ATTACHMENT A

Revise the Beaver Valley Power Station, Unit No.2
Proposed technical Specification Change No. 47

Revise the Technical Specifications as follows:

Remove Pages	Insert Pages
3/4 3-15	3/4 3-15
3/4 3-33	3/4 3-33
3/4 3-34	3/4 3-34
3/4 3-35	3/4 3-35
3/4 3-36	3/4 3-36
3/4 3-37	3/4 3-37
3/4 3-38	3/4 3-38

3/4.3.2 ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION

SURVEILLANCE REQUIREMENTS

4.3.2.1.1 Each engineered safety feature actuation system instrumentation channel and interlock and the automatic actuation logic with master and slave relays shall be demonstrated OPERABLE by the performance of the ESFAS Instrumentation Surveillance Requirements* during the MODES and at the frequencies shown in Table 4.3-2.

4.3.2.1.2 The logic for the interlocks shall be demonstrated OPERABLE during the at power CHANNEL FUNCTIONAL TEST of channels affected by interlock operation. The total interlock function shall be demonstrated OPERABLE at least once per 18 months during CHANNEL CALIBRATION testing of each channel affected by interlock operation.

4.3.2.1.3 The ENGINEERED SAFETY FEATURES RESPONSE TIME of each ESF function shall be demonstrated to be within the limit at least once per 18 months.** Each test shall include at least one logic train such that both logic trains are tested at least once per 36 months and one channel per function such that all channels are tested at least once per N times 18 months where N is the total number of redundant channels in a specific ESF function as shown in the "Total No. of Channels" Column of Table 3.3-3.

DELETE

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*For the automatic actuation logic, the surveillance requirements shall be the application of various simulated input conditions in conjunction with each possible interlock logic state and verification of the required logic output including, as a minimum, a continuity check of output devices. For the actuation relays, the surveillance requirements shall be the energization of each master and slave relay and verification of OPERABILITY of each relay. The test of master relays shall include a continuity check of each associated slave relay. The test of slave relays (to be performed at least once per 92 days in lieu of at least once per 31 days) shall include, as a minimum, a continuity check of associated actuation devices that are not testable.

**The specified 18-month surveillance interval during the first fuel cycle may be extended to coincide with completion of the first refueling outage.

DELETE

(Proposed Wording)

TABLE 4.3-2

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES IN WHICH SURVEILLANCE REQUIRED
1. SAFETY INJECTION AND FEEDWATER ISOLATION				
a. Manual Initiation	N.A.	N.A.	M(1)	1, 2, 3, 4
b. Automatic Actuation Logic and Actuation Relays	N.A.	N.A.	M(2)	1, 2, 3, 4
c. Containment Pressure-High	S	R	M	1, 2, 3
d. Pressurizer Pressure--Low	S	R	M	1, 2, 3
e. Steam Line Pressure--Low	S	R	M	1, 2, 3
1.1 SAFETY INJECTION-TRANSFER FROM INJECTION TO THE RECIRCULATION MODE				
a. Automatic Actuation Logic, Coincident with Safety Injection Signal	N.A.	N.A.	M(2)	1, 2, 3, 4
b. Refueling Water Storage Tank Level-Extreme Low	S	R	M	1, 2, 3, 4

REPLACE WITH INSERT "A"

(Proposed Wording)

ATTACHMENT TO TABLE 4.3-2
INSERT "A"

(Proposed Wording)

TABLE 4.3-2

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION
SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MASTER RELAY TEST	SLAVE RELAY TEST	MODES IN WHICH SURVEILLANCE REQUIRED
1. SAFETY INJECTION AND FEEDWATER ISOLATION						
a. Manual Initiation	N.A.	N.A.	M (1)	N.A.	N.A.	1, 2, 3, 4
b. Automatic Actuation Logic and Actuation Relays	N.A.	N.A.	M (2)	M(2)	Q(3)	1, 2, 3, 4
c. Containment Pressure-High	S	R	M	N.A.	N.A.	1, 2, 3
d. Pressurizer Pressure--Low	S	R	M	N.A.	N.A.	1, 2, 3
e. Steam Line Pressure--Low	S	R	M	N.A.	N.A.	1, 2, 3
1.1 SAFETY INJECTION-TRANSFER FROM INJECTION TO THE RECIRCULATION MODE						
a. Automatic Actuation Logic, Coincident with Safety Injection Signal	N.A.	N.A.	M (2)	N.A	N.A	1, 2, 3, 4
b. Refueling Water Storage Tank Level-Extreme Low	S	R	M	N.A	N.A	1, 2, 3, 4

TABLE 4.3-2 (Continued)

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES IN WHICH SURVEILLANCE REQUIRED
2. CONTAINMENT SPRAY				
a. Manual Initiation	N.A.	N.A.	M(1)	1, 2, 3, 4
b. Automatic Actuation and Logic Actuation Relays	N.A.	N.A.	M(2)	1, 2, 3, 4
c. Containment Pressure--High-High	S	R	M	1, 2, 3
3. CONTAINMENT ISOLATION				
a. Phase "A" Isolation				
1. Manual Initiation	N.A.	N.A.	M(1)	1, 2, 3, 4
2. Automatic Actuation Logic and Actuation Relays	N.A.	N.A.	M(2)	1, 2, 3, 4
3. Safety Injection	See Functional Unit 1. above for all Safety Injection Surveillance Requirements.			
b. Phase "B" Isolation				
1. Manual Initation	N.A.	N.A.	M(1)	1, 2, 3, 4
2. Automatic Actuation Logic and Actuation Relays	N.A.	N.A.	M(2)	1, 2, 3, 4
3. Containment Pressure--High-High	S	R	M	1, 2, 3, 4

REPLACE WITH INSERT "B"

(Proposed Wording)

ATTACHMENT TO TABLE 4.3-2

INSERT "B"

BEAVER VALLEY - UNIT 2

(Proposed Wording)

TABLE 4.3-2 (Continued)

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MASTER RELAY TEST	SLAVE RELAY TEST	MODES IN WHICH SURVEILLANCE REQUIRED
2. CONTAINMENT SPRAY						
a. Manual Initiation	N.A.	N.A.	M(1)	N.A.	N.A.	1, 2, 3, 4
b. Automatic Actuation and Logic Actuation Relays	N.A.	N.A.	M(2)	M(2)	Q(3)	1, 2, 3, 4
c. Containment Pressure--High-High	S	R	M	N.A.	N.A.	1, 2, 3
3. CONTAINMENT ISOLATION						
a. Phase "A" Isolation						
1. Manual Initiation	N.A.	N.A.	M(1)	N.A.	N.A.	1, 2, 3, 4
2. Automatic Actuation Logic and Actuation Relays	N.A.	N.A.	M(2)	M(2)	Q(3)	1, 2, 3, 4
3. Safety Injection	See Functional Unit 1. above for all Safety Injection Surveillance Requirements.					
b. Phase "B" Isolation						
1. Manual Initation	N.A.	N.A.	M(1)	N.A.	N.A.	1, 2, 3, 4
2. Automatic Actuation Logic and Actuation Relays *	N.A.	N.A.	M(2)	M(2)	Q(3)	1, 2, 3, 4
3. Containment Pressure--High-High	S	R	M	N.A.	N.A.	1, 2, 3, 4

* Includes testing of CIB actuated slave relay(s) associated with Control Room Emergency Ventilation

TABLE 4.3-2 (Continued)

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES IN WHICH SURVEILLANCE REQUIRED
4. STEAM LINE ISOLATION				
a. Manual Initiation				
1. Individual	N.A.	N.A.	M(1)	1, 2, 3
2. System	N.A.	N.A.	M(1)	1, 2, 3
b. Automatic Actuation Logic and Actuation Relays	N.A.	N.A.	M(2)	1, 2, 3
c. Containment Pressure--Intermediate-High-High	S	R	M	1, 2, 3
d. Steam Line Pressure--Low	S	R	M	1, 2, 3
e. Steamline Pressure Rate-High Negative	S	R	M	1, 2, 3
5. TURBINE TRIP AND FEEDWATER ISOLATION				
a. Automatic Actuation Logic and Actuation Relays	N.A.	N.A.	M(2)	1, 2, 3
b. Steam Generator Water Level--High-High, P-14	S	R	M	1, 2, 3
c. Safety Injection	See Functional Unit 1 above for all Safety Injection Surveillance Requirements.			

REPLACE WITH INSERT "C"

(Proposed Wording)

ATTACHMENT TO TABLE 4.3-2
INSERT "C"

(Proposed Wording)

TABLE 4.3-2 (Continued)

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION
SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MASTER RELAY TEST	SLAVE RELAY TEST	MODES IN WHICH SURVEILLANCE REQUIRED
4. STEAM LINE ISOLATION						
a. Manual Initiation						
1. Individual	N.A.	N.A.	M (1)	N.A.	N.A.	1, 2, 3
2. System	N.A.	N.A.	M (1)	N.A.	N.A.	1, 2, 3
b. Automatic Actuation Logic and Actuation Relays	N.A.	N.A.	M(1)	M(2)	Q(3)	1, 2, 3
c. Containment Pressure--Intermediate-High-High	S	R	M	N.A.	N.A.	1, 2, 3
d. Steam Line Pressure--Low	S	R	M	N.A.	N.A.	1, 2, 3
e. Steamline Pressure Rate-High Negative	S	R	M	N.A.	N.A.	1, 2, 3
5. TURBINE TRIP AND FEEDWATER ISOLATION						
a. Automatic Actuation Logic and Actuation Relays	N.A.	N.A.	M(1)	M(2)	Q(3)	1, 2, 3
b. Steam Generator Water Level--High-High, P-14	S	R	M	N.A.	N.A.	1, 2, 3
c. Safety Injection	See Functional Unit 1 above for all Safety Injection Surveillance Requirements.					

TABLE 4.3-2 (Continued)

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION
SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES IN WHICH SURVEILLANCE REQUIRED
6. LOSS OF POWER				
a 4.16kv Emergency Bus	N.A.	R	M	1, 2, 3, 4
1. Undervoltage (Trip Feed)				
2. Undervoltage (Start Diesel)	N.A.	R	M	1, 2, 3, 4
b. 4.16kv Emergency Bus (Degraded Voltage)	N.A.	R	M	1, 2, 3, 4
c. 480 Volt Emergency Bus (Degraded Voltage)	N.A.	R	M	1, 2, 3, 4
7. AUXILIARY FEEDWATER*				
a. Automatic Actuation Logic and Actuation Relays	N.A.	N.A.	M(2)	1, 2, 3
b. Steam Generator Water Level--Low-Low				
1. Start Turbine Driven Pump	S	R	M	1, 2, 3
2. Start. Motor Driven Pumps	S	R	M	1, 2, 3
c. Undervoltage - RCP (Start Turbine Driven Pump)	S	R	M	1, 2

*Manual initiation is included in Specification 4.7.1.2.

REPLACE WITH INSERT "D"

(Proposed Wording)

ATTACHMENT TO TABLE 4.3-2

INSERT "O"

BEAVER VALLEY - UNIT 2

(Proposed Wording)

TABLE 4.3-2 (Continued)

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION
SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MASTER RELAY TEST	SLAVE RELAY TEST	MODES IN WHICH SURVEILLANCE REQUIRED
6. LOSS OF POWER						
a. 4.16kv Emergency Bus	N.A.	R	M	N.A.	N.A.	1, 2, 3, 4
1. Undervoltage (Trip Feed)						
2. Undervoltage (Start Diesel)	N.A.	R	M	N.A.	N.A.	1, 2, 3, 4
b. 4.16kv Emergency Bus (Degraded Voltage)	N.A.	R	M	N.A.	N.A.	1, 2, 3, 4
c. 480 Volt Emergency Bus (Degraded Voltage)	N.A.	R	M	N.A.	N.A.	1, 2, 3, 4
7. AUXILIARY FEEDWATER*						
a. Automatic Actuation Logic and Actuation Relays	N.A.	N.A.	M(1)	M(2)	Q(3)	1, 2, 3
b. Steam Generator Water Level--Low-Low						
1. Start Turbine Driven Pump	S	R	M	N.A.	N.A.	1, 2, 3
2. Start Motor Driven Pumps	S	R	M	N.A.	N.A.	1, 2, 3
c. Undervoltage - RCP (Start Turbine Driven Pump)	S	R	M	N.A.	N.A.	1, 2

*Manual initiation is included in Specification 4.7.1.2.

(Proposed Wording)

TABLE 4.3-2 (Continued)

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION
SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES IN WHICH SURVEILLANCE REQUIRED
7. AUXILIARY FEEDWATER (continued)				
d. Safety Injection (Start Motor-Driven Pumps)	See 1 above (all SI surveillance requirements)			
e. Trip of Main Feedwater Pumps (Start Motor-Driven Pumps)	N.A.	N.A.	R	1, 2, 3
8. ENGINEERED SAFETY FEATURE INTERLOCKS				
a. Reactor Trip, P-4	N.A.	N.A.	R(3)	1, 2, 3
b. Pressurizer Pressure, P-11	N.A.	R	M	1, 2, 3
c. Low-Low T_{avg}, P-12	N.A.	R	M	1, 2, 3

REPLACE WITH INSERT "E"

ATTACHMENT TO TABLE 4.3-2

INSERT "E"

TABLE 4.3-2 (Continued)

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MASTER RELAY TEST	SLAVE RELAY TEST	MODES IN WHICH SURVEILLANCE REQUIRED
7. AUXILIARY FEEDWATER (continued)						
d. Safety Injection (Start Motor-Driven Pumps)	See 1 above (all SI surveillance requirements)					
e. Trip of Main Feedwater Pumps (Start Motor-Driven Pumps)	N.A.	N.A.	R	N.A.	N.A.	1, 2, 3
8. ENGINEERED SAFETY FEATURE INTERLOCKS						
a. Reactor Trip, P-4	N.A.	N.A.	R	N.A.	N.A.	1, 2, 3
b. Pressurizer Pressure, P-11	N.A.	R	M	N.A.	N.A.	1, 2, 3
c. Low-Low T_{avg}, P-12	N.A.	R	M	N.A.	N.A.	1, 2, 3

(Proposed Wording)

TABLE 4.3-2 (Continued)

TABLE NOTATION

DELETE

(1) Manual actuation switches shall be tested at least once per 18 months during shutdown. This 18-month surveillance interval during the first fuel cycle may be extended to coincide with completion of the first refueling outage for Containment Spray, Safety Injection and Feedwater Isolation and Phase B Isolation manual actuation switches. All other circuitry associated with manual safeguards actuation shall receive a CHANNEL FUNCTIONAL TEST at least once per 31 days.

(2) Each train or logic channel shall be tested at least every other 31 days.

(3) ~~The specified surveillance interval during the first fuel cycle may be extended to coincide with completion of the first refueling outage.~~

Slave relays that satisfy at least one of the following criteria are required to be functionally tested on a refueling frequency basis only, all other slave relays will be tested on a quarterly frequency:

a. A single failure in the Safeguards Test Cabinet circuitry would cause an inadvertent RPS or ESF actuation.

b. The test will adversely affect two or more components in one ESF system or two or more ESF systems.

c. The test will create a transient (reactivity, thermal, or hydraulic) condition on the RCS.

(Proposed Wording)

ATTACHMENT B

Beaver Valley Power Station, Unit No. 2
Proposed Technical Specification Change No. 47
REVISION OF TECHNICAL SPECIFICATION 4.3.2.1.1

DESCRIPTION OF AMENDMENT REQUEST

e proposed amendment would allow slave relay testing to be nducted on a refueling frequency for those slave relays which tisfy certain screening criteria. The slave relays which do not tisfy the screening criteria will continue to be tested on a arterly test frequency. A Master Relay column and a Slave Relay lumn would be added to Table 4.3-2 to denote required test equencies and applicable notes. A new Table Notation (3) would be ded which specifies the previously mentioned screening criteria for arterly testing of slave relays. A note would be added to Table 3-2 Item 3.b.2 to denote that this item includes testing of CIB tuated slave relay(s) associated with control room emergency ntilation. Part of Table Notation (1) and the entire Table tation (3) would be deleted since they were only applicable for the rst fuel cycle.

BACKGROUND

e following information describes slave relay testing as applicable Beaver Valley Power Station (BVPS) Unit 2 solid state protection stem (SSPS). Slave relays are tested to comply with Technical ecification 3.3.2.1, Surveillance Requirements 4.3.2.1.1, Table 3-2 for actuation relays. A note at the bottom of Technical ecification page 3/4 3-15 states in part:

"The test of slave relays (to be performed at least once per 92 days in lieu of at least once per 31 days) shall include, as a minimum, a continuity check of associated actuation devices that are not testable."

tuation devices are considered to be equipment (i.e. pumps, valves, mers, etc.) that function upon slave relay actuation.

e solid state protection system output slave relays were designed r contact multiplication from the master relays to actuate various gineered safety features (ESF) components directly or through xiliary relays. The system was provided with a test cabinet for sting the slave relays. The test circuitry will actuate the slave lays and either allow equipment to operate (go testing), or block s operation (blocked testing) if it will result in an adverse pact on the unit. The original design of this test circuitry did t consider all operational factors which may lead to reduced level safety while performing slave relay testing during plant eration. Attachment B-2 titled "Test Circuit Operation" contains a chnical description of the three basic types of test circuits used the safeguards test cabinet. Attachment B-3 titled "Safeguards sting Cabinet Blocking Circuit Failure Analysis" contains an alysis of the types of failures that can occur in blocking type st circuits.

ertain equipment cannot be re-positioned by slave actuation at power ithout resulting in a reactor trip. Therefore, these slave relays ave blocking schemes incorporated in the test circuit design. Other SPS slaves if actuated individually cause partial ESF actuations and quipment operation. In anticipation of such undesirable results, any systems must be manipulated extensively to prepare for a slave elay test and re-aligned after testing to restore plant conditions o normal system arrangement. In many cases, equipment is eliberately disabled by closing a valve or opening a component reaker to accommodate continuity testing. In several instances, reakers are racked to the test position, control power fuses pulled nd jumpers installed to allow use of a MCC TEST SET to verify ontactor actuation. Once a component's status is altered to prepare or a relay test, it is no longer available to perform its design afety function if called upon. Without local operator action to eset the relay in test and/or restore system mechanical and lectrical alignments, the ESF equipment would not perform as xpected.

n the interest of prompt restoration in the event of an actual ESF ignal, each slave relay test includes a precaution to return all est switches to normal. The reset switch in the test cabinet is ommon and would result in at least momentary reset of ALL SLAVE ELAYS in that Train. The consequences of such action are npredictable due to time dependence (whether valves have reached the ull stroke limit, etc.), which relay was under test, and what ESF ignal was received.

perations personnel have always been concerned about performing SSPS lave relay testing outside the design of the Solid State Protection ystem. Deliberately disabling ESF equipment or closing a normally pen valve to demonstrate that it will open on slave actuation, or topping a pump, re-aligning a flow system, then re-starting the pump ith slave actuation seems to be an unnecessary cycle of equipment nd potentially dangerous. The potential for undesirable system ransients is very high.

ven blockable testing of slave relays involves some risk. This was vident when one MG-6 relay failed to block during undervoltage esting of a normal 4160 volt bus. A reactor trip occurred due to he trip of a reactor coolant pump. (See IR2-88-35 and LER 2-88-07 n 4-4-88). A blocking relay failure during SSPS slave relay testing ould occur with similar undesirable results.

nother area of concern is human error. Due to the number of people nvolved and the complex nature of the testing, significant potential or human error exists. One possible scenario might be actuation of he incorrect relay. This could be very significant since test onditions are established to expect certain equipment to actuate or est continuity in a disabled state. Actuation of the incorrect elay would start equipment whose associated system valves may be e-energized in the non-ESF position. This is the case because

several relays are used for each ESF function, (i.e. SI^ CIA, CIB/Containment Spray Actuation) and components actuated by a single relay are not always consistent with system needs. By design, unless all relays for a train of SSPS actuate at the same time a safety system will not function as expected.

Since November 1987, BVPS Unit 2 has been performing SSPS slave relay testing on a quarterly basis to comply with technical specification requirements. To date, there have been no SSPS relay failures to actuate upon demand. In contrast, several incident and licensee event reports have been written documenting inadvertent ESF actuations and other undesirable conditions during such testing. The licensee event and incident reports are as follows:

- LER 88-016-00 - Auto start of B chemical injection pump
- IR 2-89-83 - Incorrect test method-trip startup feed pump on SSPS relay actuation
- LER 90-004-01 - Charging valve closure when breaker was closed before SI reset
- LER 90-009-00 - Letdown isolation on loss of containment air pressure

Since the onset of testing, surveillance test procedures have been revised numerous times to reduce the potential for causing a plant upset while still complying with technical specification requirements.

