ENCLOSURE 1

PROPOSED TECHNICAL SPECIFICATION
REVISIONS
(TVA BFNP TS 180)
BROWNS FERRY NUCLEAR PLANT
UNITS 1, 2, AND 3

UNIT 1

TABLE 4.1.A
REACTOR PROTECTION SYSTEM (SCRAM) INSTRUMENTATION FUNCTIONAL TESTS
MINIMUM FUNCTIONAL TEST FREQUENCIES FOR SAFETY INSTR. AND CONTROL CIRCUITS

	Group (2)	Functional Test	Minimum Frequency (3)
Mode Switch in Shutdown	A	Place Mode Switch in Shutdown	Each Refueling Outage
Manual Scram	A	Trip Channel and Alarm	Every 3 Months
IRM			
High Flux	C	Trip Channel and Alarm (4)	Once Per Week During Refueling and Before Each Startup
Inoperative	C	Trip Channel and Alarm (4)	Once Per Week During Refueling and Before Each Startup
APRM			
High Flux (15% scram)	C	Trip Output Relays (4)	Before Each Startup and Weekly When Required to be Operable
High Flux	B	Trip Output Relays (4)	Once/Week
Inoperative	B	Trip Output Relays (4)	Once/Week
Downscale	B	Trip Output Relays (4)	Once/Week
Flow Bias	B	(6)	(6)
High Reactor Pressure	A	Trip Channel and Alarm	Once/Month (1)
High Drywell Pressure	A	Trip Channel and Alarm	Once/Month (1)
Reactor Low Water Level (5)	A	Trip Channel and Alarm	Once/Month (1)
High Water Level in Scram Discharge Tank	A	Trip Channel and Alarm	Once/Month
Turbine Condenser Low Vacuum	A	Trip Channel and Alarm	Once/Month (1)
Main Steam Line High Radiation	B	Trip Channel and Alarm (4)	Once/3 Months (7)

TABLE 4.1.A (Continued)

	Group (2)	Functional Test	Minimum Frequency (3)
Main Steam Line Isolation Valve Closure	A	Trip Channel and Alarm	Once/3 Months (7)
Turbine Control Valve Fast Closure or Turbine Trip	A	Trip Channel and Alarm	Once/Month (1)
Turbine First Stage Pressure Permissive	A	Trip Channel and Alarm	Every 3 Months
Turbine Stop Valve Closure	A	Trip Channel and Alarm	Once/Month (1)

NOTES FOR TABLE 4.1.A

1. Initially the minimum frequency for the indicated tests shall be once per month.

2. A description of the three groups is included in the Bases of this specification.

3. Functional tests are not required when the systems are not required to be operable or are operating (i.e., already tripped). If tests are missed, they shall be performed prior to returning the systems to an operable status.

4. This instrumentation is exempted from the instrument channel test definition. This instrument channel functional test will consist of injecting a simulated electrical signal into the measurement channels.

5. The water level in the reactor vessel will be perturbed and the corresponding level indicator changes will be monitored. This perturbation test will be performed every month after completion of the monthly functional test program.

6. The functional test of the flow bias network is performed in accordance with Table 4.2.C.

7. The functional test frequency decreased to once/3 months to reduce challenges to relief valves per NUREG 0737, Item II.K.3.16.

TABLE 4.2.A
SURVEILLANCE REQUIREMENTS FOR PRIMARY CONTAINMENT AND REACTOR BUILDING ISOLATION INSTRUMENTATION

Function	Functional Test	Calibration Frequency	Instrument Check
Instrument Channel - Reactor Low Water Level (LIS-3-203A-D, SW 2-3)	(1)	(5)	once/day
Instrument Channel - Reactor High Pressure	(1)	once/3 months	none
Instrument Channel - Reactor Low Water Level (LIS-3-56A-D, SW #1)	(1)	once/3 month	once/day
Instrument Channel - High Drywell Pressure (PS-64-56A-D)	(1)	(5)	N/A
Instrument Channel - High Radiation Main Steam Line Tunnel	once/3 months (27)	(5)	once/day
Instrument Channel - Low Pressure Main Steam Line	once/3 months (27)	once/3 months	none
Instrument Channel - High Flow Main Steam Line	once/3 months (27)	once/3 months	once/day
Instrument Channel - Main Steam Line Tunnel High Temperature	once/3 months (27)	once/operating cycle	none
Instrument Channel - Reactor Building Ventilation High Radiation - Reactor Zone	(1) (14) (22)	once/3 months	once/day (8)

