valve Oil Pres. Set Pt.	Turb Stop Valve Pos <90% Full Open	MSIV Pos. <90% Full Open	APRM >120%	MSIV Hi Rad. >6 x Background
MSIV Closure	3	4				1	2	
Turb Trip	3				1		2	
Generator Trip	3			1			2	
Pres. Regulator Failure (primary pressure decrease)	3	4				1	2	
Pres. Regulator Failure (primary pressure increase)	2						1	
F.W. Flow Control, Failure (reactor water inventory increase)	4		1		2		3	
F.W. Flow Control, Failure (reactor water inventory decrease)	3	1				2		4
Loss of Condenser Vacuum	3			4	1	5	2	
Loss of Normal AC Power	4	5		2	1	6	3	

U89rgl

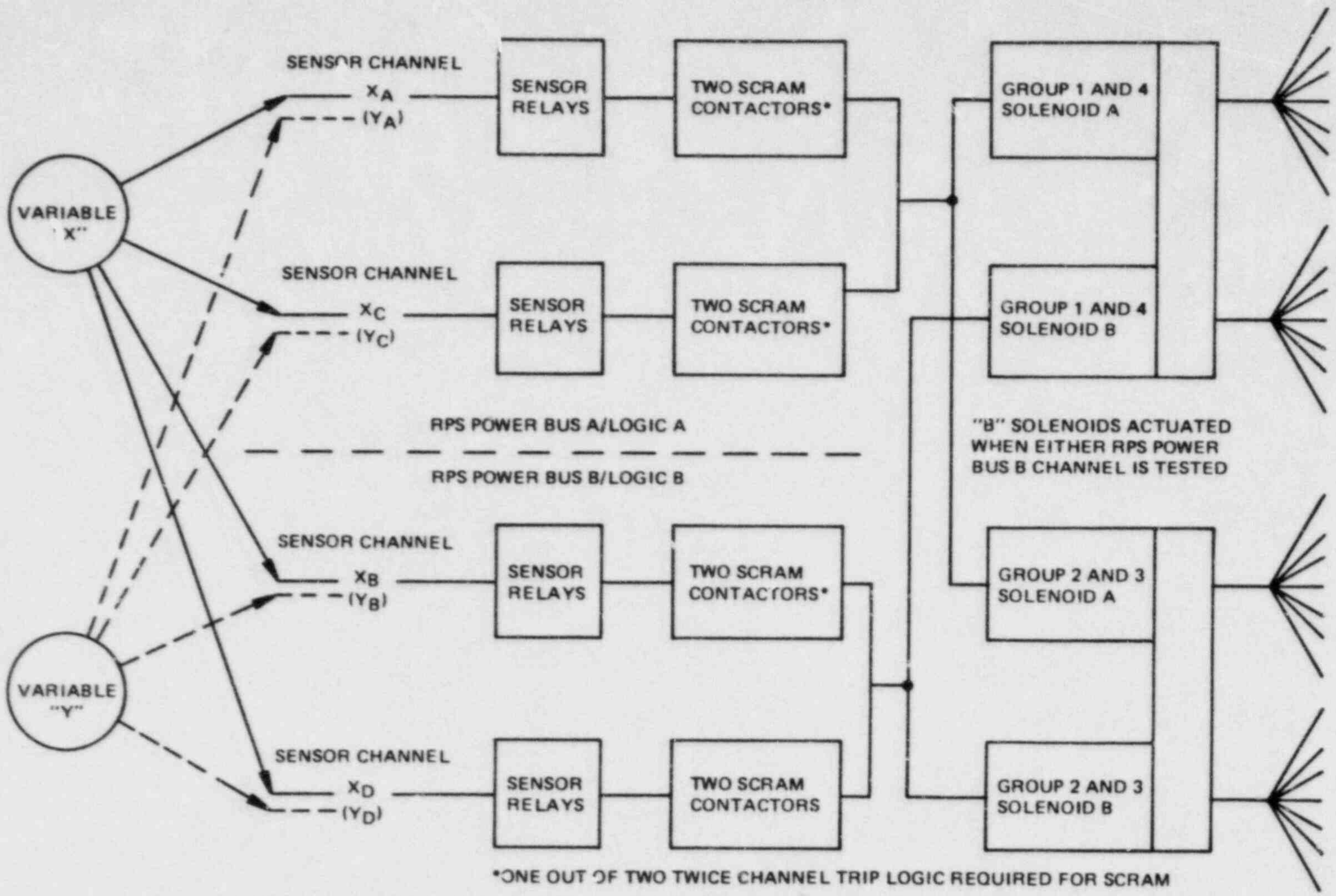

Figure 1. RPS Relay Logic Configuration