C. JUSTIFICATION

The proposed change would allow slave relay testing to be conducted on a refueling frequency for those slave relays which satisfy any of the following criteria:

1) A single failure in the safeguards test cabinet circuitry would cause an inadvertent reactor protection system (RPS) or engineered safety feature (ESF) actuation.

2) The test will adversely affect two or more components in one ESF system or two or more ESF systems.

3) The test will create a transient (reactivity, thermal, or hydraulic) condition on the reactor coolant system (RCS).

These criteria are the same that were approved under Amendments 123 and 107, (TAC NOS, 73236 and 73237), for Virginia Electric and Power Company North Anna Units 1 and 2.

In accordance with the Safety Guide 22, actuation devices and actuated equipment are to be designed to permit testing during power operation. If this operation could damage plant equipment or disrupt reactor operation, alternative methods for testing are provided in the Safety Guide. These methods include testing relays in judiciously selected groups, preventing the operation of certain

actuated equipment, or designing the system so that it requires more than one actuation device to operate the equipment. In any case, actuation devices and equipment should be tested. As stated in Section D, part 4 of Safety Guide 22, where actuated equipment can not be operated, it should be shown that there is no practicable design to permit operation of the actuated equipment, there is a low probability of failure, and the equipment can be tested during shutdown.

Safety Guide 22 provides guidance when the design will not allow safe testing of plant equipment. The slave relays which meet at least one of the three proposed screening criteria that were previously stated would satisfy Section D, part 4a of Safety Guide 22. A summary of specific relays which meet this criteria is shown in Attachment B-1. A summary of failures that can occur in a blocking circuit are provided in Attachment B-3 and are supported by proposed screening criteria No. 1. A fourth criteria is also stated in Attachment B-1, which is for slave relays which can be tested during plant operation.

Safety Guide 22 Section D, part 4b and 4c states, "The probability that the protection system will fail to initiate the operation of the actuated equipment is, and can be maintained, acceptably low without testing the actuated equipment during reactor operation, and the actuated equipment can be routinely tested when the reactor is shut down". A high level of confidence that the relay will perform its safety function will be maintained by the system design and testing. The slave relays are designed to be normally de-energized there-by reducing their susceptibility to failure modes common to energized components. Master relay tests will still be conducted on a quarterly frequency. Master relay tests include a coil continuity of the slave relays. A limited number of slave relays will continue to be tested during plant operation (see Attachment B-1, Criteria (4)). By testing a portion of the slave relays each quarter, there is a reasonable time limit in which common-mode failure could be detected. A total ESF functional test every refueling outage will ensure that all slave relays and auxiliary contacts function properly. To date, there have been no SSPS relay failures to actuate upon demand. Considering the reliability of the SSPS relays, coupled with the fact that there are two safety trains, the probability of a slave relay failing to actuate is extremely low and the probability for its redundant relay failing concurrently is even lower. Therefore, the proposed change to the SSPS relays test frequencies is consistent with Section D, part 4 of Safety Guide 22.

The reduction in the scope of slave relay testing is also consistent with the NRC Policy issued October 26, 1988 (Secy 88-304) regarding "Staff Actions to Reduce Testing at Power" wherein the stated ultimate objective is to eliminate testing at power for equipment where acceptable reliability can be achieved without such testing. Based on the above, there is reasonable assurance that the relays will function as required with the proposed testing schedule.

A reduction in the number of slave relays which are required to be tested on a quarterly basis would save approximately 180 man-hours of operator time each quarter and remove eight surveillance tests

lving sixty-eight different SSPS slave relays and reduce human r potential. Each relay test, whether Blockable or Go testing, the potential to cause a plant upset, reactor trip or forced down should test circuit failure or operator error occur. On the age, Go testing involves four to eight operators, Blockable ing takes three to four operators, and SIS Go testing involves to twelve operators. Blockable testing normally is performed in to two hours where Go testing takes the entire shift. Due to the lex nature of testing and system alteration/re-alignments, only slave relay test (5-6 relays per test) is scheduled each week a 10 week period.

e relay testing results in undue hardship and unusual umstances without a compensating increase in the level of quality safety. It provides increased opportunity for human error (as in previously noted LER's) as complex controls - involving encing jumpers and lifted leads, special test equipment, special trical and mechanical alignments in multiple locations under ed plant specific conditions - challenge both operator and edures. It also results in many hours of plant operation with aded safeguards status.

ote ould be added to Table 4.3-2 Item 3.b.2, which would state this item includes testing of CIB actuated slave relay(s) ciated with control room emergency ventilation. This change will ify that in addition to the Surveillance Requirement 4.7.7.1.e.6, h requires that the control room bottled air pressurization em is initiated from a CIB signal on an 18 month frequency, the ability of CIB actuated slave relays associated with the control emergency ventilation system is required to be demonstrated ABLE in accordance with surveillance requirement 4.3.2.1.1.

2/3 chlorine detectors/control room isolation actuation relays A/K630B) are included in Attachment B-1. These relays were itted to be tested as part of SSPS on a quarterly frequency as ed in a DLC letter to the NRC (2NRC-7-128) dated May 22, 1987. ing of the K630A/K630B relays, which isolates both trains of the rol room emergency pressurization system, on a quarterly uency creates that same operational impact and degrades overall safety as does many of the other relays included in Attachment Therefore, these relays are included to justify changing their frequency from quarterly to refueling.

SAFETY ANALYSIS

additional assurance of equipment operability provided by testing slave relays on line is negated by the adverse consequences such the overall margin of safety is reduced. The testing of certain relays on line requires significant plant manipulations, rmal configurations, and the removal from service of various

ipment for the duration of the slave relay test. (See Attachment). By imposing off-normal plant manipulations and configurations, re is an increased probability of human error or component function which may lead to more significant events. In the event actual demand was required during this time, some equipment would be available to perform its intended safety function. The safety lications of this are significant when considering that a single lure on the opposite train could result in a total loss of an ESF ety function. This could also lead to a more safety significant nt and could cause the BVPS Unit 2 design basis and accident lysis to be exceeded.

any ESF component fails to actuate due to a malfunction or failure a slave relay or its contacts, adequate testing, design, and inistrative controls exist to ensure that the mitigative function ESF equipment can be relied upon to perform the required safety ated function. The majority of all ESF equipment (i.e., pumps and ves) is tested at least quarterly by the BVPS Unit 2 Inservice t (IST) Program . These tests verify equipment operability as l as the operability of the manual actuation circuitry. The ual actuation circuitry was designed such that a failure of the ve relay will not prevent the equipment from being manually uated. Therefore, if a slave relay fails, manual actuation is ll available. Immediate actions described in the emergency rating procedures ensure that all equipment actuates by requiring manual actuation for equipment which may not automatically rate. Major equipment is verified immediately while verification all equipment takes approximately five minutes to perform. refore, the reliability of ESF equipment to perform its safety ction remains high, and any additional assurance provided by ting all of the relays on line does not outweigh the possible sequences incurred as a result of current slave relay testing.

reliability of the slave relays has been effectively demonstrated recognizing that no slave relay has ever failed to actuate upon and. Testing some of the relays, but not all, provides adequate urance of equipment operability and relay reliability without jecting the unit to compromising conditions. Such testing has the rall effect of increasing the margin of safety.

refore, this change is considered safe based on the reduction in associated with testing all the slave relays on line. Current ting is not justified by the circuit failure analysis, operational ect, and safety significance when there presently exists adequate ign features, sufficient, safe and proven testing methods, and inistrative controls to assure proper equipment operation.

NO SIGNIFICANT HAZARDS EVALUATION

The no significant hazard considerations involved with the proposed amendment have been evaluated, focusing on the three standards set forth in 10 CFR 50.92(c) as quoted below:

The Commission may make a final determination, pursuant to the procedures in paragraph 50.91, that a proposed amendment to an operating license for a facility licensed under paragraph 50.21(b) or paragraph 50.22 or for a testing facility involves no significant hazards consideration, if operation of the facility in accordance with the proposed amendment would not:

(1) Involve a significant increase in the probability or consequences of an accident previously evaluated; or

(2) Create the possibility of a new or different kind of accident from any accident previously evaluated; or

(3) Involve a significant reduction in a margin of safety.

The following evaluation is provided for the no significant hazards consideration standards.

1. Does the change involve a significant increase in the probability or consequences of an accident previously evaluated?

   The design and safety function of the ESF system and associated equipment have not changed. The availability of ESF components (i.e. pumps and valves) has increased by not placing them in off normal configurations. This has the effect of decreasing the probability and consequences of previously evaluated accidents. The reduced surveillance frequency for slave relays will not cause a significant increase in the probability or consequences of an accident previously evaluated due to the demonstrated very low failure rate of the slave relays. Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the change create the possibility of a new or different kind of accident from any accident previously evaluated?

   The design and safety function of any component or system has not been changed. Overall system availability is increased by not testing certain slave relays during plant operation and the probability of challenging single failure accident analysis is reduced. Therefore, the proposed changes do not create the possibility of a new or different kind of accident previously evaluated.

3. Does the change involve a significant reduction in a margin of safety?

   The proposed change will continue to ensure that the ESF protection system maintains an overall system functional capability comparable to the original design standards. The

documented SSPS relay failure rates show a high level of reliability. By continuing to test a portion of the slave relays each quarter, there will not be a significant reduction in the margin of safety due to an undetected common mode failure. Any perceived decrease in the margin of safety through reduced frequency testing will be offset through fewer abnormal plant configurations, including significant plant manipulation, and removal from service of various plant equipment. Therefore, the proposed change does not involve a significant reduction in a margin of safety.

F. NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

Based on the considerations expressed above, it is concluded that the activities associated with this license amendment request satisfies the no significant hazards consideration standards of 10 CFR 50.92(c) and, accordingly, a no significant hazards consideration finding is justified.

G. ENVIRONMENTAL EVALUATION

The proposed changes have been evaluated and it has been determined that the changes do not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amount of any effluents that may be released off site, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed changes meet the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22 (c) (9). Therefore, pursuant to 10 CFR 51.22 (b), an environmental assessment of the proposed changes is not required.

H. UFSAR CHANGES

Attachment D provides changes to the UFSAR to accommodate the proposed revisions to the slave relay testing requirements. The UFSAR changes are provided for information only and will be incorporated following approval of the proposed Technical Specification changes.

ATTACHMENT B-1
Beaver Valley Power Station, Unit No. 2
Proposed Technical Specification Change No. 47
Equipment Testing Requirements Evaluation

The attached evaluation provides the basis for which SSPS output relays should not be tested during plant operation.

EQUIPMENT TESTING REQUIREMENTS EVALUATION

The attached data sheets identify the SSPS output relays for one train which perform an ESF function. The other train is similar; any differences will be noted. The data sheets describe the signal which actuates the relay and lists the major equipment tested by the relay and the type of test performed (Block or Go). The data sheets also describe the design function, operational impact of testing, and safety significance of testing each relay. The relays are grouped by actuation signal. The first relay in each group describes the function of the actuation signal. The remaining relays in the group do not repeat the function of the actuation signal to eliminate redundancy. Details on why specific equipment is actuated by each relay is located in each design function description.

Based on operational impact and safety significance of testing, the relays have been categorized according to the following:

Category 1: A single failure in the safeguards test cabinet circuitry would cause an inadvertent RPS or ESF actuation.

Category 2: The test will adversely affect two or more components in one ESF system or two or more ESF systems.

Category 3: The test will create a transient (reactivity, thermal, or hydraulic) condition on the RCS.

Category 4: Testable during plant operation.

A summary of specific items such as test category and actuation signal are contained in Tables 1 and 2.

The results below show how many relays fall into each category:

Category 1: 13 Relays
Category 2: 48 Relays
Category 3: 7 Relays
Category 4: 6 Relays

TABLE 1

Train "A"

Relay	Test Category	Actuation Signal	Type	Test Plan	Page #
K602A	4	Safety Injection (SI)	Go	Quarterly/Refueling	7
K603A/K603XA	2	SI	Go	Refueling	8
K604A/K604XA	2	SI	Go	Refueling	10
K609A	2	SI	Go	Refueling	12
K610A/K610XA	3	SI	Go	Refueling	14
K611A/K611XA	2	SI	Go	Refueling	16
K605A	3	Containment Isolation Phase A (CIA)	Go	Refueling	18
K606A	2	CIA	Go	Refueling	22
K607A	1	CIA	Blocked	Refueling	24
K612A	4	CIA	Go	Quarterly/Refueling	25
K613A/K613XA	2	CIA	Go	Refueling	26
K614A/K614XA	2	CIA	Go	Refueling	28
K618A/K618XA	2	Containment Isolation Phase B (CIB)	Go	Refueling	30
K619A	1	CIB	Blocked	Refueling	32
K626A/K626XA	2	CIB	Go	Refueling	33

TABLE 1; Continued

Train "A"

Relay	Test Category	Actuation Signal	Type	Test Plan	Page #
K643A	2	CIB/Spray Actuation	Go	Refueling	35
K644A	2	CIB/Spray Actuation	Go	Refueling	37
K645A	2	CIB/Spray Actuation	Go	Refueling	39
K621A	1	Feedwater Isolation	Blocked/Go	Refueling	42
K622A	1	Feedwater Isolation	Blocked	Refueling	43
K616A	4	Steam Line Isolation	Go	Quarterly/Refueling	45
K623A	1	Steam Line Isolation	Blocked	Refueling	46
K632A	2	Reactor trip	Go	Refueling	47
K633A	2	2/3 S/G Level Low-Low	Go	Refueling	47
K634A	2	2/3 S/G level Low-Low	Go	Refueling	49
K635A	1	Turbine trip	Blocked	Refueling	50
K625A	2	CIB/Control Room Isolation	Go	Refueling	51
K630A	2	Chlorine/Control Room Isolation	Go	Refueling	53

TABLE 2

Train "B"

Relay	Test Category	Actuation Signal	Type	Test Plan	Page #
K602B	4	Safety Injection (SI)	Go	Quarterly/Refueling	7
K603B/K603XB	2	SI	Go	Refueling	8
K604B/K604XB	2	SI	Go	Refueling	10
K609B	2	SI	Go	Refueling	12
K610B/K610XB	3	SI	Go	Refueling	14
K611B/K611XB	2	SI	Go	Refueling	16
K605B	3	Containment Isolation Phase A (CIA)	Go	Refueling	20
K606B	2	CIA	Go	Refueling	22
K607B	1	CIA	Blocked	Refueling	24
K612B	4	CIA	Go	Quarterly/Refueling	25
K613B/K613XB	2	CIA	Go	Refueling	26
K614B/K614XB	2	CIA	Go	Refueling	28
K618B/K618XB	2	Containment Isolation Phase B (CIB)	Go	Refueling	30

TABLE 2; Continued

Train "B"

Relay	Test Category	Actuation Signal	Type	Test Plan	Page #
K619B	1	CIB	Blocked	Refueling	32
K626B/K626XB	2	CIB	Go	Refueling	33
K643B	2	CIB/Spray Actuation	Go	Refueling	35
K644B	2	CIB/Spray Actuation	Go	Refueling	37
K645B	2	CIB/Spray Actuation	Go	Refueling	39
K601B	1	Feedwater Isolation	Blocked	Refueling	41
K620B	1	Feedwater Isolation	Blocked	Refueling	41
K621B	1	Feedwater Isolation	Blocked/Go	Refueling	42
K636B	3	Feedwater Isolation	Go	Refueling	44
K616B	4	Steam Line Isolation	Go	Quarterly/Refueling	45
K623B	1	Steam Line Isolation	Blocked	Refueling	46
K632B	2	Reactor Trip	Go	Refueling	47
K633B	2	2/3 S/G Level Low-Low	Go	Refueling	47
K634B	2	2/3 S/G Level Low-Low	Go	Refueling	49
K635B	1	Turbine Trip	Blocked	Refueling	50
K625B	2	CIB/Control Room Isolation	Go	Refueling	51
K630B	2	Chlorine/Control Room Isolation	Go	Refueling	53

RELAY: K602A (Train-B Relay K602B testing identical)

ACTUATION SIGNAL: Safety Injection

TEST CATEGORY: (4)

RELAY ACTUATION TYPE: (Go)

MAJOR EQUIPMENT ACTUATED:

1. Trip [2HVR*FN202B1] Control Rod Drive Mechanism (CRDM) shroud cooling fan.

2. Close [2SWM*MOV562] [2SWM*MOV561] chlorine injection to A&B service water headers

3. Open [2HCS*SOV133A] [2HCS*SOV134A] Hydrogen analyzer isolation valves.

DESIGN FUNCTION:

The K602A relay actuates on a safety injection signal which protects against a loss-of-coolant, steam generator tube rupture, or a steam line break accident. Automatic actuations of the safety injection system ensures that emergency core cooling and reactivity control are provided. The K602A relay trips the no longer required shroud cooling fan and isolates the non-safety grade chlorine injection lines to prevent an undesired leak path. The hydrogen analyzer valves are opened to initiate sampling of the containment atmosphere for hydrogen.

OPERATIONAL IMPACT OF TESTING:

1. Operator action is needed to start the CRDM fan if not in service and to re-align after relay testing.

2. Operator action is needed to place the chlorine injection system back in service after relay testing.

3. Operator action is needed to re-align hydrogen analyzer valves after relay testing.

SAFETY SIGNIFICANCE OF TESTING:

1. The CRDM fans are used in the EOPs to cool the reactor head and minimize steam bubble formation during a natural circulation cooldown. Repeated cycling of the fans increases the likelihood of motor and blading failure, repair of which would require a plant shutdown. The fans also exhaust the reactor coolant pump cubicles and cool the control rod drive coil stacks and digital rod position indication coils, both of which are temperature sensitive.

<u>RELAY</u>: K603A, K603XA (Train-B Relays K603B, K603XB testing identical)

<u>ACTUATION SIGNAL</u>: Safety Injection

<u>TEST CATEGORY</u>: (2)

<u>RELAY ACTUATION TYPE</u>: (Go)

<u>MAJOR EQUIPMENT ACTUATED</u>:

1. Contactor actuation for [2CHS*LCV115B] RWST supply to charging pumps
2. Contactor actuation for [2CHS*LCV115C] VCT supply to charging pumps
3. Contactor actuation for [2CHS*MOV289] normal charging isolation
4. Open [2SIS*MOV867C] cold leg injection valve (flow remains isolated)
5. Trip (or contactor actuation) for [2HVR*FN201A(C)] CNMT air recirculation fans
6. Trip (or contactor actuation) for [2HVR*FN202A1] CRDM shroud cooling fan
7. Trip (or contactor actuation) for [2RCP*H2D] PRZR heater backup group D

<u>DESIGN FUNCTION</u>:

The K603A and K603XA relays actuate on a safety injection (SI) signal. These relays open or close valves necessary to ensure that a flow path exists from the refueling water storage tank (RWST) to the reactor core via the high head injection pumps during the initial phase of SI. The containment air recirculation and the control rod drive mechanism cooling fans are tripped by these relays since they are no longer required. The pressurizer backup heaters are tripped by these relays for the same reason.

<u>OPERATIONAL IMPACT OF TESTING</u>:

<u>For items 1 thru 3 (above)</u>

If allowed to actuate, the normal charging valve would begin to close as the RWST supply valve begins to open. When the RWST supply valve is fully open the VCT isolation valve would begin to close. For the duration of this test a boration of the RCS will occur. The boration rate would be at lease 15 gpm assuming seal injection flow only. The significance of this boration increases with core life. In addition pressurizer level would decrease

unless letdown was isolated. One method to test this relay and contacts would require going on excess letdown and diluting the RCS to allow rods to compensate for the boration. Boration is undesirable, therefore, contactor actuation is the method used to verify relay actuation. This method, however, requires the breakers for these valves to be placed in the OFF position rendering their automatic functions inoperable. With the MCC breakers in the OFF position to remove 480 VAC from the valve motors, leads are lifted, control power fuse pulled and a MCC test set is attached to each of the three valve breakers in succession. This test set uses three hookup leads and jumpers 120 VAC to the line starter to verify contactor actuation without valve motion. While these checks are performed, the slave relay is in test and is not reset until all breakers have been checked. Also electrical maintenance personnel are required to lift leads prior to the slave test and to re-land the lead after testing. Human error resulted in isolating charging to the RCS when a breaker was inadventenly re-closed before the SIS signal was reset during performance of this slave relay testing (See LER 90-004-01).

<u>For Items 4 thru 7 (above)</u>

These components are allowed to actuate and require operator action to restore to pretest conditions. For containment air recirculation fans, if tripping is not desirable, relay contacts are visually observed to have changed position. Restoration requires cycling the breakers to reset the relays.