NOTES FOR TABLES 4.2.A THROUGH 4.2.H (Continued)

14. Upscale trip is functionally tested during functional test time as required by section 4.7.B.1.a and 4.7.C.1.c.

15. The flow bias comparator will be tested by putting one flow unit in "Test" (producing 1/2 scram) and adjusting the test input to obtain comparator rod block. The flow bias upscale will be verified by observing a local upscale trip light during operation and verified that it will produce a rod block during the operating cycle.

16. Performed during operating cycle. Portions of the logic is checked more frequently during functional tests of the functions that produce a rod block.

17. This calibration consists of removing the function from service and performing an electronic calibration of the channel.

18. Functional test is limited to the condition where secondary containment integrity is not required as specified in sections 3.7.C.2 and 3.7.C.3.

19. Functional test is limited to the time where the SGTS is required to meet the requirements of section 4.7.C.1.c.

20. Calibration of the comparator requires the inputs from both recirculation loops to be interrupted, thereby removing the flow bias signal to the APRM and RBM and scramming the reactor. This calibration can only be performed during an outage.

21. Logic test is limited to the time where actual operation of the equipment is permissible.

22. One channel of either the reactor zone or refueling zone Reactor Building Ventilation Radiation Monitoring System may be administratively bypassed for a period not to exceed 24 hours for functional testing and calibration.

23. The Reactor Cleanup System Space Temperature monitors are RTD's that feed a temperature switch in the control room. The temperature switch may be tested monthly by using a simulated signal. The RTD itself is a highly reliable instrument and less frequent testing is necessary.

24. This instrument check consists of comparing the thermocouple readings for all valves for consistence and for nominal expected values (not required during refueling outages).

25. During each refueling outage, all acoustic monitoring channels shall be calibrated. This calibration includes verification of accelerometer response due to mechanical excitation in the vicinity of the sensor.

26. This instrument check consists of comparing the background signal levels for all valves for consistency and for nominal expected values (not required during refueling outages).

27. The functional test frequency decreased to once/3 months to reduce challenges to relief valves per NUREG-0737, Item II.K.3.16.

UNIT 2

TABLE 4.1.A
REACTOR PROTECTION SYSTEM (SCRAM) INSTRUMENTATION FUNCTIONAL TESTS
MINIMUM FUNCTIONAL TEST FREQUENCIES FOR SAFETY INSTR. AND CONTROL CIRCUITS

	Group (2)	Functional Test	Minimum Frequency (3)
Mode Switch in Shutdown	A	Place Mode Switch in Shutdown	Each Refueling Outage
Manual Scram	A	Trip Channel and Alarm	Every 3 Months
IRM			
High Flux	C	Trip Channel and Alarm (4)	Once Per Week During Refueling and Before Each Startup
Inoperative	C	Trip Channel and Alarm (4)	Once Per Week During Refueling and Before Each Startup
APRM			
High Flux (15% scram)	C	Trip Output Relays (4)	Before Each Startup and Weekly When Required to be Operable
High Flux	B	Trip Output Relays (4)	Once/Week
Inoperative	B	Trip Output Relays (4)	Once/Week
Downscale	B	Trip Output Relays (4)	Once/Week
Flow Bias	B	(6)	(6)
High Reactor Pressure	A	Trip Channel and Alarm	Once/Month (1)
High Drywell Pressure	A	Trip Channel and Alarm	Once/Month (1)
Reactor Low Water Level (5)	A	Trip Channel and Alarm	Once/Month (1)
High Water Level in Scram Discharge Tank	A	Trip Channel and Alarm	Once/Month
Turbine Condenser Low Vacuum	A	Trip Channel and Alarm	Once/Month (1)
Main Steam Line High Radiation	B	Trip Channel and Alarm (4)	Once/3 Months (7)