<u>SAFETY SIGNIFICANCE OF TESTING</u>:

One train of high head SI is made inoperable by de-energizing the valves which are required to align the high head safety injection pumps to the RWST. A single failure of the redundant train will result in loss of the initial phase of emergency core cooling and reactivity control.

<u>RELAY</u>: K604A, K604XA (Train-B Relay K604B, K604XB testing identical except that common HHSI mini-flow isolation 2CHS*MOV373 is rendered inoperable for contractor actuation using the MCC test set with its breaker OFF).

<u>ACTUATION SIGNAL</u>: Safety Injection

<u>Test Category</u>: (2)

<u>RELAY ACTUATION TYPE</u>: (Go)

<u>MAJOR EQUIPMENT ACTUATED</u>:

1. Open [2SIS*MOV867A] cold leg injection
2. Contactor Actuation (or circuit continuity) for [2SIS*MOV865A] "A" Accumulator discharge
3. Trip [2HVR*FN202C1] CRDM shroud cooling fan
4. Trip [2RCP*H2A] PRZR heater backup group A
5. Trip [2HVW*FN269A] Alternate intake structure exhaust fan
6. Closure (or contactor actuation) for [2CHS*MOV275A, B, C] HHSI mini-flow recirculation valves

<u>DESIGN FUNCTION</u>:

The K604A and K604XA relays actuate on a safety injection (SI) signal. These relays open the valve which establishes cold leg injection to the reactor coolant system. The relays also ensure that the accumulator discharge valve is open and capable of performing its passive core injection function. The three electrical loads (items 3-5) are tripped since they are no longer required. The mini-flow recirculation valves are closed to ensure all SI flow is directed to reactor core.

<u>OPERATIONAL IMPACT OF TESTING</u>:

<u>For Item 1</u>

The cold leg injection valve is allowed to open and requires operator action to re-close after slave testing.

<u>For Item 2</u>

Since the accumulator discharge valve cannot be closed during power operation, slave actuation is verified by banana jack white light illuminated. If the valve is closed during shutdown, slave actuation is verified by continuity measurement at contactor terminal points. Restoration after slave actuation requires operator action to cycle the power breaker OFF then ON.

For Items 3 thru 5

These components are allowed to trip during slave actuation. Operator action is required to energize this equipment if not in operation and to restore to pretest conditions.

For Item 6

Testing these valves requires operator action to open the recirculation valves for the charging pumps not in service. For the in-service charging pump, the MCC test set is used to verify contactor actuation but requires the valve to be de-energized rendering its auto closure function inoperable for the duration of the test.

SAFETY SIGNIFICANCE OF TESTING:

The auto closure function for the charging pump mini-flow recirculation is inoperable for the duration of the test. The auto closure function ensures that total flow from the charging pumps goes to the safety injection system for reactor core cooling and reactivity control. One train of high head safety injection is degraded for the duration of this test.

RELAY: K609A (Train-B Relay K609B testing identical)

ACTUATION SIGNAL: Safety Injection

TEST CATEGORY: (2)

RELAY ACTUATION TYPE: (Go)

MAJOR EQUIPMENT ACTUATED:

1. Start [2SWS*P21A] service water pump
2. Start [2CHS*P21A] HHSI pump (High Head Safety Injection Pump)
3. Start [2SIS*P21A] LHSI pump (Low Head Safety Injection Pump)
4. Start [2SWS*STRN47] Train A service water seal water strainer
5. Close [2SWS*SOV118A] normal filtered water supply to SWS pumps
6. Close [2QSS*AOV120A] suction to RWST cooling pumps

DESIGN FUNCTION:

The K609A relay actuates on a safety injection (SI) signal. This relay starts a service water pump which provides cooling water to the recirculation spray heat exchangers. Additionally, a high head and a low head safety injection pump are started to provide emergency core cooling immediately following a loss of coolant accident. The normal filtered water supply to the service water pumps and the RWST cooling are isolated since they are no longer required.

OPERATIONAL IMPACT OF TESTING:

For Item 1

This is an unnecessary start of the service water pump. If it is the running pump, then the other pumps must be realigned and the "A" pump shutdown to verify its starting or its breaker closing in test. Also standby service water pump [2SWE*P21A] is placed in service contrary to biota control.

For Item 2

This is an unnecessary start of a charging pump. If "A" HHSI pump is running, the other pumps must be realigned and the "A" HHSI pump shutdown to verify start. Swapping pumps is a significant evolution causing transients on the CVCS and the RCP seal injection systems.

For Item 3

The normal LHSI pump 21A discharge valve to cold leg injection is closed to align the pump to recirculation which renders the LHSI pump inoperable during the slave relay test. This is an unnecessary start of the LHSI pump and requires operator action to return the system to operable status.

For Item 4

Leads are lifted in reactor protection rack "A" to simulate actuation of relay K610A, which is necessary for start of [2SWS*STRN47]. Leads must be re-landed after the slave is reset.

For Item 5

This valve is allowed to close and is an unnecessary isolation of normal filtered water supply to the service water pump seals. It places SWS pump seal water and motor cooling on the backup source of unfiltered river water which contributes to silting of the system.

For Item 6

Closure of this valve also trips [2QSS-P22A and B] causing loss of RWST cooling and requires operator action to restore the system to normal.

SAFETY SIGNFICANCE OF TESTING:

A low head safety injection (LHSI) pump is inoperable for the duration of the test. A single failure of the redundant train LHSI pump would result in a significant decrease in the flow of cooling water to the core. The RWST cooling system is rendered inoperable for the duration of the test. If cooling to the RWST is not returned to service in a timely manner, the RWST temperature could exceed technical specification limits. The limit on RWST temperature is to ensure the maximum peak containment pressure and fuel peak clad temperature are not exceeded.

<u>RELAY</u>: K610A, K610XA (Train-B Relay K610B, K610XB testing similar except for testing "C" HHSI and SWS pumps when powered from the "B" train emergency bus. Also 21C accumulator discharge valve [2SIS*MOV865C] relay actuation is verified by white light illuminated or contactor continuity without valve operation)

<u>ACTUATION SIGNAL</u>: Safety Injection

<u>TEST CATEGORY</u>: (3)

<u>RELAY ACTUATION TYPE</u>: (Go)

<u>MAJOR EQUIPMENT ACTUATED</u>:

1. Start [2CHS*P21C] HHSI (High Head Safety Injection Pump)
2. Start [2SWS*P21C] service water pump
3. Start [2HCS*HA100A] hydrogen analyzer

<u>DESIGN FUNCTION</u>:

The K610A and K610XA relays actuate on a safety injection (SI) signal. These relays start both a service water pump which provides cooling water to the recirculation spray heat exhcangers, and a high head SI pump to provide emergency core cooling immediately following a loss of coolant accident. A hydrogen analyzer is also started to provide containment sampling for hydrogen following a loss of coolant accident.

<u>OPERATIONAL IMPACT OF TESTING</u>:

<u>For Item 1</u>

This is an unnecessary start of the "C" HHSI pump and may require swapping in-service charging pumps. In order to test, the pump breaker must be racked on the "A" Train emergency bus and allowed to auto-start. This evolution requires operator action to electrically and mechanically align pumps for testing.

<u>For Item 2</u>

This is an unnecessary start of the "C" service water pump. In order to test, the pump breaker must be racked on the "A" Train emergency bus and allowed to auto-start. This evolution requires operator action to electrically and mechanically align service water pumps for testing, and to startup the stand-by service water system contrary to biota control.

For Item 3

The hydrogen analyzer is allowed to start and all associated valves to and from containment stroke open. Operator action is required to reposition valves and to cycle the analyzer breaker (off to on) to return the system to a stand-by condition.

SAFETY SIGNIFICANCE OF TESTING:

A hydraulic transient on the RCS occurs with the start of a second charging pump, affecting pressurizer level control and RCP seal injection. The degradation of the service water system by biota and silt buildup is accelerated by starting idle service water and standby service water pumps.

RELAY: K611A, K611XA (Train-B Relays K611B, K611XB Testing identical)

ACTUATION SIGNAL: Safety Injection

TEST CATEGORY: (2)

RELAY ACTUATION TYPE: (Go)

MAJOR EQUIPMENT ACTUATED:

1. Energize starting relays 2EGA*ES-1 and ES-2 for emergency diesel generator [2EGS*DG2-1]
2. Open [2HCS*SOV136A,B] hydrogen analyzer 100A inlet valves.
3. Open [2SWS*MOV113A] cooling water inlet valves for 2EGS*DG2-1 heat exchanger 21A
4. Open [2MSS*SOV120] discharge isolation for radiation monitors 2MSS*RO101A,B,C.
5. Start [2FWE*P23A] auxiliary feedwater pump

DESIGN FUNCTION:

The K611A and K611XA relays actuate on a safety injection (SI) signal. These relays align the components necessary to support diesel generator operation in the event a loss of offsite power occurs simultaneously with a LOCA. Each diesel generator is capable of driving all pumps, valves, and necessary instruments associated with one train of ECCS. The main steam high-range off-line steam detectors are aligned for service to assist in monitoring plant effluents during and following an accident in which the atmospheric dump valves and the main steam safety valves may be used as a potential discharge path to the environment. This discharge path may contain radioactive material derived from primary to secondary leakage. The motor driven auxiliary feedwater pump is started to ensure a heat sink is available for the reactor coolant system. A hydrogen analyzer is aligned for service to monitor the containment atmosphere following a LOCA.

OPERATIONAL IMPACT OF TESTING:

For Item 1

Considerable operator action is involved in setup and restoration, including reset of DG 2-1 start failure, as well as support systems, and re-establishing steam generator blowdown. Diesel generator 2-1 is inoperable for the duration of this test because starting

~ir is isolated to prevent an unnecessary start. Starting relay actuation is verified by visual observation locally at the excitation panel.

<u>For Item 2</u>

Hydrogen analyzer valves are allowed to open.

<u>For Item 3</u>

2SWS*MOV113A verified to open.

<u>For Item 4</u>

2MSS*SOV120 verified to open.

<u>For Item 5</u>

Auxiliary feedwater pump P23A is inoperable for the duration of the relay test. Its normal discharge valve is shut and the pump is started in recirculation. This test method requires constant communication with operators at the pump and in the control room to meet T.S. Surveillance 4.7.1.2.a.4. In addition the blowdown and blowdown sample valves are shut since they will go closed on the feed pump start. Secondary chemistry parameters take an undesirable trend while blowdown is isolated during relay actuation.

<u>SAFETY SIGNIFICANCE OF TESTING</u>:

A diesel generator and an auxiliary feedwater pump are made inoperable for the test duration. A single failure of the redundant trains emergency power supply will result in a complete loss of these systems. This would result in BVPS Unit 2 exceeding 10 CFR 100 limits during a design basis accident.

RELAY: K605A (Train-B Relay K605B testing similar, but for valves [2CHS*AOV204] [2RCS*AOV519] and [2RCS-AOV101] see relay K605B sheet)

ACTUATION SIGNAL: Containment Isolation Phase A

TEST CATEGORY: (3)

RELAY ACTUATION TYPE: (Go)

MAJOR EQUIPMENT ACTUATED:

1. Close [2CHS*AOV200 A, B, C] letdown orifice 21, 23, 22 isolation valves
2. Close [2SIS*AOV889] SI accumulator check valve test line isolation
3. Close [2GNS*AOV101-1] SI accumulator nitrogen makeup isolation valve
4. Close [2IAC*MOV130, 133] containment instrument air isolation valves

DESIGN FUNCTION:

The K605A relay actuates on a containment isolation phase A (CIA) signal as a result of a safety injection signal. The CIA signal is generated to isolate the containment atmosphere from the outside atmosphere in accident scenarios which result in an increased containment pressure. This isolation is accomplished by isolating system piping which penetrates containment and is not essential to reactor protection. Letdown isolation (Item 1) limits RCS inventory loss and mitigates any release in the event of fuel failure. Items 2 thru 4 (above) are lines which are not essential to reactor protection.

OPERATIONAL IMPACT OF TESTING:

For Item 1

Letdown demineralizers are bypassed by placing [2CHS-TCV143] to the volume control tank position. All three letdown orifice isolation valves are opened (only one is normally open) and allowed to close when relay K605A is actuated. Operator action is required to re-establish normal letdown. Should the letdown valves fail to re-open shutdown may be required due to limited RCS inventory control on excess letdown.

For Item 2

[2SIS*MOV842] SI accumulator test line isolation (inside containment) is closed while the outside containment valve [2SIS*AOV889] is cycled. These valves isolate the same containment penetration. Cycling these valves at power is unnecessary since they are normally closed and only used during shutdown testing of the accumulator check valves.

For Item 3

Normally open [2GNS*AOV101-1] is allowed to close when relay K605A is actuated. Failure to re-open would isolate nitrogen to all three accumulators and could result in a plant shutdown if accumulator pressure cannot be maintained to technical specification values.

For Item 4

Station instrument air is cross-connected with containment instrument air by opening [2IAC-MOV131] and containment instrument air compressors (C21A and B) are stopped. Operator action is needed to re-establish containment instrument air to pretest conditions.

SAFETY SIGNIFICANCE OF TESTING:

Isolation of RCS letdown during power operation on a quarterly basis can result in thermal transients not accounted for in the design of the system. These transients may result in exceeding the fatigue usage factor design limits.

RELAY: K605B (See Relay K605A for similar testing)

ACTUATION SIGNAL: Containment Isolation Phase A

TEST CATEGORY: (3)

RELAY ACTUATION TYPE: (Go)

MAJOR EQUIPMENT ACTUATED:

1. Loss of continuity for [2CHS*AOV204] non-regenerative heat exchanger letdown inlet valve
2. Close [2SIS*MOV842] SI accumulator check valve test line isolation
3. Close [2GNS*AOV101-2] SI accumulator nitrogen makeup isolation valve
4. Close [2IAC*MOV134] containment instrument air isolation valve
5. Close [2RCS*AOV519] pressurizer relief tank primary grade water makeup
6. Close [2RCS*AOV101] pressurizer relief tank nitrogen supply

DESIGN FUNCTION:

The K605B relay actuates on a containment isolation phase A (CIA) signal as a result of a safety injection signal. Letdown (Item 1) limits RCS inventory loss and mitigates any release in the event of fuel failure. Items 2 thru 4 (above are lines which are not essential to reactor protection).

OPERATIONAL IMPACT OF TESTING:

For Item 1

[2CHS*AOV204] is maintained open by by-passing the SOV that is actuated by relay K605B actuation. Verification that [2CHS*AOV204] received a close signal is determined by lack of continuity (infinite resistance) between contact terminal points. Operator action is again needed to verify the valve will remain open after the relay is reset by measuring continuity (zero resistance) between contact terminal points. Failure of the testing scheme would result in isolating letdown and may result in a plant shutdown due to limited RCS inventory control on excess letdown.

For Item 2

See Relay K605A for identical testing.

For Item 3

See Relay K605A for identical testing.

For Item 4

See Relay K605A for identical testing.

For Items 5 and 6

These valves are normally closed and require operator action to open to allow closure on relay actuation.

SAFETY SIGNIFICANCE OF TESTING:

Failure of the testing scheme would result in isolation of RCS letdown during power operation. Isolation of RCS letdown during power operation on a quarterly basis can result in thermal transients not accounted for in the design of the system. These transients may result in exceeding the fatigue usage factor design limits. The isolation of letdown during power operation was recently identified by Westinghouse Electric Corporation as a potential issue which may involve thermal transients not accounted for in the design of the system.

RELAY: K606A (Train-B Relay K606B testing identical)

ACTUATION SIGNAL: Containment Isolation Phase A

TEST CATEGORY: (2)

RELAY ACTUATION TYPE: (Go)

MAJOR EQUIPMENT ACTUATED:

1. Close [2CCP*MOV175-1] [2CCP*MOV177-1] Primary component cooling water supply and return isolations, "B" header.
2. Close [2SSR*SOV128A1] reactor coolant hot leg sample
   Close [2SSR*SOV129A1] RHR/containment sump sample
   Close [2SSR*SOV130A1] pressurizer relief tank/primary drains transfer tank sample
   Close [2PAS*SOV105A1] containment air sample
3. Close [2CVS*SOV151A, 151B, 153A] containment vacuum pumps P21A and B suction valves and containment air activity monitor isolation.
4. Timing out of [62-SSRAB] post accident sample timer for sample valves
5. Closure (or contactor actuation)[2SWS*MOV107A] "A" header service water supply to secondary component cooling water heat exchanger.

DESIGN FUNCTION:

The K606A relay actuate on a containment isolation phase A (CIA) signal as a result of a safety injection signal. The lines isolated, as noted above, are not required for reactor protection.

OPERATIONAL IMPACT OF TESTING:

For Item 1

Valves are allowed to close. Component cooling flow is isolated to blowdown evaporators, degasifiers, and sample coolers while the relay is in test.

For Item 2

Valves are allowed to close. Restoration requires operator action to reset control switch to dropout (CIA) seal in contacts.

For Item 3

Closure of these valves requires shutdown of the containment vacuum pumps and air activity monitor. A technical specification action leading to plant shutdown is entered each time this relay is tested. Radcon support is needed to place the air activity monitor back in service.

For Item 4

Verification of timer operation on relay actuation is locally observed. This timer allows override of (CIA) to permit re-opening of sample valves under Item 2 (major equipment).

For Item 5

[2SWS*MOV107A] cannot be stroked closed with the chillers heavily loaded during operation. Therefore, its breaker is placed in OFF and the MCC test set is used to verify contactor actuation. The auto close function of this valve, on low service water pressure, is defeated for the duration of this relay test. During low chiller cooling demand this valve can be cycled but is unnecessary and may result in a service water system transient.

SAFETY SIGNIFICANCE OF TESTING

Two of the required RCS leakage detections systems are inoperable for the duration of the test. The containment atmosphere gaseous and particulate radioactivity monitoring system is made inoperable by closure of the valves listed in Item 3. This monitor detects the presence of leakage from the RCS by an increase in activity in the containment atmosphere and is recommended by Regulatory Guide 1.45 "Reactor Coolant Pressure Boundary Leakage Detection System." Performing this slave test during plant operation degrades the RCS leak detection capability and places the plant in a technical specification action statement which requires a plant shutdown within 12 hours.

The automatic closure of the service water valve to the secondary component cooling water heat exchanger is defeated for the duration of the test. Without the automatic closure of the service water valve, adequate service water flow may not be available for cooling of ESF heat exchangers such as the recirculation spray, the charging pump lube oil, and emergency diesel generator coolers in the affected train.

RELAY: K607A (Train B Relay K607B testing identical)

ACTUATION SIGNAL: Containment Isolation Phase A

TEST CATEGORY: (1)

RELAY ACTUATION TYPE: (Blocked)

MAJOR EQUIPMENT ACTUATED:

1. Close 2CHS*MOV378 RCP seal leak off return

DESIGN FUNCTION:

The K607A relay actuates on a containment isolation phase A (CIA) signal as a result of a safety injection signal. The reactor coolant pump (RCP) seal leak off return is isolated since it is not required for reactor protection.

OPERATIONAL IMPACT OF TESTING:

For Item 1

Closure of this valve isolates seal leakoff from all 3 RCPs, challenging the seal return relief valve, and the RCP seals which must respond to the increased back pressure.

SAFETY SIGNIFICANCE OF TESTING:

Test circuit failure would result in an ESF actuation which will change RCP seal flow conditions and may cause seal damage or failure. In addition, the seal return relief valve, may be damaged. A LOCA at the RCP shaft seals (failed seals) or out the relief valve (if stuck open) could result.

RELAY: K612A (Train-B Relay K612B testing identical)

ACTUATION SIGNAL: Containment Isolation Phase A

TEST CATEGORY: (4)

RELAY ACTUATION TYPE: (Go)

MAJOR EQUIPMENT ACTUATED:

1. Close [2DAS*AOV100A] [2DGS*AOV108A] containment sump pump discharge valves
2. Close [2SSR*AOV100A1, 102A1, 109A1, 112A1] primary sample valves
3. Close [2VRS*AOV109A1] pressurizer relief tank/primary drains transfer tanks vents isolations.

DESIGN FUNCTION:

The K612A relay actuates on a containment isolation phase A (CIA) signal as a result of a safety injection signal. The lines isolated in Items 1 thru 3 above are all lines which are not required for reactor protection.

OPERATIONAL IMPACT OF TESTING:

For Items 1 thru 3

Reactor containment sump pumps [2DAS-P204A,B] are stopped and all valves are allowed to close on relay K612A actuation. Operator action is required to place control switches for [2DAS*AOV100A] and [2DGS*AOV108A] to close to drop-out CIA seal in contacts before valve repositioning and placing the containment sump pump control switches to auto. Until relay K612A is reset, or if valves fail to re-open the reactor operator loses the capability to:

- pump out the containment sump
- sample RCS cold legs, SIS accumulators, pressurizer liquid and vapor spaces
- vent the pressurizer relief tank and the primary drains tank.

SAFETY SIGNFICANCE OF TESTING:

Containment sump pump controls and discharge valves out of auto defeats the UFSAR required unidentified leakrate monitor. Inability to vent the pressurizer relief tank & primary drains tank could lead to a release of RCS gases to containment atmosphere.

RELAY: K613A, K613XA (Train-B Relay K613B, K613XB testing identical)

ACTUATION SIGNAL: Containment Isolation Phase A

TEST CATEGORY: (2)

RELAY ACTUATION TYPE: (Go)

MAJOR EQUIPMENT ACTUATED:

1. Close [2CCP*MOV176-1, 178-1] component cooling water supply and return header valve
2. Start [2HVS*CH219A] - Train A SLCRS duct heater
3. Open [2HVS*MOD203A, 218A, 210A, 211A, 212A, 213A] SLCRS dampers
4. Closure (or contactor actuation) for [2SWS*MOV107C] "B" header service water supply to secondary component cooling water heat exchanger.

DESIGN FUNCTION:

The K613A and K613XA relays actuate on a containment isolation phase A (CIA) signal as a result of a safety injection signal. The actuation of ventilation components (Items 2 & 3) are necessary to ensure that possible radioactive leakage from ECCS components is filtered prior to release to the environment. The componenet cooling water and the service water lines (Items 1 & 4) are isolated since they are not required.

OPEATIONAL IMPACT OF TESTING:

For Items 1 thru 3

Train A Supplementary Leak Collection and Release System (SLCRS) must be shutdown to perform this relay test. If Train A is in service, SLCRS systems must be swapped and is an unnecessary start of the fan and cycling of associated components.

For Item 4

If chilled water units are heavily loaded [2SWS&MOV107C] is tested by opening its breaker and using the MCC test set. Considerable operator action is needed for set-up, contactor actuation verification and restoration. With the breaker for [2SWS&MOV107C] in the off position, the auto closure of this valve on low service water header pressure is prevented. During low chiller cooling needs this valve can be cycled but is unnecesary and may result in a service water system transient.

SAFETY SIGNIFICANCE OF TESTING:

The automatic closure of the service water valve to the secondary component cooling water heat exchanger is defeated for the duration of the test. Without the automatic closure of the service water valve, adequate service water flow may not be available for cooling of other ESF heat exchangers such as the recirculation spray, the charging pump lube oil, and emergency diesel generator coolers in the affected train.

RELAY: K614A, K614XA (Train-B Relay K614B, K614XB testing similar except for (FPW) fire protection valves)

ACTUATION SIGNAL: Containment Isolation Phase A

TEST CATEGORY: (2)

RELAY ACTUATION TYPE: (Go)

MAJOR EQUIPMENT ACTUATED:

1. Close [2HVP*MOD22A] auxiliary building exhaust filter damper
2. Close [2HVS*MOD201A] normal leak collection damper for fan [2HVS*FN263A]
3. Open [2HVS*MOD202A] filter leak collection damper for fan [2HVS*FN204A,B]
4. Close [2CCP*MOV118] [2CCP*AOV171,173] component cooling water to containment instrument air compressors and supply and return to primary drains cooler.
5. [2FPW*AOV204, 205, 206, 221] fire protection water to containment.

DESIGN FUNCTION:

The K614A and K614XA relays actuate on a containment isolation phase A (CIA) signal as a result of a safety injection signal. The actuation of the ventilation components (Items 1 thru 3) are necessary to ensure that possible radioactive leakage from ECCS components is filtered prior to release to the environment. The component cooling water and the fire protection lines are isolated since they are not required for reactor protection.

OPERATIONAL IMPACT OF TESTING:

For Items 1 thru 3

Testing these dampers to close also causes the Train-B dampers to close due to low flow and position interlocks. Also when damper [2HVP*MOD22A] closes, air conditioning unit 2HVP*ACU211B will shutdown. These actions result in an auxiliary building ventilation transient with Radcon notification and operator action to restore ventilation.

For Item 4

Due to loss of cooling to the containment instrument air compressors, they are shutdown and station instrument air is cross connected to containment instrument air. Operator action is needed to re-align containment instrument air and to restore cooling to primary drains.

For Item 5

These valves are normally closed and must be opened to test to close. To preclude inadvertent introduction of fire protection water to containment, manual valves in each line to these AOV's are closed. Therefore, fire protection to containment is isolated for the duration of this test.

SAFETY SIGNIFICANCE OF TESTING:

All fire protection to containment is isolated for the duration of the test. If an actual fire in containment were to occur, action to extinguish the fire would be delayed. This may result in increased equipment damage as a result of the delayed action. Without proper operator action, a loss of cooling to the containment instrument air compressors will result in tripping of the compressors. A total loss of containment instrument air will then occurr. Letdown isolation (an ESF actuation) will then follow as the air operated letdown valves drift closed. An ESF actuation did occur at BVPS Unit No. 2 in 1990 during testing of this slave relay due to loss of containment instrument air (LER 90-009-00).

RELAY: K618A, K618XA (Train B Relay K618B, K618XB testing identical)

ACTUATION SIGNAL: Containment Isolation Phase B

TEST CATEGORY: (2)

RELAY ACTUATION TYPE: (Go)

MAJOR EQUIPMENT ACTUATED:

1. Close [2SWS*MOV153-1, 154-1] chilled water supply and return header isolation valves to containment air recirculation fan [2HVR-FN201A] cooling coils
2. Trip [2CCP*P21A] component cooling water pump.
3. Contactor actuation for [2QSS*P24A] chemical addition pump
4. Breaker trip for [2RHS*P21A] residual heat removal pump.

DESIGN FUNCTION:

The K618A and K618XA actuate on a containment isolation phase B (CIB) signal as a result of a containment high-high pressure signal. The CIB signal ensures that all penetrations, not already closed by a containment isolation phase A (CIA) are isolated, except for ESF lines. This action isolates the containment following a LOCA, steam line break, or a feedwater break, within containment, to limit radioactive releases. The chemical addition pump is actuated by these relays to ensure that sodium hydroxide is added to the containment spray water, which results in improved removal of radioactive iodine. The remaining components listed above are either isolated or tripped since they are no longer required.

OPERATIONAL IMPACT OF TESTING:

Considerable operator action is needed to set-up and restore equipment to pre-test conditions.

For Item 1

Actuation of relay K618A isolates chilled water flow to containment air recirculation cooling coil "A." Failure of the test circuit could resut in a plant shutdown due to high containment air temperatures.

For Item 2

Component cooling water (CCP) pump 21A is allowed to trip which requires re-alignment of the CCP system to place both the "A" and "B" CCP pumps in operation and the "C" pump in auto. "C" CCP pump will auto start when [2CCP*P21A] trips to maintain CCP flow requirements. Tripping of a running pump challenges cooling loads (RCPs) until the system responds to the transient.

For Item 3

The breaker for chemical addition pump [2QSS*P24A] is placed in the off position. Pump 24A would have no suction if allowed to start because [2QSS*MOV102A] is controlled by relay K644A. Therefore, contactor actuation is verified using the MCC test set. The pump is inoperable for the duration of the test. Human error previously resulted in chemical addition pump 24B inadvertenly starting (ESF actuation) during performance of this slave relay testing (See LER 88-016)

For Item 4

To simulate RHR pump running, the pump breaker is placed in test and jumpers are installed. The pump control switch is placed in auto. The breaker is allowed to trip when the slave relay is actuated. The control switch is CAUTION TAGGED if the slave is tested at power since the RHR pump cannot be bump start tested after reclosing its breaker. The RHR pump is unavailable for use during the slave test and may be questionable after testing conditions are restored.

SAFETY SIGNIFICANCE OF TESTING:

Failure of the chilled water valves (Item 1) to re-open could result in a plant shutdown due to high containment air temperatures. The tripping of a running component cooling pump challenges cooling loads, such as the operating reactor coolant pump(s) (RCP), until the CCP system can respond to the transient. If CCP is not restored, RCP bearing temperature may reach the administrative limit necessitating a RCP shutdown and reactor trip. A chemical addition pump is made inoperable for the test duration. A single failure of the redundant trains emergency power supply will result in a complete loss of this system. Loss of chemical addition will reduce the effectiveness of the quench spray system to remove radioactive iodine. The reduced removal efficency of iodine may result in an increase to offsite dose consequences.

RELAY: K619A (Train-B Relay K619B testing identical. If the test circuit fails a partial CIB will also occur.)

ACTUATION SIGNAL: Containment Isolation Phase B

TEST CATEGORY: (1)

RELAY ACTUATION TYPE: (Blocked)

MAJOR EQUIPMENT ACTUATED:

1. Closes [2CCP*MOV150-2] "A" component cooling supply header to containment
2. Closes [2CCP*MOV151-1] "B" component cooling supply header to containment
3. Closes [2CCP*MOV156-2] "A" component cooling return header from containment
4. Closes [2CCP*MOV157-1] "B" component cooling return header from containment
5. Closes [2SWS*MOV106A] "A" service water supply header to CCP heat exchangers

DESIGN FUNCITON:

The K619A relay actuates on a containment isolation phase B (CIB) signal as a result of a containment high-high pressure signal. The component cooling to containment and the service water to component cooling are isolated since this cooling is no longer required.

OPERATIONAL IMPACT OF TESTING:

For items 1 thru 5

There are no special test requirements for this relay. However, if the test circuit fails, a partial CIB actuation will occur. Both component cooling headers to all three reactor coolant pumps and residual heat removal heat exchangers would be isolated. Also, the "A" train service water supply header to the component cooling heat exchangers would be isolated. Additionally, the normal and alternate supply of CCP to the control rod drive mechanism shroud coils would be isolated.

SAFETY SIGNIFICANCE OF TESTING:

Failure of the test circuit would result in a partial CIB actuation, requiring a manual reactor trip on loss of CCP cooling to all RCPs.

RELAY: K626A, K626XA (Train B Relay K626B, K626XB testing identical)

ACTUATION SIGNAL: Containment Isolation Phase B

TEST CATEGORY: (2)

RELAY ACTUATION TYPE: (Go)

MAJOR EQUIPMENT ACTUATED:

1. Open [2QSS*SOV100A] chemical injection pump discharge to containment sump
2. Open [2QSS*SOV101A] chemical injection pump discharge to quench spray pump 21A
3. Open [2QSS*SOV102B] chemical injection pump discharge to quench spray pump 21B
4. Close [2SWS*MOV152-1] service water supply to containment air recirculation cooling coils B & C
5. Close [2SWS*MOV155-1] service water return from containment air recirculation cooling coils B & C
6. Trip [2CCP*P21C] component cooling water pump

DESIGN FUNCTION:

Relays K626A and K626XA actuate on a containment isolation phase B (CIB) signal as a result of a containment high-high pressure signal. The opening of chemical addition valves (Items 2 and 3 above) is to ensure that sodium hydroxide is added to the suction of the quench spray pumps to control pH of the containment spray water. The flow path of sodium hydroxide to the containment sump via [2QSS*SOV100A] (Item 1) ensures that the remaining contents of the chemical addition tank is directed to the sump once the RWST reaches an extreme Lo-Lo level. The component cooling water pump is tripped since it is no longer required. Service water is also isolated to the containment air recirc cooling coils since it is no longer required.

OPERATIONAL IMPACT OF TESTING:

For Items 1 thru 3

Relay K626A actuates [2QSS*SOV101A, 102B] directly. These are normally open valves and require operator action to close to test to open on relay actuation. Additional operator action is needed to set-up [2QSS*SOV100A] to open on CIB by actuating the RWST extreme Lo-Lo level simulation relay in a different panel. To restore [2QSS*SOV101A, 102B] operator action is needed to reset CIB contacts in the valve control circuit thru control switch manipulation. These actions ensure the auto closure function for [2QSS*SOV101A, 102B] on extreme Lo-Lo in the RWST is re-instated.

For Items 4 and 5

Actuation of relay K626A isolates chilled water flow to containment air recirculation cooling coils B and C.

For Item 6

Component cooling pump P21C is allowed to trip. This action requires re-alignment of the CCP system with the B and C pumps running and the A pump in auto. CCP pump 21A will auto start when [2CCP*P21C] trips to maintain CCP flow.

SAFETY SIGNIFICANCE OF TESTING:

Failure of the chilled water valves (Items 4 & 5) to re-open could result in a plant shutdown due to high containment air temperatures. The tripping of a running component cooling (CCP) pump challenges cooling loads, such as the operating reactor coolant pump(s) (RCP), until the CCP system can respond to the transient. If CCP is not restored within five minutes, a manual reactor trip is required and all RCPs stopped to prevent motor damage.

The chemical addition system, which normally supplies NaOH to the containment quench spray system on a CIB would be degraded. The premature opening of QSS-SOV100A by the test would divert the NaOH to the containment sump where it would not be available to reduce containment iodine concentrations until much later when (or if) recirculation spray from the sump was intitiated.

RELAY: K643A (Train B, Relay K643B testing identical)

ACTUATION SIGNAL: Containment Spray Actuation/CIB

TEST CATEGORY: 2

RELAY ACTUATION TYPE: (Go)

MAJOR EQUIPMENT ACTUATED:

1. Open [2RSS*MOV155A, 156A] suction and discharge valves for recirculation spray system (RSS) pump 21A
2. Energize relay [3-QSSAAX] start quench spray pump P21A
3. Contactor actuation for [2SWS*MOV103A] service water to RSS heat exchangers

DESIGN FUNCTION:

The K643B relay actuates on a containment spray actuation signal which is generated in response to a containment high-high pressure. This signal actuates the quench spray and recirculation spray systems. These systems are designed to reduce the containment pressure to sub-atmospheric pressure within one hour following a loss of coolant accident. The components, listed above, which are actuated by the K643B relay are part of the containment spray system necessary to achieve the design requirements.

OPERATIONAL IMPACT OF TESTING:

For Item 1

Normally open recirculation spray pump 21A suction and discharge valves are closed by operator action and allowed to open on relay actuation.

For Item 2

Actuation of relay K643A would start [2QSS*P21A] and spray containment. Therefore, to satisfy relay testing, one train of quench spray is made inoperable by racking the pump breaker to test and closing the suction and discharge valves. Operator action is needed to restore the QSS system to operable pre-test conditions.

For Item 3

Relay K643A actuation would open [2SWS*MOV103A] directing service water to the RSS heat exchangers. This condition is unacceptable and would require draining the heat exchangers for biota and corbicula control. Therefore, the breaker for [2SWS*MOV103A] is placed in the OFF position and contactor actuation verified by using the MCC test set. Operator action is needed to remove the control power fuse and attach test set leads at the breaker. Service water valve [2SWS*MOV103A] auto open function to supply water to the RSS heat exchangers A and C is inoperable. One train of ECCS is also degraded since the "C" RSS subsystem is part of transfer to recirculation.

SAFETY SIGNIFICANCE OF TESTING:

One train of the quench spray system and the recirculation spray system are made inoperable for the test duration. This reduces the overall availability of these systesm. A single failure of the redundant trains emergency power supply will result in a complete loss of these systems. This would result in BVPS Unit 2 exceeding 10 CFR 100 limits during a design basis accident.

RELAY: K644A (Train B, Relay K644B testing identical)

ACTUATION SIGNAL: Containment Spray Actuation/CIB

TEST CATEGORY: (2)

RELAY ACTUATION TYPE: (Go)

MAJOR EQUIPMENT ACTUATED:

1. Open [2QSS*MOV100A, 101A] suction and discharge valves for quench spray pump P21A
2. Energize timer relay [62-RSSAS] for recirculation spray pump P21A
3. Contactor actuation for [2QSS*MOV102A] suction valve to chemical injection pump P24A

DESIGN FUNCTION:

The K644A relay actuates on a containment spray actuation signal which is generated in response to a containment high-high pressure. The components, listed above, which are actuated by the K644A relay are part of the containment spray system necessary to achieve the design requirements.

OPERATIONAL IMPACT OF TESTING:

For Item 1

Actuation of relay K644A opens [2QSS*MOV100A, 101A]. To allow the valves to open they must be closed first. The quench spray pump P21A is placed in Pull-To-Lock to protect the pump while its suction valve is isolated. Therefore, one train of quench spray is inoperable.

For Item 2

Actuation of relay K644A starts RSS pump 21A with no water in the containment sump. This situation is undesirable. Therefore, the breaker for [2RSS*P21A] is placed in test. Contactor actuation is verified by observing that timer [62-RSSAA] starts. Operator action is required to reset the timer. RSS pump P21A is inoperable for the duration of this relay test.

For Item 3

Actuation of relay K644A causes [2QSS*MOV102A] to open allowing RWST water in the quench spray piping system to communicate with a high concentration of Sodium hydroxide (NaOH) in the chemical addition system. Subsequent ASME chemical addition and quench spray pump testing each quarter causes a buildup of NaOH in the RWST. To preclude sodium hydroxide cross contamination of the RWST, [2QSS*MOV102A] is left closed. To satisfy slave testing the breaker for [2QSS*MOV102A] is placed in OFF and contactor actuation verified using the MCC test set. One train of chemical addition is, therefore, inoperable for the duration of this relay test.

SAFETY SIGNIFICANCE OF TESTING:

One train of the quench spray system, chemical addition system and the recirculation spray system are made inoperable for the test duration. This reduces the overall availability of these systems. A single failure of the redundant trains emergency power supply will result in a complete loss of these systems. This would result in BVPS Unit 2 exceeding 10 CFR 100 limits during a design basis accident.

<u>RELAY</u>: K645A (Train B Relay K645B testing identical)

<u>ACTUATION SIGNAL</u>: Containment Spray Actuation/CIB

<u>TEST CATEGORY</u>: (2)

<u>RELAY ACTUATION TYPE</u>: (Go)

<u>MAJOR EQUIPMENT ACTUATED</u>:

1. Open [2RSS*MOV 155C, 156C] suction and discharge for recirculation spray pump P21C
2. Energize timer relay [62-RSSCA] for recirculation spray pump P21C

<u>DESIGN FUNCTION</u>:

The K645A relay actuates on a containment spray actuation signal which is generated in response to a containment high-high pressure. The components, listed above, which are actuated by the K645A relay are part of the containment spray system necessary to achieve the design requirements.

<u>OPERATIONAL IMPACT OF TESTING</u>:

<u>For Item 1</u>

Recirculation spray pump P21C suction and discharge valves are normally open and require operator action to close to allow the valves to open on a relay actuation.

<u>For Item 2</u>

Actuation of relay K645A starts RSS pump P21C with no water in the containment sump and suction and discharge valves closed as stated in Item 1 above. This situation is undesirable. Therefore, the breaker for [2RSS*P21C] is placed in test. Contactor actuation is verified by observing that timer [62-RSSCA] starts. Operator action is required to reset the timer. RSS Pump P21C is inoperable for the duration of the test.

SAFETY SIGNIFICANCE OF TESTING:

One subsystem of recirculation spray is inoperable and one train of emergency core cooling system (ECCS) is also degraded since the "C" RSS subsystem is part of transfer to recirculation. See Relay K643A. This reduces the overall effectiveness of one train of ECCS in recirulation mode. The [2RSS*P21C] pump transfers from being a low head safety injection pump to become a recirculation spray pump during the switch over for injection to recirculation phase for core cooling. A single failure of the redundant trains emergency power supply will result in a partial loss of emergency core cooling.

RELAY: K601B and K620B

ACTUATION SIGNAL: Feedwater Isolation (Train-B) *

TEST CATEGORY: (1)

RELAY ACTUATION TYPE: (Blocked)

MAJOR EQUIPMENT ACTUATED:

1. Close all main feedwater regulating valves [2FWS*FCV478, 488, 498]

   A. 2FWS*FCV478; Supply feedwater flow to 'A' steam generator
   B. 2FWS*FCV488; Supply feedwater flow to 'B' steam generator
   C. 2FWS*FCV498; Supply feedwater flow to 'C' steam generator

DESIGN FUNCTION:

These relays actuate on a safety injection signal to close the feedwater regulating valves in response to a main steam line or feedwater line break inside or outside containment. For breaks inside containment, isolating feedwater will limit the amount of energy transferred to the containment atmosphere and thus limit the peak containment, pressure. For a break outside of containment, isolating feedwater ensures that an excessive RCS cooldown does not occur and prevents the reactor from exceeding any thermal-hydraulic design limits.