TABLE 4.1.A (Continued)

	Group (2)	Functional Test	Minimum Frequency (3)
Main Steam Line Isolation Valve Closure	A	Trip Channel and Alarm	Once/3 Months (7)
Turbine Control Valve Fast Closure or Turbine Trip	A	Trip Channel and Alarm	Once/Month (1)
Turbine First Stage Pressure Permissive	A	Trip Channel and Alarm	Every 3 Months
Turbine Stop Valve Closure	A	Trip Channel and Alarm	Once/Month (1)

NOTES FOR TABLE 4.1.A

1. Initially the minimum frequency for the indicated tests shall be once per month.

2. A description of the three groups is included in the Bases of this specification.

3. Functional tests are not required when the systems are not required to be operable or are operating (i.e., already tripped). If tests are missed, they shall be performed prior to returning the systems to an operable status.

4. This instrumentation is exempted from the instrument channel test definition. This instrument channel functional test will consist of injecting a simulated electrical signal into the measurement channels.

5. The water level in the reactor vessel will be perturbed and the corresponding level indicator changes will be monitored. This perturbation test will be performed every month after completion of the monthly functional test program.

6. The functional test of the flow bias network is performed in accordance with Table 4.2.C.

7. The functional test frequency decreased to once/3 months to reduce challenges to relief valves per NUREG 0737, Item II.K.3.16.

TABLE 4.2.A

SURVEILLANCE REQUIREMENTS FOR PRIMARY CONTAINMENT AND REACTOR BUILDING ISOLATION INSTRUMENTATION

Function	Functional Test	Calibration Frequency	Instrument Check
Instrument Channel - Reactor Low Water Level (LIS-3-203A-D, SW 2-3)	(1)	(5)	once/day
Instrument Channel - Reactor High Pressure	(1)	once/3 months	none
Instrument Channel - Reactor Low Water Level (LIS-3-56A-D, SW #1)	(1)	once/3 month	once/day
Instrument Channel - High Drywell Pressure (PS-64-56A-D)	(1)	(5)	N/A
Instrument Channel - High Radiation Main Steam Line Tunnel	once/3 months (27)	(5)	once/day
Instrument Channel - Low Pressure Main Steam Line	once/3 months (27)	once/3 months	none
Instrument Channel - High Flow Main Steam Line	once/3 months (27)	once/3 months	once/day
Instrument Channel - Main Steam Line Tunnel High Temperature	once/3 months (27)	once/operating cycle	none
Instrument Channel - Reactor Building Ventilation High Radiation - Reactor Zone	(1) (14) (22)	once/3 months	once/day (8)

NOTES FOR TABLES 4.2.A THROUGH 4.2.H (Continued)

14. Upscale trip is functionally tested during functional test time as required by section 4.7.B.1.a and 4.7.C.1.c.

15. The flow bias comparator will be tested by putting one flow unit in "Test" (producing 1/2 scram) and adjusting the test input to obtain comparator rod block. The flow bias upscale will be verified by observing a local upscale trip light during operation and verified that it will produce a rod block during the operating cycle.

16. Performed during operating cycle. Portions of the logic is checked more frequently during functional tests of the functions that produce a rod block.

17. This calibration consists of removing the function from service and performing an electronic calibration of the channel.

18. Functional test is limited to the condition where secondary containment integrity is not required as specified in sections 3.7.C.2 and 3.7.C.3.

19. Functional test is limited to the time where the SGTS is required to meet the requirements of section 4.7.C.1.c.

20. Calibration of the comparator requires the inputs from both recirculation loops to be interrupted, thereby removing the flow bias signal to the APRM and RBM and scramming the reactor. This calibration can only be performed during an outage.

21. Logic test is limited to the time where actual operation of the equipment is permissible.

22. One channel of either the reactor zone or refueling zone Reactor Building Ventilation Radiation Monitoring System may be administratively bypassed for a period not to exceed 24 hours for functional testing and calibration.