OPERATIONAL IMPACT OF TESTING:

Since these valves are block tested, there is no operational impact except upon test circuit failure. Testing the relays with the reactor trip breakers open (i.e. Modes 3 & 4) requires lifting a lead in the reactor protection system to simulate the reactor trip breakers are closed and placing the steam dump mode selector switch in the STEAM PRESSURE MODE.

SAFETY SIGNIFICANCE OF TESTING:

Provided that the test circuit does not fail there is no safety significance in testing this relay. However, if the circuit does fail, significant safety concerns exist. A loss of normal feedwater will occur challenging the reactor protection system to initiate a reactor trip and actuate auxiliary feedwater. Closure of all the valves would result in a loss of normal feedwater accident, a condition II event. The lifted lead changes the status of the P-4 protection interlock which affects SI reset, turbine trip on reactor trip, condenser steam dump control, and closure of main feed reg valves on low RCS temperature.

* See Relay (K622A) for (Train-A) feedwater isolation.

RELAY: K621A (Train B Relay K621B testing identical)

ACTUATION SIGNAL: Feedwater Isolation

TEST CATEGORY: (1)

Relay Actuation Type: (Blocked/Go)

MAJOR EQUIPMENT ACTUATED:

1. Trip turbine trip via [99-TMAAAX1]
2. Trip [2FWS*P21A, P21B] main feedwater pumps
3. Trip [2FWS-P24] start-up feed pump (Not Blockable)

DESIGN FUNCTION:

The K621A relay is actuated by a safety injection (SI) signal or a steam generator high-high water level. The operation of this relay serves two purposes. On a SI in response to a main steam or feed line break, this relay ensures that all feedwater and main steam to the turbine is isolated. The isolation of feedwater is accomplished by tripping of the main and start-up feed pump(s). Isolating main steam to the turbine is accomplished by closing the turbine governor and throttle valves. The second purpose is to actuate on a steam generator high-high level which prevents an excessive reactivity addition from a cooldown, prevents filling the main steam piping with water, and prevents excessive moisture carry over to the turbine.

OPERATIONAL IMPACT OF TESTING:

For Items 1 thru 3

Testing with main feedwater pumps running requires operator action to install jumpers and to rack the supply breaker for the start-up feed pump [2FWS-P24] to the test position. The start-up feed pump will trip since the feedwater isolation signal to [2FWS-P24] is Not Blockable. If the start-up feed pump is supplying main feedwater, relay K621A cannot be tested. If the plant is shutdown (i.e. Modes 3 or 4) testing relay K621A requires operator action to install a jumper to simulate the reactor trip breakers are closed and to place the steam dump mode selector switch in the steam pressure mode.

SAFETY SIGNIFICANCE OF TESTING:

Test circuit failure will result in a turbine and reactor trip.

RELAY: K622A

ACTUATION SIGNAL: Feedwater Isolation (Train-A) * See Relays K601B/K620B for Train-B feedwater isolation

TEST CATEGORY: (1)

RELAY ACTUATION TYPE: (Blocked)

MAJOR EQUIPMENT ACTUATED:

1. [2FWS*HYV157A, B, C] main feedwater isolation valves

DESIGN FUNCTION:

The K622A relay actuates on a feedwater isolation signal generated by a safety injection signal to close the main feedwater isolation valves in response to a main steam line or feedwater line break inside or outside containment.

OPERATIONAL IMPACT OF TESTING:

For Item 1

There are no special requirements for testing this relay at power. However, testing this relay with reactor trip breakers open (i.e., Modes 3 & 4) requires operator action to lift a lead to simulate the reactor trip breakers are closed and to place the steam dump mode selector switch in the STEAM PRESS MODE.

SAFETY SIGNIFICANCE OF TESTING:

Failure of the test circuit will result in a reactor trip due to closure of the main feedwater isolation valves.

Closure of all the main feedwater isolation valves would result in a loss of normal feedwater accident, a condition II event.

RELAY: K636B

ACTUATION SIGNAL: Feedwater Isolation (Train B)*

TEST CATEGORY: (3)

RELAY ACTUATION TYPE: (Go)

MAJOR EQUIPMENT ACTUATED:

1. Close [2FWS*FCV479, 489, 499] main feedwater bypass valves

DESIGN FUNCTION:

Relay K636B actuates on a feedwater isolation signal to close the feedwater bypass regulating valves in response to a main steam line or feedwater line break inside or outside containment.

OPEATIONAL IMPACT OF TESTING:

For Item 1

Testing these valves requires manipulation of the steam generator level control system. At 100% power the bypass valves are open approximately 10% while allowing the MFRVs (main feed regulating valves) (See relay K601B) to control in auto. When the bypass valves close the MFRVs will have to compensate. A feedwater transient may occur if the MFRV's are slow too respond or incapable of responding if the bypass valves were open too far initially. At 30% power, this test would be much harder since the MFRVs will be erratic at low feed flow conditions. Therefore, to minimize feedwater oscillations the bypass valve isolation valves [2FWS*MOV155A, B, C] are closed. Then [2FWS*FCV479, 489, 499] are opened and allowed to auto-close on relay actuation. Operator action is needed to re-establish feed flow balance with the main feed bypass valves approximately 10% open.

SAFETY SIGNIFICANCE OF TESTING:

A reactor trip may occur during feedwater valve manipulation due reaching the Lo-Lo steam generator reactor trip setpoint. Feedwater system transients are the largest single contributor to reactor trips.

* See Relay K622A for Train A Feedwater Isolation

RELAY: K616A (Train B Relay K616B testing identical)

ACTUATION SIGNAL: Steam Line Isolation

TEST CATEGORY: (4)

RELAY ACTUATION TYPE: (Go)

MAJOR EQUIPMENT ACTUATED:

1. Close [2SDS*AOV129A] residual heat release valve piping drain valve
2. Close [2SDS*AOV111A1, 111B1, 111C1] steam lines drain valves to condenser
3. Close [2MSS*AOV102A, B, C] main steam bypass valves

DESIGN FUNCTION:

The K616A relay actuates on steam line isolation signal in response to a steam line break. This action stops the sudden and large release of energy in the form of steam, which in turn prevents rapid cooling of the RCS. This relay closes the remaining normally open drain paths that were not closed by the K623A relay. The main steam bypass valves are normally closed valves.

OPERATIONAL IMPACT OF TESTING:

For Items 1 and 2

Valves are normally open and closed when testing this relay. Failure of these drain valves to re-open would result in water (condensate) accumulation and when placed back in service, water hammer could result. All four valves are stroke tested and timed quarterly per the ASME program.

For Item 3

Valves are normally closed, opened for this relay test and allowed to close during relay actuation. This is an unnecessary cycling of these valves. All three valves are stroke tested and timed quarterly per the ASME program.

SAFETY SIGNIFICANCE OF TESTING:

Failure of the test relay to reset would keep the steam line drain valves closed, causing condensate to accumulate in the main steam lines. The water could result in a steam line break due to water hammer or turbine blading damage.

RELAY: K623A (Train B Relay K623B testing identical)

ACTUATION SIGNAL: Steam Line Isolation

TEST CATEGORY: (1)

RELAY ACTUATION TYPE: (Blocked)

MAJOR EQUIPMENT ACTUATED:

1. [2MSS*AOV101A, B, C] main steam trip valves

DESIGN FUNCTION:

The K623A relay actuates on a steam line isolation signal to close all three main steam trip valves in response to a main steam line break downstream of the trip valves. If a main steam line breaks occurs between the trip valves and a steam generator, only that steam generator will blowdown. Closure of the trip valve in the ruptured line prevents blowdown from the other steam generators.

OPERATIONAL IMPACT OF TESTING:

For Item 1

Since this is a block test, there is no operational impact unless the test circuit fails.

SAFETY SIGNIFICANCE OF TESTING:

Failure of the test circuit will result in steam line isolation and a reactor trip.

RELAY: K632A (Train B, Relay K632B testing identical)
K633A (Train B, Relay K633B testing identical)

ACTUATION SIGNAL: Reactor Trip (K632A)
2/3 S/G level low-low (K633A)

TEST CATEGORY: (2)

RELAY ACTUATION TYPE: (Go)

MAJOR EQUIPMENT ACTUATED:

1. Start [2FWE*P22] steam driven auxiliary feedwater (AFW) pump

DESIGN FUNCTION:

The K632A relay actuates on a undervoltage condition on the reactor coolant pump bus in anticipation of unit blackout. This relay actuates the steam supply valves to start the steam driven auxiliary feedwater pump. The K633A relay actuates on a steam generator Lo-Lo level. This relay starts the steam driven auxiliary feedwater pump. The starting of the steam driven auxiliary feedwater pump ensures that an adequate heat sink is available when the unit trips.

OPERATIONAL IMPACT OF TESTING:

For Items 1 thru 3

To prevent an undesirable start of the auxiliary feedwater system the "A" motor driven auxiliary feedwater pump control switch is placed in Pull-To-Lock and the steam supply isolation [2FWE*TTV22] to the turbine driven auxiliary feedwater pump is closed. Steam generator blowdown will isolate when the steam supply valves to the turbine driven AFW pumps are opened. Therefore, blowdown is slowly isolated by closing [2BDG-HCV101A, B, C] and requires operator action to restore the system to operation after slave relay testing. The motor driven AFW pump P23A and the steam driven AFW pump are inoperable and blowdown remains isolated for three (3) relay tests in succession (K632A, K633A, K634A).

NOTE: Relays K632A and K633A require the same test conditions and actuate the same steam supply valves to the turbine driven AFW pump. Each relay is actuated independently in succession and [2MSS*SOV105A, C, D] are stroked twice. In addition 2 of 3 AFW pumps are disabled while testing the above (2) relays.

SAFETY SIGNIFICANCE OF TESTING:

Two of the three auxiliary feedwater pumps, which are solely relied upon as the primary heat sink during an accident, are rendered inoperable for the period of the test. During this period of testing, the auxiliary feedwater system does not meet single failure criteria as the failure of the one remaining pump would result in a total loss of auxiliary feedwater. This would place the unit in a condition which is outside the design analysis and in certain accident scenarios could result in core damage.

RELAY: K634A (Train B Relay K634B testing identical)

ACTUATION SIGNAL: Motor Driven Auxiliary Feedwater Pump Start (2/3 S/G level Low-Low)

TEST CATEGORY: (2)

RELAY ACTUATION TYPE: (Go)

MAJOR EQUIPMENT ACTUATED:

1. Start [2FWE*P23A] motor driven auxiliary feedwater (AFW) pump

DESIGN FUNCTION:

The K634A relay actuates on a steam generator Lo-Lo level. This relay starts one of the motor driven auxiliary feedwater pumps (2FWE*P23A). The starting of the motor driven auxiliary feedwater pump ensures that an adequate heat sink is available when the unit trips and a safety injection is not required.

OPERATIONAL IMPACT OF TESTING:

For Item 1

Operator action is required to align the pump for recirculation testing. The normal discharge valve is shut rendering the pump inoperable and constant communications are established and maintained between operators at the pump and in the contorl room. Communications are required to comply with technical specification Surveillance Requirement 4.7.1.2.a.4. Steam generator blowdown is isolated as discussed for relays K632A and K633A.

SAFETY SIGNIFICANCE OF TESTING:

One motor driven auxiliary feedwater pump is rendered inoperable during the testing of relay K634A. This test reduces the overall availability of the auxiliary feedwater system and increases the probability that an RCS heat sink will not be available if an accident would occur during the test.

RELAY: K635A (Train B Relay K635B testing identical)

ACTUATION SIGNAL: Turbine Trip (30 second trip delay on generator)

TEST CATEGORY: (1)

RELAY ACTUATION TYPE: (Blocked)

MAJOR EQUIPMENT ACTUATED:

1. Generator Trip via [62-TMAAA]

DESIGN FUNCTION:

The K635A relay is actuated by a turbine trip. There is a 30 second time delay following a turbine trip to prevent overspeeding the turbine.

OPERATIONAL IMPACT OF TESTING:

For Item 1

There are no special test requirements if the relay is tested with the main turbine latched. However, if the test circuit fails, a reactor trip will occur. To test this relay with the main turbine not latched requires operator action to install three (3) jumpers to simulate turbine stop valves not shut and auto stop oil not low.

SAFETY SIGNIFICANCE OF TESTING:

A failure of the test circuit will lead to a turbine trip and above 49% power a reactor trip will occur.

RELAY: K625A (Train-B Relay K625B testing identical)

ACTUATION SIGNAL: Containment Isolation Phase B/Control Room Isolation

TEST CATEGORY: (2)

RELAY ACTUATION TYPE: (Go)

MAJOR EQUIPMENT ACTUATED:

1. Close all control room ventilation dampers (Unit-1 & Unit-2) [2HVC * MOD 201A, 201B, 201C, 201D] (Unit-2) [1VS-D-40-1A, 1B, 1C, 1D] (Unit-1)

2. Open all control air SOV's for control room pressurization [SOV-1VS-103A1, A2, B1, B2, C1, C2, D1, D2, E1, E2] (Unit-1)

3. Start timers [62-HVCAP and 62-HVCBP] (60 minutes) to start control room pressurization fans 2HVC&FN241A,B

DESIGN FUNCTION:

The K625A or K625B relay actuates on a containment isolation phase B (CIB) signal and initiates the control room emergency bottled air pressurization system (CREBAPS). The control room is isolated from outside air and the bottled air system begins discharging. The bottled air system assures that the control room will be maintained positive for 1 hour followed by the start of the control room pressurization fans to continue long term habitability.

OPERATIONAL IMPACT OF TESTING:

Considerable operator action and coordination from both units is needed to set-up, test and restore equipment to pretest conditions. Both relays K625A and K625B are tested independently and in succession with the bottles isolated since each slave actuates a set of 5 parallel SOV's. Otherwise, 15 manual valves would be cycled twice to isolate and unisolate the bottles for each relay test increasing the probability of an inadvertent bottle actuation.

FOR ITEM 1

All of the control room supply and exhaust dampers for both units are allowed to close on slave actuation. Unit-1 and Unit-2 operators are needed to return dampers to pre-test conditions.

FOR ITEM 2

The bottled air pressurization system is comprised of 10 bottles in parallel (5 subsystems - 2 bottles per subsystem) and by technical specifications must be maintained operable in all modes for both units at > 1825 psig. All ten bottles are located in Unit-1 and 3 groups of 5 manual valves have to be repositioned in three different locations in the Unit-1 auxiliary building. If the bottles were allowed to discharge on slave relay actuation they could not be recharged fast enough to meet technical specification requirements and would result in shutting down both units.

To avoid a forced shutdown, all ten bottles are manually isolated and all SOV's allowed to open on slave actuation. Technical specifications provide an 8 hour period for isolation of the bottles for performance of instrumentation and control system testing. The control room bottled air pressurization system is inoperable for the duration of slave relay testing and renders actuation of the bottles air system by CIB, chlorine or high-high radiation ineffective.

FOR ITEM 3

Timers 62-HVCAP and 62-HVCBP are allowed to start and if not reset within 60 minutes would start control room pressurization fans 2HVC*FN241A, B. Fan switches are placed to stop after the timers are started to prevent unwanted fan starts.

SAFETY SIGNIFICANCE OF TESTING:

Both trains of the bottled air pressurization system are disabled for the duration of slave relay testing. CREBAPS actuation due to High-High radiation or chlorine are also ineffective. The total radiological dose to the control room operators would increase significantly in certain accident scenarios without the operation of CREBAPS. Inadvertent actuation of the bottled air pressurization system would depressurize the bottles and may require a shutdown of both units.

RELAY: K630A (Train-B Relay K630B testing identical)

ACTUATION SIGNAL: 2/3 Chlorine Detectors/Control Room Isolation

TEST CATEGORY: (2)

RELAY ACTUATION TYPE: (Go)

MAJOR EQUIPMENT ACTUATED:

1. Close all control room ventilation dampers (Unit-1 & Unit-2) [2HVC*MOD 201A, 201B, 201C, 201D] (Unit-2) [1VS-D-40-1A, 1B, 1C, 1D] (Unit -1)

2. Open all control air SOV's for control Room pressurization [SOV-1VS-103 A1, A2, B1, B2, C1, C2, D1, D2, E1, E2] (Unit-1)

DESIGN FUNCTION:

The K630A or K630B relay actuates on a chlorine detection signal and initiates control room emergency bottled air pressurization system (CREBAPS). The control room is isolated from outside air and the bottled air system begins discharging. The bottled air system assures that the control room will be maintained positive for 1 hour. (Fans are not started on chlorine actuation of CREBAPS).

OPERATIONAL IMPACT OF TESTING:

Considerable operator action and coordination from both units is needed to set-up, test and restore equipment to pretest conditions. Both relays K630A and K630B are tested independently and in succession with the bottles isolated since each slave actuates a set of 5 parallel SOV's. Otherwise, 15 manual valves would be cycled twice to isolate and unisolate the bottles for each relay test increasing the probability of an inadvertent bottle actuation.

FOR ITEM 1

All of the control room supply and exhaust dampers for both units are allowed to close on slave actuation. Unit-1 and Unit-2 operators are needed to return dampers to pre-test conditions.

FOR ITEM 2

The bottled air pressurization system is comprised of 10 bottles in parallel (5 subsystems - 2 bottles per subsystem) and by technical specifications must be maintained operable in all modes for both units at > 1825 psig. All ten bottles are located in Unit-1 and 3 groups of 5 manual valves have to be repositioned in three different locations in the Unit-1 auxiliary building. If the bottles were allowed to discharge on slave relay actuation they could not be recharged fast enough to meet technical specification requirements and would result in shutting down both units.

To avoid a forced shutdown, all ten bottles are manually isolated and all SOV's allowed to open on slave actuation. Technical specifications provide an 8 hour period for isolation of the bottles for performance of instrumentation and control system testing. The control room bottled air pressurization system is inoperable for the duration of slave relay testing and renders actuation of the bottles air system by CIB, chlorine or high-high radiation ineffective.

SAFETY SIGNIFICANCE OF TESTING:

Both trains of the bottled air pressurization system are disabled for the duration of slave relay testing. CREBAPS actuation due to High-High radiation or chlorine are also ineffective. Inadvertent actuation of the bottled air pressurization system would depressurize the bottles and may require a shutdown of both units.

ATTACHMENT B-2

Beaver Valley Power Station, Unit 2
Proposed Technical Specification Change No. 47
Test Circuit Operation

The attached information describes the basic test circuits used in the Safeguards Test Cabinet.

TEST CIRCUIT
DETAILED DESCRIPTION

1. GENERAL

The Engineered Safety Features Actuation System (ESFAS) final actuation device or actuated equipment testing is performed from the Engineered Safeguards Test Cabinets. There is one test cabinet provided for each of the two protection trains "A" and "B". Each cabinet contains individual test switches necessary to actuate the logic output or slave relays (K601, K602, etc.) and since many of the slave relays are latch type, a common reset switch per train is also provided. To prevent accidental actuation, test switches are of the type that must be rotated and then depressed to operate the slave relays. Assignments of contacts of the slave relays for actuation of various final devices or actuators has been made such that most of the slave relays, and thus groups of devices or actuated equipment, can be operated individually during plant operation (See Section 1.1).

Those final actuation devices that cannot be actuated during plant operation have been assigned to slave relays for which additional test circuitry has been provided to individually block actuation of a final device upon operation of the associated slave relays during testing. (See Section 1.2). Operation of these slave relays, including contact operations, and continuity of the electrical circuits associated with the final devices control are checked in lieu of actual operation. Interlocking prevents blocking the output from more than one output relay in a protection train at a time. Interlocking between trains is also provided to prevent continuity testing in both trains simultaneously, therefore the redundant device associated with the protection train not under test will be available in event protective action is required. If an accident occurs during testing, the automatic actuation circuitry will override testing. One exception to this is that if the accident occurs while testing a slave relay whose output must be blocked, those final actuation devices associated with this slave relay will not be overridden.

The following symbology is used to represent the various system equipments involved in the attached Figures A thru D.

- SPS - PSC - Solid State Protection System
- STC - Safeguards Test Cabinet
- X - Field Connections; i.e., SWGR, MCC, etc.
- K* - PSC Relay; i.e., K601, K602, etc.
- K8* - STC Relay; i.e., K801, K811, etc.
- S* - STC Test Switch; i.e., S801, S811, etc.
- DS* - STC Test Indicator Lamp; DS8001, DS8011, etc.

1.1 Circuits With No Blocking Schemes Required

In the typical circuit, Figure A, depressing the test switch "S*" will result in relay "K*" contact to close and allow bus voltage to be applied to load Z1. If load Z1 is functioning properly, some indicator (such as a lamp on another panel) will operate, indicating that the circuit is functioning properly. The "K*" relay is returned to an open condition by returning the test switch "S*" to the Normal position.

1.2 Actuator Blocking and Continuity Test Circuits

The typical schemes for blocking operation of selected protection function actuator circuits are shown in Figures B, C and D. The schemes operate as explained below and are duplicated for each safeguards train.

Figure B shows the DC or AC circuit for contact closure for protection function actuation. Under normal plant operation, and equipment not under test, the test lamps "DS*" for the various circuits will be energized. Typical circuit path will be through the normally closed test relay contact "K8*" and through test lamp connections 1 to 3. Coil "X2" will be capable of being energized for protection function actuation upon closure of solid state logic output relay contacts "K*". Coil "X2" is typical for a breaker closing auxiliary coil, motor starter master coil, coil of a solenoid valve, auxiliary relay, etc.

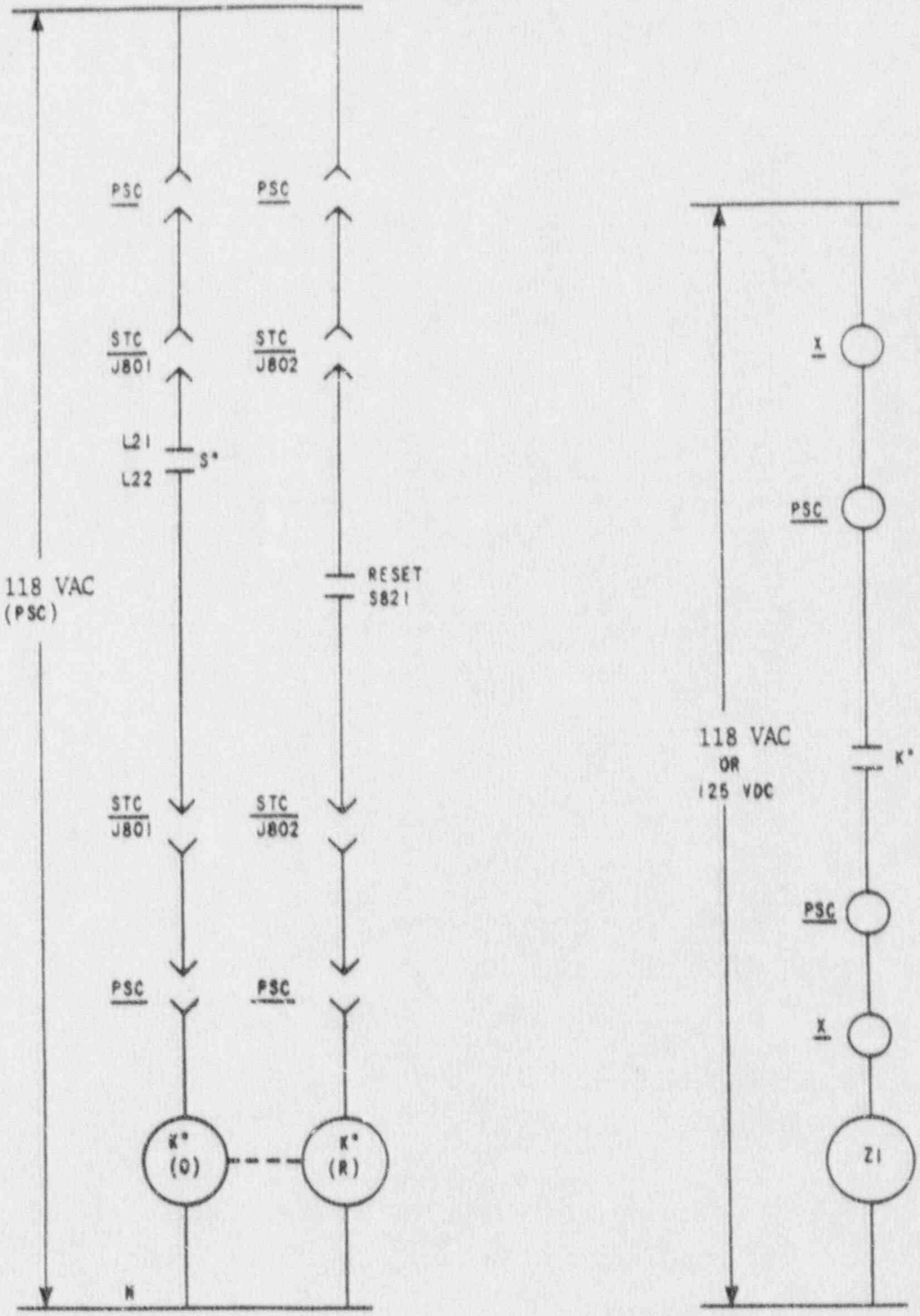
Actuation of the test relay associated with the protection functions or devices to be tested is accomplished by using the appropriate test switch "S*". In the typical circuit, Figure B, depressing the test switch "S*" will result in output relay "K8*" contact to open and "K*" to close. Verification that continuity exists in the associated actuator coil circuit is accomplished by depressing the appropriate test lamp assembly and observing that the lamp becomes energized. The circuit path will be through the test lamp connections 2 to 1 (contact "K8*" open), through solid state logic output relay contact "K*" (now closed) and finally through actuator coil "X2". Sufficient current will flow in the circuit to cause the lamp to glow, but insufficient to cause actuator coil "X2" to operate. Resetting the solid state logic output relay is accomplished using the test cabinet reset switch (S821). Confirmation that the safeguards output relay contacts are open, is accomplished by noting that the test lamp "DS*" will not energize when depressed. The test relay "K8" is reset by positioning the appropriate test switch "S" to the Normal position and observing that the test lamp "DS*" is energized indicating reclosure of associated test relay contacts "K8" and the existance of control power.

Figure C shows the DC circuit for contact opening for protection function actuation. Under normal plant operation, and equipment not under test, the white test lamps "DS*" for the various circuits will be energized, and green test lamp "DS*" will be de-energized. Typical circuit path for white lamp "DS*" will be through the normally closed solid state logic output relay contact "K*" and through test lamp connections 1 to 3. Coil "Y2" will be capable of being de-energized for protection function actuation upon opening of solid state logic output relay contacts "K*". Coil "Y2" is typical for a solenoid valve coil, auxiliary relay, etc.

Actuation of the test relay associated with the protection functions or devices to be tested is accomplished by using the appropriate test switch "S*". In the typical DC circuit, Figure C, positioning the test switch "S*" to the Test position will result in relay "K8*" contact to close to block de-energizing of coil "Y2". Verification that various test relay contacts have closed to block de-energizing of the "Y2" coil is confirmed by the energizing of the associated green test lamp, "DS*". Depressing the test switch "S*" and observing that the white test lamp "DS*" de-energizes is a verification that the output relay's contacts "K*" have opened. Coil "Y2" will be kept energized during the test by the circuit through test relay contacts "K8*". False operations of test lamps will be blocked by diodes. With the diodes working, as well as assumption of proper operation of the slave relay, and with the test switch turned to the right and depressed, first the green light goes on, then the white light goes out. Any other sequence would mean a failed test of either the slave relay or the testing circuitry. Resetting the solid state logic output relay is accomplished using the test cabinet reset switch (S821). Confirmation, that the safeguards output relay contacts are closed, is accomplished by noting that the white test lamp "DS*" is energized indicating that the solid state logic output relay contacts are closed. The test relay "K8" is reset by positioning the appropriate test switch "S" to the left and observing that the green test lamp "DS" is de-energized indicating opening of the associated test relay contact "K8*".

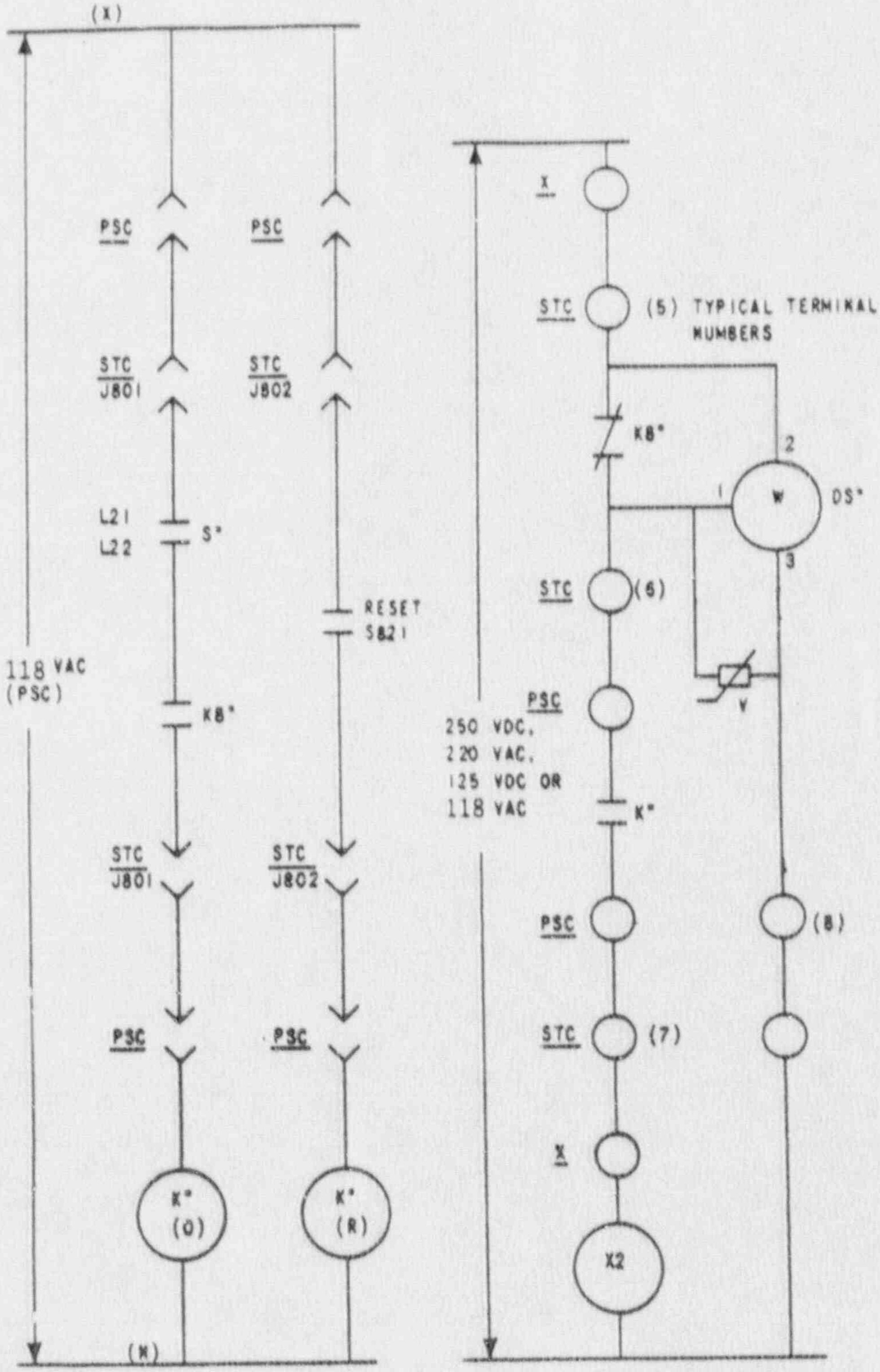
The typical AC circuit, Figure D, functions in the same manner as the DC Circuit (Figure C) except that a current monitoring device, consisting of a Zener diode and LED type indicator, is used in place of the regular test lamp(s).

Figure A



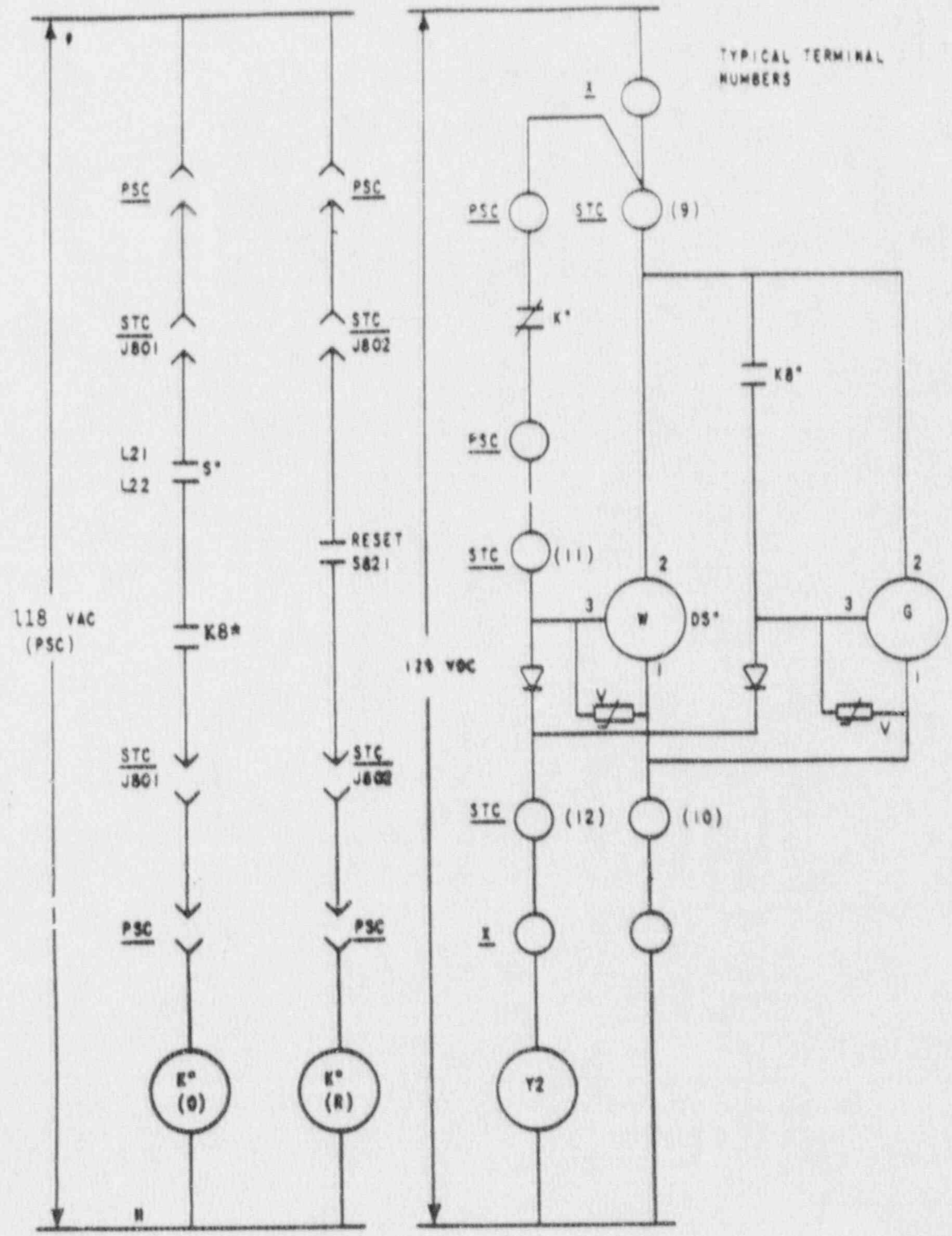
AC or DC Test Circuit with No Blocking Scheme Required

Figure B



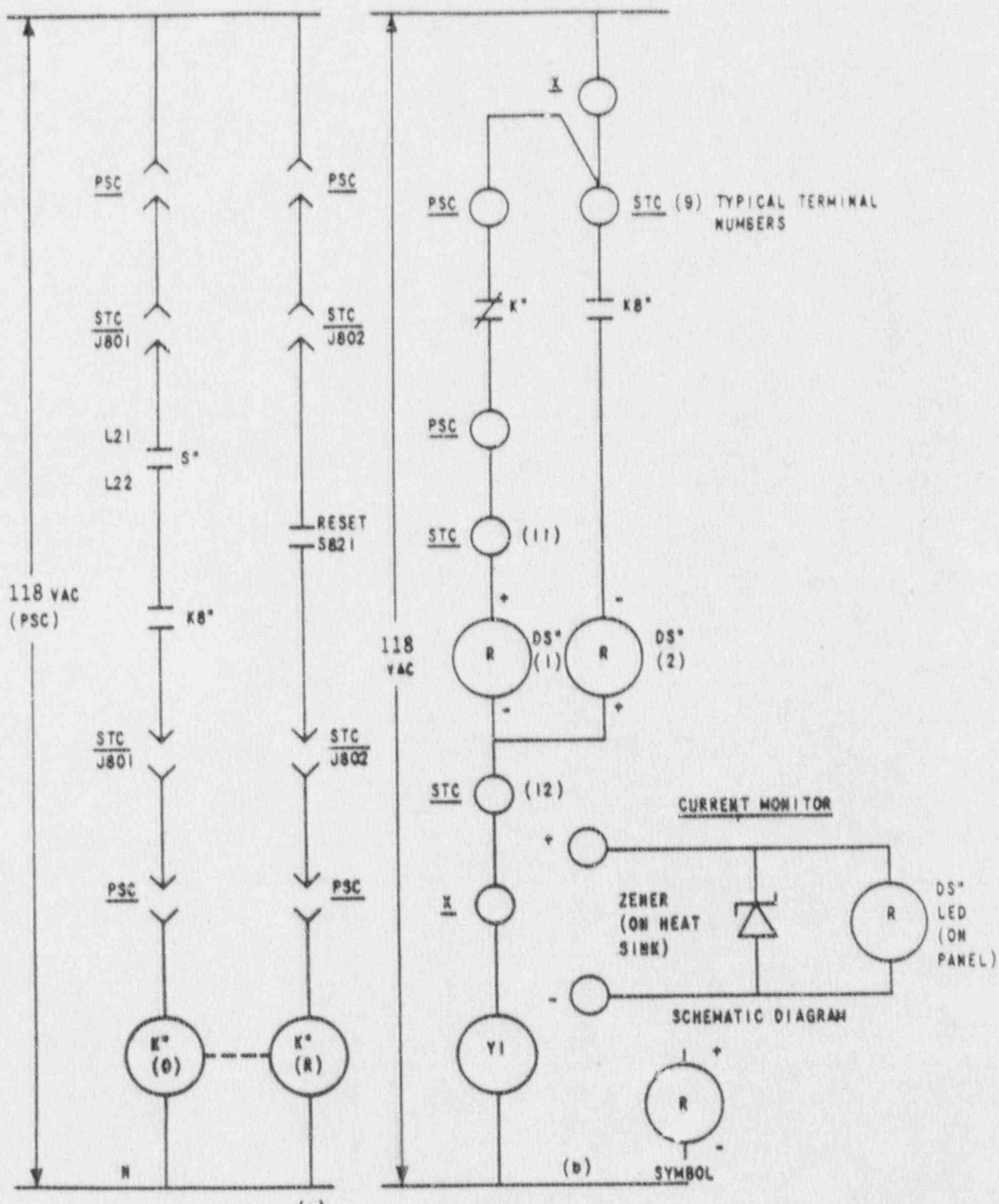
DC or AC Test Circuit with Contact Closure for Actuation

Figure C



DC Test Circuit with Contact Open for Actuation

Figure D



AC Test Circuit with Contact Open for Actuation

ATTACHMENT B-3

Beaver Valley Power Station, Unit 2
Proposed Technical Specification Change No. 47
Safeguards Testing Cabinet Blocking
Circuit Failure Analysis

The attached information provides a failure analysis for blocking type test circuits.

SAFEGUARDS TESTING CABINET BLOCKING CIRCUIT FAILURE ANALYSIS

The Safeguards Test Cabinet (STC) is designed to test the integrity of the ESF Protection Safeguards System output slave relays. This is accomplished by energizing various slave relays and utilizing the test circuitry of the STC to verify that certain protection relays have been energized and their contacts are opening or closing properly.

Two basic types of testing are performed, "GO" testing, in which the protection slave relay is actuated and its operation verified by observation of the equipment, the "BLOCK" testing, in which actuation of the ESF equipment is blocked, and circuit integrity is verified by continuity testing.

Each of the Blocking schemes and their functions are explained in Attachment B-2 titled "Test Circuit Operation" and are provided for the reader's information. This report will only address the possible failures that have been analyzed for each of the blocking schemes.

Beaver Valley Unit 2's STC employs basically four types of blocking schemes and they will be referred to as Detail A, B, C, or D (see attached drawings). The selection of what type of blocking scheme is required depends upon two factors; the individual contact (normally open or normally closed) of the slave relay and the power supply (AC or DC) which the final actuator requires. With two types of contacts and two possible power supplies there are four possible combinations, thus the four details. The analysis will describe the failure mechanisms that could occur to these four circuits, it should be noted that a failure of any blocking circuit to block actuation of the ESF equipment would either cause a significant plant transient or unit trip.