23. The Reactor Cleanup System Space Temperature monitors are RTD's that feed a temperature switch in the control room. The temperature switch may be tested monthly by using a simulated signal. The RTD itself is a highly reliable instrument and less frequent testing is necessary.

24. This instrument check consists of comparing the thermocouple readings for all valves for consistence and for nominal expected values (not required during refueling outages).

25. During each refueling outage, all acoustic monitoring channels shall be calibrated. This calibration includes verification of accelerometer response due to mechanical excitation in the vicinity of the sensor.

26. This instrument check consists of comparing the background signal levels for all valves for consistency and for nominal expected values (not required during refueling outages).

27. The functional test frequency decreased to once/3 months to reduce challenges to relief valves per NUREG-0737, Item II.K.3.16.

UNIT 3

TABLE 4.1.A
REACTOR PROTECTION SYSTEM (SCRAM) INSTRUMENTATION FUNCTIONAL TESTS
MINIMUM FUNCTIONAL TEST FREQUENCIES FOR SAFETY INSTR. AND CONTROL CIRCUITS

	Group (2)	Functional Test	Minimum Frequency (3)
Main Steam Line High Radiation	B	Trip Channel and Alarm (4)	Once/ 3 months (7)
Main Steam Line Isolation Valve Closure	A	Trip Channel and Alarm	Once/3 Months (7)
Turbine Control Valve Fast Closure or Turbine Trip	A	Trip Channel and Alarm	Once/Month (1)
Turbine First Stage Pressure Permissive	A	Trip Channel and Alarm	Every 3 Months
Turbine Stop Valve Closure	A	Trip Channel and Alarm	Once/Month (1)

NOTES FOR TABLE 4.1.A

1. Initially the minimum frequency for the indicated tests shall be once per month.

2. A description of the three groups is included in the Bases of this specification.

3. Functional tests are not required when the systems are not required to be operable or are operating (i.e., already tripped). If tests are missed, they shall be performed prior to returning the systems to an operable status.

4. This instrumentation is exempted from the instrument channel test definition. This instrument channel functional test will consist of injecting a simulated electrical signal into the measurement channels.

5. The water level in the reactor vessel will be perturbed and the corresponding level indicator changes will be monitored. This perturbation test will be performed every month after completion of the monthly functional test program.

6. The functional test of the flow bias network is performed in accordance with Table 4.2.C.

7. Functional test frequency decreased to once/ 3 months to reduce the challenges to relief valves per NUREG 0737, Item II.K.3.16.

TABLE 4.2.A
SURVEILLANCE REQUIREMENTS FOR PRIMARY CONTAINMENT AND REACTOR BUILDING ISOLATION INSTRUMENTATION

Function	Functional Test	Calibration Frequency	Instrument Check
Instrument Channel - Reactor Low Water Level (LIS-3-203A-D, SW 2-3)	(1)	(5)	once/day
Instrument Channel - Reactor High Pressure	(3)	once/3 months	none
Instrument Channel - Reactor Low Water Level (LIS-3-56A-D, SW #1)	(1)	once/3 month	once/day
Instrument Channel - High Drywell Pressure (PS-64-56A-D)	(1)	(5)	N/A
Instrument Channel - High Radiation Main Steam Line Tunnel	once/3 months (27)	(5)	once/day
Instrument Channel - Low Pressure Main Steam Line	once/3 months (27)	once/3 months	none
Instrument Channel - High Flow Main Steam Line	once/3 months (27)	once/3 months	once/day
Instrument Channel - Main Steam Line Tunnel High Temperature	once/3 months (27)	once/operating cycle	none
Instrument Channel - Reactor Building Ventilation High Radiation - Reactor Zone	(1) (14) (22)	once/3 months	once/day (8)

NOTES FOR TABLES 4.2.A THROUGH 4.2.H (Continued)

14. Upscale trip is functionally tested during functional test time as required by section 4.7.B.1.a and 4.7.C.1.c.

15. The flow bias comparator will be tested by putting one flow unit in "Test" (producing 1/2 scram) and adjusting the test input to obtain comparator rod block. The flow bias upscale will be verified by observing a local upscale trip light during operation and verified that it will produce a rod block during the operating cycle.

16. Performed during operating cycle. Portions of the logic is checked more frequently during functional tests of the functions that produce a rod block.

17. This calibration consists of removing the function from service and performing an electronic calibration of the channel.

18. Functional test is limited to the condition where secondary containment integrity is not required as specified in sections 3.7.C.2 and 3.7.C.3.

19. Functional test is limited to the time where the SGTS is required to meet the requirements of section 4.7.C.1.c.

20. Calibration of the comparator requires the inputs from both recirculation loops to be interrupted, thereby removing the flow bias signal to the APRM and RBM and scramming the reactor. This calibration can only be performed during an outage.

21. Logic test is limited to the time where actual operation of the equipment is permissible.

22. One channel of either the reactor zone or refueling zone Reactor Building Ventilation Radiation Monitoring System may be administratively bypassed for a period not to exceed 24 hours for functional testing and calibration.

23. The Reactor Cleanup System Space Temperature monitors are RTD's that feed a temperature switch in the control room. The temperature switch may be tested monthly by using a simulated signal. The RTD itself is a highly reliable instrument and less frequent testing is necessary.

24. This instrument check consists of comparing the thermocouple readings for all valves for consistence and for nominal expected values (not required during refueling outages).

25. During each refueling outage, all acoustic monitoring channels shall be calibrated. This calibration includes verification of accelerometer response due to mechanical excitation in the vicinity of the sensor.

26. This instrument check consists of comparing the background signal levels for all valves for consistency and for nominal expected values (not required during refueling outages).

27. Functional test frequency decreased to once/3 months to reduce the challenges to relief valves per NUREG-0737, item II.K.3.16.

ENCLOSURE 2

DESCRIPTION AND JUSTIFICATION
(TVA BFNP TS 180)

Justification and Safety Analysis

Item II.K.3.16 of NUREG-0737 calls for a comprehensive study to determine feasible means to reduce the challenges to relief valves. One suggestion stated in item II.K.3.16 was to reduce the testing frequency of the main steam isolation valves. Item II.K.3.16 also states that "those changes which are shown to reduce relief valve challenges without compromising the performance of the relief valves or other systems should be implemented."

These proposed technical specification revisions are a result of a feasibility study which indicates that testing frequency may be reduced without impacting overall system reliability. This will in turn produce a marked decrease in inadvertent reactor isolation events and scrams associated with testing. Besides reducing challenges to the relief valves by a significant and quantifiable factor, it follows that the general reduction in initiator events will have commensurate benefit in reducing challenges to other reactor protection and safeguard features.

INTRODUCTION

This report documents a study performed in response to NUREG-0737, item II.K.3.16 which requires an evaluation of the feasibility of reducing challenges to the relief valves. This study specifically addresses item 3.1.4.4 of the BWR Owners' Group Evaluation of NUREG-0737, item II.K.3.16, "Reduce MSIV Testing Frequency," as it applies to Browns Ferry Nuclear Plant (letter from D. B. Waters (BWROG) to D. G. Eisenhut (NRC) dated March 31, 1981). Reducing the MSIV testing frequency will directly reduce the challenges to the relief valves and, in return, reduce the likelihood of a stuck-open relief valve.

DISCUSSION

This study is to determine the feasibility of reducing the testing frequency of the main steam line isolation valves and associated instrumentation to reduce the challenges of the relief valves while still maintaining overall system reliability. During a typical 12-month operating cycle on each unit, there are approximately 100 functional tests and 14 integrated calibrations performed on instrumentation associated with the main steam line isolation logic. From the Browns Ferry Nuclear Plant Unit Scram List, there have been approximately 41 inadvertent scrams or isolations in the history of Browns Ferry associated with the MSIVs and associated logic. Of these 33 have occurred while performing a surveillance instruction (SI). Therefore, 80.5 percent of the forced scrams associated with the MSIV logic have occurred as a result of an SI.