DETAIL A:

A detail "A" blocking scheme is used for slave relays that are powered from a 120 volt AC source and have contacts which are normally open. An example of equipment that requires this type of blocking scheme is a motor operated valve (MOV). Most MOV's require a contact to close to give the controlling circuitry the logic to stroke the valve.

The failure mechanisms are as follows:

1) During the test, the K600 (K*) slave relay is energized by the circuitry in the STC. The continuity path of this circuit is through the light bulb path 2 to 1 down through the closed contact of the slave relay through the coil of the actuated equipment to the AC return. The voltage is dropped across the light bulb which reduces the power to a level such that there is insufficient voltage to actuate the equipment (X1). If for any reason the K8* test relay in the STC de-energizes, all the actuated equipment that slave relay controls will actuate.

2) If a contact resistance on the STC K8* relay increases due to oxidation products or dirt/dust build up, there exists a possibility that there will not be sufficient voltage available to energize the actuated equipment when a valid ESF signal is requiring actuation because of the voltage drop across the contacts. This as left condition after STC testing would not be readily detectable.

As it has been pointed out in the discussion so far, a failure of one component will cause ESF equipment to actuate when not desired or not be available to actuate when a valid ESF signal is present.

DETAIL B:

A detail "B" blocking scheme is used for a slave relay that is powered from 125 volt DC source and has a contact which is normally open. The continuity path for this blocking circuit is similar to the one described in detail "A". Therefore it will not be discussed again. The failure mechanisms and consequences for this circuit are the same as the ones mentioned in detail "A". As shown in detail "B" there is an additional component in parallel with the push to test lamp socket. The component is a varistor. A varistor is a two-electrode semiconductor device with a voltage dependent nonlinear resistance that drops as the applied voltage is increased. These devices were incorporated into the test circuit design to protect the lamps from burning up due to voltage surges.

DETAIL C:

A detail "C" blocking scheme is used for slave relays that are powered from 120 volt AC source and have contacts which are normally closed. An example of equipment which de-energizes to actuate is a solenoid operated valve (SOV). Many SOV's are used as controllers to containment isolation air operated valves. When power is removed from the SOV it de-energizes. This action causes air to be removed from the trip valve and the valve shuts. The detail "C" circuit has the following current path. When no ESF signal is present the current path is a follows: The path starts at the AC power supply and continues down through the closed contacts of the slave relay through a zener diode down through the actuating equipments coil to the AC return. The zener diode is there to provide a voltage drop of approximately .7 volts to a status indicating LED wired in parallel to the zener diode. During a test of the K* relay, the current is maintained to the coil of the actuated equipment (Y1) through the closed contacts of the test relay. When the test switch on the front of the STC is turned to the PUSH TO TEST position the contacts of the test K8* relay close. The current path is similar to the one mentioned above.

The failure mechanisms are the following:

1) Since the contacts of the test relay are normally open, the contacts are susceptible to oxidation and dirt/dust build up. If for any reason the contact resistance increases, there may not be sufficient voltage to keep the actuated equipments coil energized during the test and the coil may drop out.

2) The other failure that is possible is that the coil of K8* relay opens while testing; this will have the same impact on plant equipment as the failures mentioned above.

DETAIL D:

A detail "D" blocking scheme is used for slave relays that are powered from a 125 volt DC source and have contacts which are normally closed. The detail "D" circuit operates very similar to the detail "C" circuit. The differences are that lights and diodes are used in lieu of LED's and zener diodes. As in detail "C" one of the diodes stays in the circuit regardless of testing.

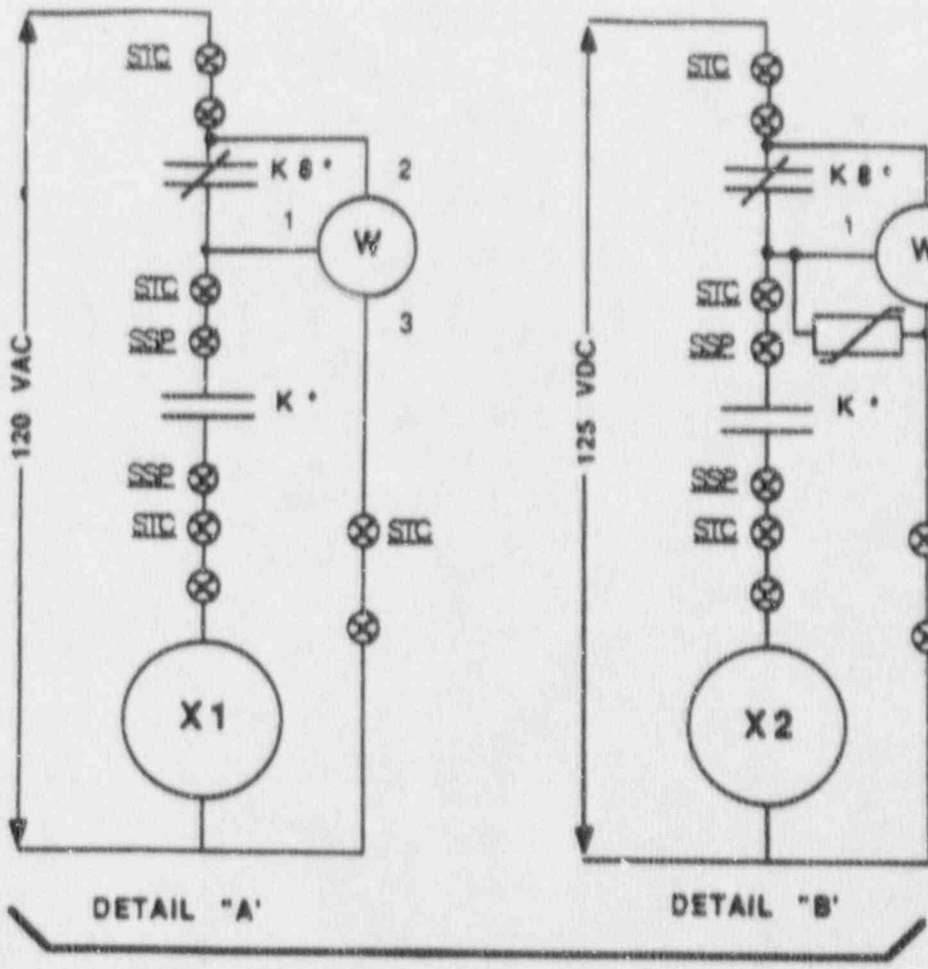
The failure mode is the following:

1) The K8* test relay's contact is also normally open. A normally open contact is more susceptible to oxidation and or dirt build up. If for any reason the contact resistance increases, there may not be sufficient voltage to keep the actuated equipments coil energized during the test and the coil may drop out.

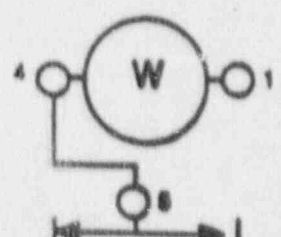
A basic design problem in the blocking schemes is the fact that the test circuitry is designed to be an integral part of the actual ESF circuit flow path. With this design a single device failure results in either,

1) ESF equipment not automatically actuating when called upon or

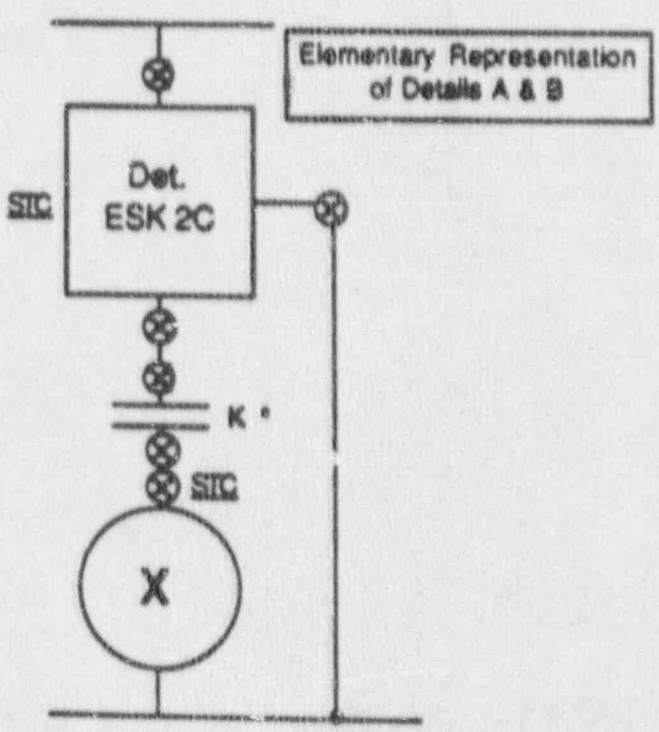
2) actuation when the unit is on-line causing a significant plant transient or a unit trip.

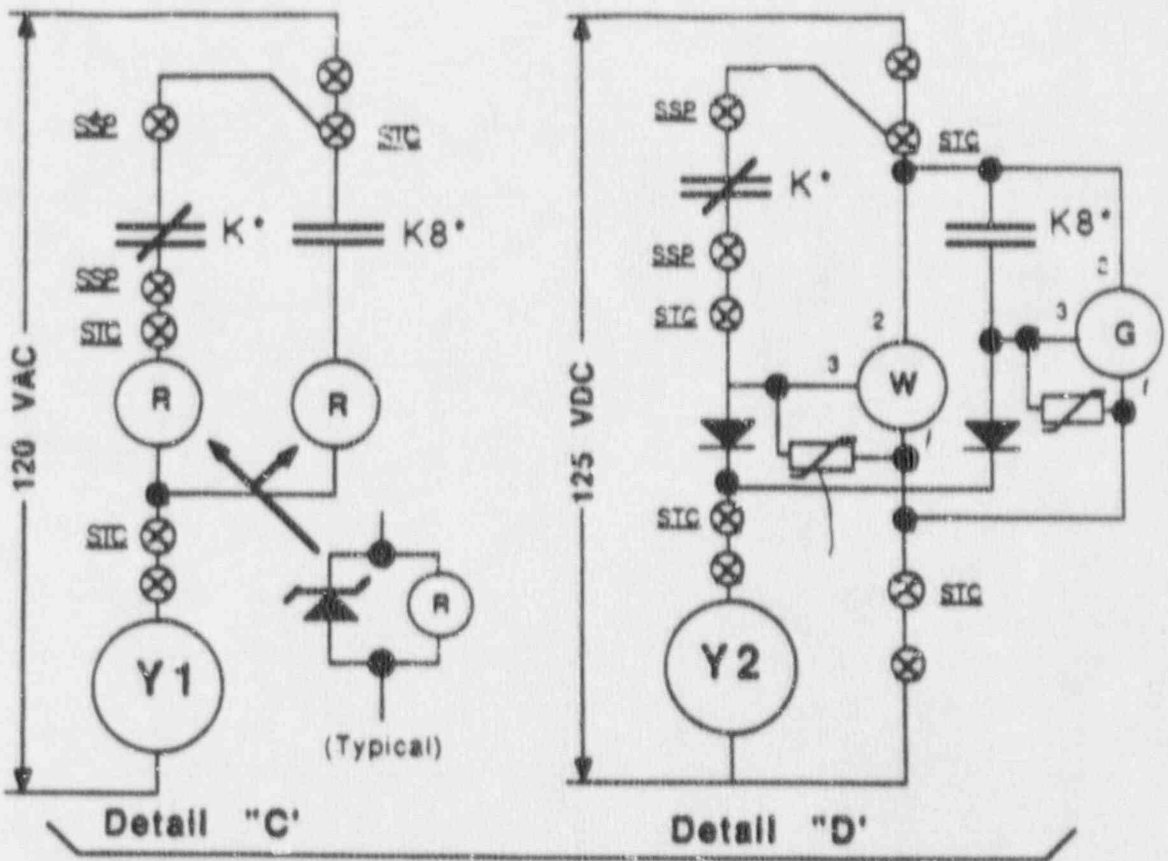


Typical Protection Actuaction Circuit Blocking Schemes
(Contact Closure for Actuation)



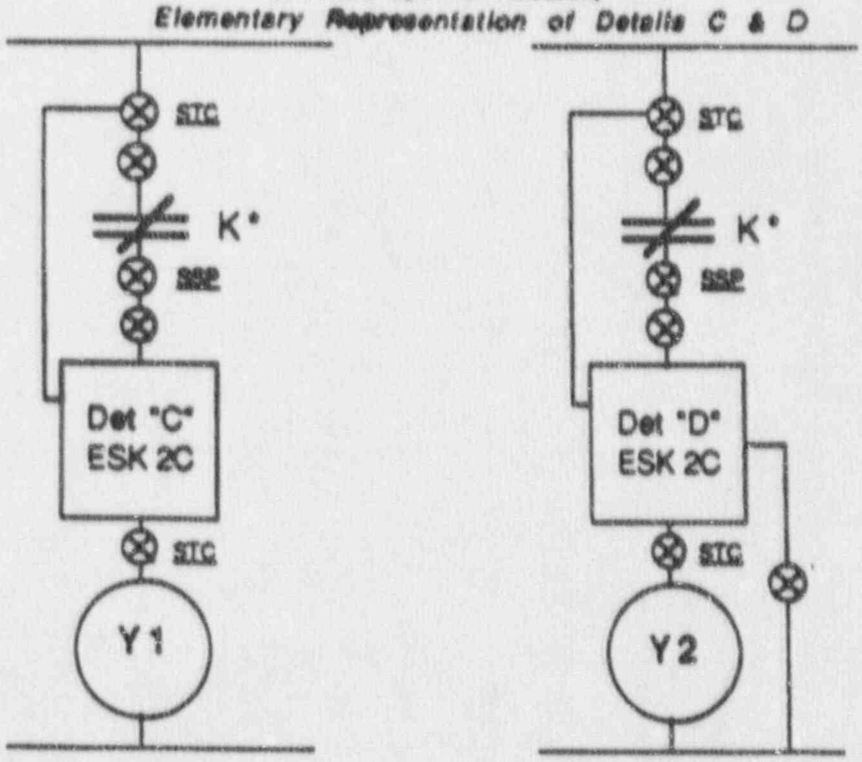
Push to Test
Lamp Detail





Typical Protection Actuation Circuit Blocking Schemes
(Contacts Open for Actuation)

Elementary Representation of Details C & D



ATTACHMENT C

Beaver Valley Power Station, Unit No. 2
Proposed Technical Specification Change No. 47

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3/4.3.2 ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION

SURVEILLANCE REQUIREMENTS

4.3.2.1.1 Each engineered safety feature actuation system instrumentation channel and interlock and the automatic actuation logic with master and slave relays shall be demonstrated OPERABLE by the performance of the ESFAS Instrumentation Surveillance Requirements* during the MODES and at the frequencies shown in Table 4.3-2.

4.3.2.1.2 The logic for the interlocks shall be demonstrated OPERABLE during the at power CHANNEL FUNCTIONAL TEST of channels affected by interlock operation. The total interlock function shall be demonstrated OPERABLE at least once per 18 months during CHANNEL CALIBRATION testing of each channel affected by interlock operation.

4.3.2.1.3 The ENGINEERED SAFETY FEATURES RESPONSE TIME of each ESF function shall be demonstrated to be within the limit at least once per 18 months. Each test shall include at least one logic train such that both logic trains are tested at least once per 36 months and one channel per function such that all channels are tested at least once per N times 18 months where N is the total number of redundant channels in a specific ESF function as shown in the "Total No. of Channels" Column of Table 3.3-3.

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*For the automatic actuation logic, the surveillance requirements shall be the application of various simulated input conditions in conjunction with each possible interlock logic state and verification of the required logic output including, as a minimum, a continuity check of output devices. For the actuation relays, the surveillance requirements shall be the energization of each master and slave relay and verification of OPERABILITY of each relay. The test of master relays shall include a continuity check of each associated slave relay. The test of slave relays shall include, as a minimum, a continuity check of associated actuation devices that are not testable.

(Proposed Wording)

TABLE 4.3-2

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION
SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MASTER RELAY TEST	SLAVE RELAY TEST	MODES IN WHICH SURVEILLANCE REQUIRED
1. SAFETY INJECTION AND FEEDWATER ISOLATION						
a. Manual Initiation	N.A.	N.A.	M(1)	N.A.	N.A.	1, 2, 3, 4
b. Automatic Actuation Logic and Actuation Relays	N.A.	N.A.	M(2)	M(2)	Q(3)	1, 2, 3, 4
c. Containment Pressure-High	S	R	M	N.A.	N.A.	1, 2, 3
d. Pressurizer Pressure--Low	S		M	N.A.	N.A.	1, 2, 3
e. Steam Line Pressure--Low	S	R	M	N.A.	N.A.	1, 2, 3
1.1 SAFETY INJECTION-TRANSFER FROM INJECTION TO THE RECIRCULATION MODE						
a. Automatic Actuation Logic, Coincident with Safety Injection Signal	N.A.	N.A.	M(2)	N.A.	N.A.	1, 2, 3, 4
b. Refueling Water Storage Tank Level-Extreme Low	S	R	M	N.A.	N.A.	1, 2, 3, 4

TABLE 4.2-3 (Continued)

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION
SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MASTER RELAY TEST	SLAVE RELAY TEST	MODES IN WHICH SURVEILLANCE REQUIRED
2. CONTAINMENT SPRAY						
a. Manual Initiation	N.A.	N.A.	M(1)	N.A.	N.A.	1, 2, 3, 4
b. Automatic Actuation and Logic Actuation Relays	N.A.	N.A.	M(2)	M(2)	Q(3)	1, 2, 3, 4
c. Containment Pressure—High-High	S	R	M	N.A.	N.A.	1, 2, 3
3. CONTAINMENT ISOLATION						
a. Phase "A" Isolation						
1. Manual Initiation	N.A.	N.A.	M(1)	N.A.	N.A.	1, 2, 3, 4
2. Automatic Actuation Logic and Actuation Relays	N.A.	N.A.	M(2)	M(2)	Q(3)	1, 2, 3, 4
3. Safety Injection	See Functional Unit 1 above for all Safety Injection Surveillance Requirements.					
b. Phase "B" Isolation						
1. Manual Initiation	N.A.	N.A.	M(1)	N.A.	N.A.	1, 2, 3, 4
2. Automatic Actuation Logic and Actuation Relays*	N.A.	N.A.	M(2)	M(2)	Q(3)	1, 2, 3, 4
3. Containment Pressure—High-High	S	R	M	N.A.	N.A.	1, 2, 3, 4

*Includes testing of CIB actuated slave relay(s) associated with Control Room Emergency Ventilation.

TABLE 4.3-2, (Continued)

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION
SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MASTER RELAY TEST	SLAVE RELAY TEST	MODES IN WHICH SURVEILLANCE REQUIRED
4. STEAM LINE ISOLATION						
a. Manual Initiation						
1. Individual	N.A.	N.A.	M(1)	N.A.	N.A.	1, 2, 3
2. System	N.A.	N.A.	M(1)	N.A.	N.A.	1, 2, 3
b. Automatic Actuation Logic and Actuation Relays	N.A.	N.A.	M(2)	M(2)	Q(3)	1, 2, 3
c. Containment Pressure--Intermediate-High-High	S	R	M	N.A.	N.A.	1, 2, 3
d. Steam Line Pressure--Low	S	R	M	N.A.	N.A.	1, 2, 3
e. Steam Line Pressure Rate-High Negative	S	R	M	N.A.	N.A.	1, 2, 3
5. TURBINE TRIP AND FEEDWATER ISOLATION						
a. Automatic Actuation Logic and Actuation Relays	N.A.	N.A.	M(2)	M(2)	Q(3)	1, 2, 3
b. Steam Generator Water Level--High-High, P-14	S	R	M	N.A.	N.A.	1, 2, 3
c. Safety Injection	See Functional Unit 1 above for all Safety Injection Surveillance Requirements.					

TABLE 4.3-2, (Continued)

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION
SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MASTER RELAY TEST	SLAVE RELAY TEST	MODES IN WHICH SURVEILLANCE REQUIRED
6. LOSS OF POWER						
a. 4.16kv Emergency Bus	N.A.	R	M	N.A.	N.A.	1, 2, 3, 4
1. Undervoltage (Trip Feed)						
2. Undervoltage (Start Diesel)	N.A.	R	M	N.A.	N.A.	1, 2, 3, 4
b. 4.16kv Emergency Bus (Degraded Voltage)	N.A.	R	M	N.A.	N.A.	1, 2, 3, 4
c. 480 Volt Emergency Bus (Degraded Voltage)	N.A.	R	M	N.A.	N.A.	1, 2, 3, 4
7. AUXILIARY FEEDWATER*						
a. Automatic Actuation Logic and Actuation Relays	N.A.	N.A.	M(2)	M(2)	Q(3)	1, 2, 3
b. Steam Generator Water Level--Low-Low						
1. Start Turbine Driven Pump	S	R	M	N.A.	N.A.	1, 2, 3
2. Start Motor Driven Pumps	S	R	M	N.A.	N.A.	1, 2, 3
c. Undervoltage - RCP (Start Turbine Driven Pump)	S	R	M	N.A.	N.A.	1, 2

*Manual initiation is included in Specification 4.7.1.2.