Conservatively assuming there have been 12 full 12-month cycles in the history of Browns Ferry units 1, 2, and 3, there has been an average of 2.75 forced scrams/isolations each cycle as a result of a main steam line instrumentation SI. This results in a probability of 0.0275/SI that an individual SI will result in a scram. By reducing the number of functional tests performed during a cycle by over two-thirds, the number of unnecessary scrams could be reduced to less than one scram each cycle. It follows directly that unnecessary challenges to relief valves and other safety systems will be proportionally reduced. Table 1 contains proposed revisions in the testing frequency for the functional tests on several main steam line instruments which will result in the lower scram probability.

The existing testing frequency for instrumentation listed in table 1 was initially established by using the methodology described in the technical specification 4.1 bases. A conservative testing frequency of once each month was established pending further analyses. Similarly, for the main steam line radiation monitor an initial testing frequency of once each week was set.

It is appropriate to show that by reducing the frequency of the functional tests listed in table 1, the overall safety of the systems will not be reduced. The Browns Ferry LER list for units 1, 2, and 3 indicates there have been ten LERs on minor setpoint deviations and only two LERs of any significance discovered during scheduled SIs. The two major LERs were results of failed sensors. Note that no change in calibration frequency is being proposed.

To determine a new functional testing frequency using the technical specification 4.1 bases, the total number of operating hours and the total number of identical components are needed. Table 2 contains the information on each surveillance instruction required, the M value calculated, and the recommended testing interval found from figure 4.1-1 of the technical specifications using the M value and the number of undetected failures. It is shown that an interval of greater than 6 months is justified. Therefore, a required testing frequency of once each three months is being proposed to maintain conservatism.

In summary, from plant records there have been 33 forced scrams associated with the specific functional tests listed in table 1 while the SIs detected only two equipment failures. This in itself would warrant a reduction in testing frequency. By reducing the MSIV isolation testing frequency from once each month to once each 3 months for main steam line isolation valve closure, main steam line low pressure, main steam line high flow, and main steam line high temperature, and from once each week to once each 3 months for main steam line high radiation, it still remains under the recommended frequency of six months as stated earlier and thus remains conservative. Therefore, the reduction of testing frequency will not reduce the margin of safety in detecting failed equipment below the recommended limit but will increase the overall margin of safety by reducing the challenges to the relief valves and other systems. This proposed testing frequency will also increase the unit capacity factor as a result of fewer resulting scrams. Ancillary benefits from human factors considerations included reduction in test activities by technicians and operators, minimization of abnormal system alignment during testing, and reduced paperwork.

CONCLUSIONS

The conclusion of this study is that the challenges to the relief valves can be reduced by reducing the testing frequency of the main steam line instrumentation without reducing system reliability.

TABLE 1

Main Steam Line Instrumentation

SI No.	Title	Functional Test Frequency		Technical Specification Changes
		Current	Proposed	
4.1.A-10	Main Steam Line Radiation Monitor	once/week	once/3 months	Table 4.1.A
4.1.A-11	Main Steam Line Isolation Valve Closure	once/month	once/3 months	Table 4.1.A
4.2.A-6	Low Pressure Main Steam Line	once/month	once/3 months	Table 4.2.A
4.2.A-7	High Flow Main Steam Line	once/month	once/3 months	Table 4.2.A
4.2.A-8	Main Steam Line Tunnel High Temperature	once/month	once/3 months	Table 4.2.A

TABLE 2

M = nT
T = 105120 hours

Surveillance Instruction	Number of Identical Components(n)*	Number of Failures	M	Interval**
4.1.A-10	12	0	1.26×10^6	6 months
4.1.A-11	24	2	2.52×10^6	6 months
4.2.A-6	12	0	1.26×10^6	6 months
4.2.A-7	48	0	5.05×10^6	6 months
4.2.A-8	48	0	5.05×10^6	6 months

*Total number of components for all 3 units.

**Interval from figure 4.1-1 of Browns Ferry Nuclear Plant technical specifications.

REFERENCES

1. Browns Ferry Technical Specifications

2. Browns Ferry Scram List

3. Browns Ferry LER List

4. Jacobs, I.M., "Reliability of Engineered Safety Features as a Function of Testing Frequency," Nuclear Safety, Vol. 9, No. 4, July-August 1968, pp. 303-312