TABLE 4.3-2, (Continued)

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION
SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MASTER RELAY TEST	SLAVE RELAY TEST	MODES IN WHICH SURVEILLANCE REQUIRED
7. AUXILIARY FEEDWATER (continued)						
d. Safety Injection (Start Motor-Driven Pumps)	See 1 above (all SI surveillance requirements)					
e. Trip of Main Feedwater Pumps (Start Motor-Driven Pumps)	N.A.	N.A.	R	N.A.	N.A.	1, 2, 3
8. ENGINEERED SAFETY FEATURE INTERLOCKS						
a. Reactor Trip, P-4	N.A.	N.A.	R	N.A.	N.A.	1, 2, 3
b. Pressurizer Pressure, P-11	N.A.	R	M	N.A.	N.A.	1, 2, 3
c. Low-Low T_{avg}, P-12	N.A.	R	M	N.A.	N.A.	1, 2, 3

TABLE 4.3-2 (Continued)

TABLE NOTATION

(1) Manual actuation switches shall be tested at least once per 18 months during shutdown. All other circuitry associated with manual safeguards actuation shall receive a CHANNEL FUNCTIONAL TEST at least once per 31 days.

(2) Each train or logic channel shall be tested at least every other 31 days.

(3) Slave relays that satisfy at least one of the following criteria are required to be functionally tested on a refueling frequency basis only, all other slave relays will be tested on a quarterly frequency:

a. A single failure in the Safeguards Test Cabinet circuitry would cause an inadvertent RPS or ESF actuation.

b. The test will adversely affect two or more components in one ESF system or two or more ESF systems.

c. The test will create a transient (reactivity, thermal, or hydraulic) condition on the RCS.

ATTACHMENT D

Beaver Valley Power Station, Unit No. 2
Proposed Technical Specification Change No. 47

Applicable UFSAR Changes

7.1.2.4 Requirements for Periodic Testing

Periodic testing of the RTS and ESFAS is described in Sections 7.2.2 and 7.3.2. Testing complies with Regulatory Guide 1.22 and IEEE Standard 338-1977, Criteria for the Periodic Testing of Nuclear Power Generating Station Class 1E Power and Protection Systems.

The surveillance requirements of the Technical Specifications, Chapter 16, ensure that the system functional operability will be maintained comparable to the original design standards. Periodic testing shall be conducted at the intervals specified in Chapter 16, Paragraph 4.3.1.1.1 for reactor trip, Paragraph 4.3.2.1.1 for ESF actuation, and Paragraph 4.3.3.6 for post-accident monitoring. Sensors will be demonstrated adequate for the design by test reports, analysis, operating experience, or by suitable type testing. The NIS detectors are excluded since delays attributable to them do not constitute a significant portion of the overall channel response.

Where the ability of a system to respond to a bona fide accident signal is intentionally bypassed for the purpose of performing a test during reactor operation, each bypass condition is automatically indicated to the reactor operator in the main control room by a separate annunciator for the train in test. Test circuitry does not allow two trains to be tested at the same time so that extension of the bypass condition to the redundant system is prevented.

The actuation logic for the RTS and ESFAS is tested as described in Sections 7.2 and 7.3. As recommended by Regulatory Guide 1.22, where actuated equipment is not tested during reactor operation, it has been determined that:

1. There is no practicable system design that would permit operation of the equipment without adversely affecting the safety or operability of BVPS-2,

2. The probability that the protection system will fail to initiate operation of the equipment is and can be maintained acceptably low without testing the equipment during reactor operation, and

3. The equipment can routinely be tested when the reactor is shut down.

~~The~~ Examples of equipment that cannot be tested at full power so as not to damage equipment or upset plant operation are:

1. Manual actuation switches for system level actuation of protective function,

2. Reactor coolant pump circuit breakers,

3. Turbine trip,

feedwater flow and pressure conditions necessary for proper operation of the steam generator water level control system.

Based on these identified problems incurred with periodic testing of the feedwater isolation valves at power, and since 1) no practical system design will permit operation of these valves without adversely affecting the safety or operability of BVPS-2, 2) the probability that the protection system will fail to initiate the activated equipment is acceptably low due to testing up to final actuation, and 3) these valves will be routinely tested during refueling outages, the proposed resolution meets the guidelines of Section D.4 of Regulatory Guide 1.22.

6. Feedwater control valves

These valves are routinely tested during refueling outages. To close them at power would adversely affect the operability of BVPS-2. The verification of operability of feedwater control valves at power is assured by confirmation of proper operation of the steam generator water level system. ~~The operability of the slave relay which actuates the solenoid, which is the actuating device, is verified during this test. Although the actual closing of these control valves is blocked when the slave relay is tested, all functions are tested to assure that no electrical malfunctions have occurred which could defeat the protective function.~~ It is noted that the solenoids work on the de-energize-to-actuate principle so that the feedwater control valves will fail closed upon either the loss of electrical power to the solenoids or loss of air pressure.

Based on the preceding, the testing of the isolating function of feedwater control valves meets the guidelines of Section D.4 of Regulatory Guide 1.22.

7. Reactor coolant pump primary component cooling water isolation valves (close)

The primary component cooling water (PCCW) supply and return containment isolation valves are routinely tested during refueling outages. Testing of these valves while the RCPs are operating introduces an unnecessary risk of costly damage to all the RCPs. Loss of PCCW to these pumps is of economic consideration only, as the RCPs are not required to perform any safety-related function.

The RCPs will not seize due to complete loss of component cooling water. Information from the pump manufacturer indicates that the bearing babbitt would eventually break down but not so rapidly as to overcome the inertia of the flywheel. If the pumps are not stopped within approximately

10. Main generator trip

The main generator trip cannot be actuated during BVPS-2 operation without causing plant upset or equipment damage. Circuitry for these devices has been provided to individually block actuation of a final device upon operation of the associated solid state logic output relay during testing. Operation of the output relay, including its contact operation and continuity of the electrical circuit associated with the final devices control, is checked in lieu of actual operation. Interlocking prevents blocking the output from more than one output relay in a protection train at a time. Interlocking between trains is also provided to prevent continuity testing in both trains simultaneously. Therefore, the redundant device associated with the protection train not under test will be available in event protection action is required.

11. Primary component cooling to containment

The PCCW containment isolation valves are required to perform a containment isolation function and will be leak-tested and exercised in accordance with the requirements of 10 CFR 50 Appendix J. These valves cannot be full-stroked or leak-tested during BVPS-2 operation. Closing of any of these valves would result in a loss of cooling water to one or two RCPs. These valves will be full-stroked and leak-tested during cold shutdown conditions, utilizing the leakage monitoring connections provided, in accordance with 10 CFR 50 Appendix J, Type C testing requirements.

12. Service water header isolation valves

The service water header isolation valves cannot be full-stroked or leak-tested during BVPS-2 operation. Closing of these valves will upset flow to the PCCW and turbine plant component cooling water heat exchangers, and will potentially cause damage to the service water pump due to run out. These valves will be tested during BVPS-2 shutdown, when the heat load on the component cooling system is low and only one heat exchanger is needed (Section 7.6.7.4).

ADD INSERT "I"

7.1.2.5 Conformance to Regulatory Guide 1.47

Bypass/inoperability indication is in agreement with Regulatory Guide 1.47 with the following clarification:

1. An indicator of bypass/inoperability will be provided for redundant or diverse portions of each safety system. (Bypass includes any deliberate action which renders a safety system inoperable.)

INSERT "1"

The slave relays and associated actuation of plant equipment, which do not satisfy at least one of the following three criteria are tested during reactor operation in accordence with plants technical specifications:

1) A single failure in the safeguards test cabinet circuitry would cause on inadvertent ESF or RPS actuation.

2) The test will adversely affect two or more components in one ESF system or two or more ESF systems.

3) The test will create a transient creativity, thermal, or hydraulic) condition on the RCS.

incorporates the capabilities for test and calibration as set forth in Paragraphs 4.9 and 4.10 of IEEE Standard 279-1971.

Final actuation devices, as defined by IEEE Standard 379-1972, are capable of periodic testing in accordance with Regulatory Guide 1.22. The final actuation devices which cannot be ~~fully~~ tested during reactor operation (for reasons as stated in Positions 4.a through 4.c of Regulatory Guide 1.22) ~~can be subjected to a partial test with the unit on-line and to~~ are fully operational testing during reactor shutdown ~~. These devices are tested and discussed in Section 7.1.2.4.~~ for refueling.

Taken as a whole, the operability of all active components necessary to achieve protective functions can be demonstrated via the testing program described in this item.

3. With regard to Position C.3 of Regulatory Guide 1.53, single switches supplying signals to redundant channels are designed with at least 6 inches separation or suitable barriers between redundant circuits.

4. Compliance with the single failure criteria can be verified based on a collective analysis of both the protective system defined in IEEE Standard 279-1971 and the final actuation devices or actuators defined in IEEE Standard 379-1972.

7.1.2.7 Conformance to Regulatory Guide 1.63

Conformance to Regulatory Guide 1.63 is discussed in Section 8.3.

7.1.2.8 Conformance to IEEE Standard 317-1976

Conformance to IEEE Standard 317-1976, Electric Penetration Assemblies in Containment Structures for Nuclear Power Generating Stations, is discussed in Section 8.3.

7.1.2.9 Conformance to IEEE Standard 336-1971

The quality assurance requirements for installing, inspecting, and testing for instrumentation and electric equipment conforms to IEEE Standard 336-1971.

7.1.2.10 Conformance to IEEE Standard 338-1977

The periodic testing of the RTS and ESFAS conforms to the requirements of IEEE Standard 338-1977, with the following comments:

1. The surveillance requirements of the Technical Specifications for protection system ensure that the system functional operability is maintained comparable to the

are met as closely as possible without causing an actual safety injection.

Testing described in Sections 6.3.4, 7.2.2.2.3, and 7.3.2.2.3 provides complete periodic testability during reactor operation of all logic and components associated with the ECCS. This design meets the requirements of Regulatory Guide 1.22, as discussed in the previous sections. The program is as follows:

1. Prior to initial plant operations, ESF system tests will be conducted.

2. Subsequent to initial start-up, ESF system tests will be conducted during each regularly scheduled refueling outage.

3. During on-line operation of the reactor, all of the ESF analog and logic circuitry will be fully tested. ~~In addition, essentially all of the ESF final actuators will be fully tested. The remaining few final actuators whose operation is not compatible with continued on-line plant operation will be checked by means of continuity testing~~.

<u>Performance Test Acceptability Standard for Safety Injection Signal and Automatic Signal for Containment Depressurization Actuation Generation</u>

During reactor operation, the basis for ESFAS acceptability will be the successful completion of the overlapping tests performed on the initiating system and the ESFAS (Figure 7.3-3). Checks of process indications verify operability of the sensors. Analog checks and tests verify the operability of the analog circuitry from the input of these circuits through and including the logic input relays except for the input relays during the solid state logic testing. Solid state logic testing also checks the digital signal path from and including logic input relay contacts through the logic matrices and master relays and perform continuity tests on the coils of the output slave relays. Final actuator testing operates the output slave relays and verifies operability of those devices which require safeguards actuation and which can be tested without causing plant upset. ~~A continuity check is performed on the actuators of the untestable devices.~~ Operation of the final devices is confirmed by control board indication, and by visual observation that the appropriate pump breakers close and automatic valves have completed their travel.

The basis for acceptability for the ESF interlocks will be control board indication of proper receipt of the signal upon introducing the required input at the appropriate set point.

A select group of ESF final actuators will be fully tested. The remaining group of final actuators will be functionally tested when the reactor is shutdown for Refueling. The final actuators are routinely tested during plant operation by the normal Pump and valve surveillance tests.

valve (MOV) contactors, solenoid-operated valves, emergency diesel generator starting, etc.

Analog Testing

Analog testing is identical (except as noted) to that used for reactor trip circuitry and is described in Section 7.2. An exception to this is containment spray, which is energized to actuate two out of four and reverts to two out of three when one channel is in test.

Solid State Logic Testing

Except for containment spray channels, solid-state logic testing is the same as that discussed in Section 7.2. During logic testing of one train, the other train can initiate the required ESF function (Katz 1971). Katz (1971) gives additional information on solid-state logic testing.

Actuator Testing

At this point, testing of the initiation circuits through operation of the master relay and its contacts to the coils of the slave relays has been accomplished. Slave relays do not operate because of the reduced voltage.

~~The~~ These ESFAS final actuation ~~device~~ devices or actuated equipment that can be tested during reactor operation ~~testing~~ will be performed from the engineered safeguards test cabinets. These cabinets are normally located near the SSPS equipment. One test cabinet is provided for each of the two protection trains, Trains A and B. Each cabinet contains individual test switches necessary to actuate the slave relays. To prevent accidental actuation, test switches are of the type that must be rotated and then depressed to operate the slave relays. Assignments of contacts of the slave relays for actuation of various final devices or actuators have been made such that groups of devices or actuated equipment can be operated individually~~, during BVPS-2 operation without causing plant upset or equipment damage~~. In the unlikely event that a safety injection signal is initiated during the test of the final device that is actuated by this test, the device will already be in its safeguards position.

During on line slave relay testing ~~this last procedure~~, close communication between the main control room operator and the operator at the test panel is required. Prior to the energizing of a slave relay, the operator in the main control room assures that plant conditions will permit operation of the equipment that is to be actuated by the relay. After the test panel operator has energized the slave relay, the main control room operator observes that all associated equipment has operated, as indicated by appropriate indicating lamps, monitor lamps, and annunciators on the main control board~~, and using a prepared checklist, records all operations~~. This operator then resets all devices and returns plant systems to pretest conditions. ~~prepares for operation of the next slave relay-actuated equipment~~.

By means of the procedure outlined previously, all ESF devices actuated by the ESFAS initiation circuits, with the exceptions noted in Section 7.1.2.4 under a discussion of Regulatory Guide 1.22, are operated by the automatic circuitry.

Actuator Blocking and Continuity Test Circuits

Those few final actuation devices that cannot be designed to be actuated during BVPS-2 operation (discussed in Section 7.1.2.4) have been assigned to slave relays, for which additional test circuitry has been provided to individually block actuation of a final device upon operation of the associated slave relay during testing. Operation of these slave relays, including contact operations and continuity of the electrical circuits associated with the final devices' control, are checked in lieu of actual operation. The circuits provide for monitoring of the slave relay contacts, the devices' control circuit cabling, control voltage, and the devices' actuation solenoids. Interlocking prevents blocking the output from more than one output relay in a protection train at a time. Interlocking between Trains A and B is also provided to prevent continuity testing in both trains simultaneously. The redundant device associated with the protection train not under test will be available in the event protective action is required. If an accident occurs during testing, the automatic actuation circuitry will override testing as noted previously. One exception to this is that if the accident occurs while testing a slave relay whose output must be blocked, those few final actuation devices associated with this slave relay will not be overridden; however, the redundant devices in the other train would be operational and would perform the required safety function. Actuation devices to be blocked are identified in Section 7.1.2.4.

The continuity test circuits for those components that cannot be actuated on-line are verified by providing indicating lights on the safeguards test racks.

ADD INSERT "2"

The typical schemes for blocking operation of selected protection function actuator circuits are shown on Figure 7.3-4 as Details A and B. The schemes operate as explained by the following and are duplicated for each safeguards train.

Detail A shows the circuit for contact closure for protection function actuation. Under normal BVPS-2 operation, and equipment not under test, the test lamp DS* for the various circuits will be energized. Typical circuit path will be through the normally closed test relay contact K8* and through test lamp connections 1 to 3. Coil X2 will be capable of being energized for protection function actuation upon closure of solid-state logic output relay contact K*. Coil X2 is typical for a breaker closing auxiliary coil, motor starter master coil, coil of a solenoid valve, auxiliary relay, etc. When the contact K8* is opened to block energizing of coil X2, the white lamp is de-energized and the slave relay K* may be energized to

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The remaining slave relays and associated final actuation devices are functionally tested during the refueling outages. Various performance tests are conducted during the refueling outages to ensure ESF system operability. The slave relays are verified to be operable during these tests. The performance tests verify that each contact in the slave relay performs its safety function.

perform continuity testing. This continuity testing is verified by depressing test lamp DS* and observing that the lamp lights through connection 2 (Contact K8* open) through solid-state logic output relay contact K* (now closed) and finally through actuator coil X2 Sufficient current will flow in the circuit to cause the lamp to glow but insufficient to cause the actuator coil X2 to operate. To verify operability of the blocking relay in both blocking and restoring normal service, open the blocking relay contact in series with lamp connections - the test lamp should be de-energized; close the blocking relay contact in series with the lamp connections - the test lamp should now be energized. This test verifies that the circuit is now in its normal, that is, operable condition.

Detail B shows the circuit for contact opening for protection function actuation. Under normal BVPS-2 operation, and equipment not under test, the white test lamp DS*, for the various circuits will be energized, and green test lamp DS* will be de-energized. Typical circuit path for white lamp DS* will be through the normally closed solid-state logic output relay contact K* and through test lamp connections 1 to 3. Coil Y2 will be capable of being de-energized for protection function actuation upon opening of solid-state logic output relay contact K*. Coil Y2 is typical for a solenoid valve coil, auxiliary relay, etc. When the contact K8* is closed to block de-energizing of coil Y2, the green test lamp is energized and the slave relay K* may be energized to verify operation (opening of its contacts). To verify operability of the blocking relay in both blocking and restoring normal service, close the blocking relay contact to the green lamp - the green test lamp should be energized; open this blocking relay contact - the green test lamp should be de-energized, which verifies that the circuit is now in its normal (that is, operable) condition.

Time Required for Testing

It is estimated that analog testing can be performed at a rate of several channels per hour. Logic testing of Train A or B can be performed in less than 2 hours. Testing of actuated components ~~(including those which can only be partially tested)~~ will be a function of main control room operator availability. It is expected to require several shifts to accomplish these tests. During this procedure automatic actuation circuitry will override testing~~, except for those few devices associated with a single slave relay whose outputs must be closed and then only while blocked. It is anticipated that continuity testing associated with a blocked slave relay could take several minutes. During this time, the redundant devices in the other trains would be functional.~~

Summary of On-Line Testing Capabilities

The procedures described provide capability for checking completely from the process signal to the logic cabinets and from there to the individual pump and fan circuit breakers or starters, valve

contractors, pilot solenoid valves, etc, including all field cabling actually used in the circuitry called upon to operate for an accident condition. For those ~~few~~ devices whose operation could adversely affect BVPS-2 or equipment operation, the same procedure provides for checking from the process signal to the logic rack. ~~To check the final actuation device a continuity test of the individual control circuits is performed.~~ Testing of the slave relay contacts to the actuated equipment is performed during refueling outages.

The procedures require testing at various locations:

1. Analog testing and verification of bistable set points are accomplished at the process analog racks. Verification of bistable relay operation is done by the main control room status lights.

2. Logic testing through operation of the master relays and low voltage application to slave relays is done at the logic rack test panel.

3. Testing of select pumps, fans, and valves is done at a test panel located in the vicinity of the logic racks, in combination with the main control room operator.

4. ~~Continuity testing for those circuits that cannot be operated is done at the same test panel mentioned in item 3.~~ The contacts of the select slave relays are verified operable during the testing mentioned in item 3.

5. A full functional test is performed during the refueling outages to ensure all actuated equipment is operable.

The reactor coolant pump (RCP) essential service isolation valves consist of the isolation valves for the component cooling water (CCW) and the seal water return header. For the discussion of testing limitations of these valves, refer to Section 7.1.2.4, Items 7 and 9.

Containment spray system tests will be performed periodically. The pump tests will be performed with the isolation valves in the spray supply lines at the containment and spray chemical additive tank closed. The valves tests are performed with the pump stopped. During this testing, automatic actuation circuitry will override testing.

Testing During Shutdown

The ECCS tests will be performed at each major fuel reloading with the RCS isolated from the ECCS by closing the appropriate valves. A test safety injection signal will then be applied to initiate operation of active components (pumps and valves) of the ECCS. This is in compliance with GDC 37.