TECHNICAL EVALUATION REPORT

OVERRIDE AND RESET OF CONTROL CIRCUITRY IN THE VENTILATION/PURGE ISOLATION AND OTHER ENGINEERED SAFETY FEATURE SYSTEMS (B-24)

PORTLAND GENERAL ELECTRIC COMPANY

TROJAN NUCLEAR PLANT

NRC DOCKET NO. 50-344

NRC TAC NO. 08291

NRC CONTRACT NO. NRC-03-79-118

FRC PROJECT C5257

FRC ASSIGNMENT 7

FRC TASK 183

Prepared by

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Prepared for

Nuclear Regulatory Commission
Washington, D.C. 20555

Lead NRC Engineer: J. Calvo

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Date: 4 Aug 82	Date: 4 Aug. 1982	Date: 4 Aug 1982

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ABSTRACT

This report documents the technical evaluation of the design of electrical, instrumentation, and control systems provided in the Trojan Nuclear Plant to initiate automatic closure of valves to isolate the containment. The evaluation was conducted in accordance with NRC criteria, based on IEEE Std 279-1971, for assuring that containment isolation and other engineered safety features will not be compromised by manual overriding and resetting of the safety actuation signals. It was concluded that the electrical, instrumentation, and control systems in the Trojan Nuclear Plant partially satisfy the NRC criteria.

FOREWORD

This Technical Evaluation Report was prepared by Franklin Research Center under a contract with the U.S. Nuclear Regulatory Commission (Office of Nuclear Reactor Regulation, Division of Licensing) for technical assistance in support of NRC operating reactor licensing actions. The technical evaluation was conducted in accordance with criteria established by the NRC.

Mr. I. H. Sargent contributed to the technical preparation of this report through a subcontract with WESTEC Services, Inc.

CONTENTS

LIST OF FIGURES

1. INTRODUCTION

Several instances have been reported at nuclear power plants where automatic closure of the containment ventilation/purge valves would not have occurred because the safety actuation signals were either overridden or blocked during normal plant operations. These events resulted from procedural inadequacies, design deficiencies, and lack of proper management controls. These events also brought into question the mechanical operability of the containment isolation valves themselves. These events were determined by the U.S. Nuclear Regulatory Commission (NRC) to be Abnormal Occurrences (#78-5) and were, accordingly, reported to the U.S. Congress.

As a followup to this Abnormal Occurrence, the NRC staff is reviewing the electrical override aspects and the mechanical operability aspects of containment purging for all operating power reactors. On November 28, 1978, the NRC issued a letter entitled "Containment Purging During Normal Plant Operation" [1]* to all boiling water reactor (BWR) and pressurized water reactor (PWR) licensees. Portland General Electric Company (PGE), Licensee for the Trojan Nuclear Plant, responded to this letter in several submittals [2, 3, 4] which advised the NRC staff of PGE's review of purging operations at the Trojan plant. These responses dealt, in general, with the physical aspects of purging, such as system susceptibility to internal missiles or debris and the effects of open purge valves on the potential operation of the emergency core cooling system (ECCS). On November 19, 1979 [5], the NRC staff provided an interim position concerning containment purge and vent valve operation pending resolution of issues associated with isolation valve operability. PGE responded to this position on January 14, 1980 [6]. In this response, PGE indicated that the containment at the Trojan plant remained isolated to the extent possible with purging and venting conducted only when required for personnel or equipment protection, that the 54-in purge and vent isolation valve would be maintained closed during plant operation, and that the hydrogen vent system 8-in motor-operated valves would be opened no further than 50

*Numbers in brackets refer to citations in the list of references, Section 5.

degrees to ensure that critical valve parts would not be damaged by a design basis accident. In addition, PGE reported the results of the review of all engineered safety feature (ESF) actuation signal circuits incorporating a manual override including the conclusion that there were no instances where the overriding of one ESF actuation signal would bypass any other ESF actuation signal.

On March 18, 1980 [7], the NRC requested additional information related to the electrical, instrumentation, and control aspects of containment purge and other ESF systems at the Trojan plant. PGE responded to this request by letter dated June 16, 1980 [8], which was received by FRC on October 20, 1980. This information was insufficient for an independent schematic level review and was supplemented, in response to a verbal request for additional information, by two transmittals dated January 13, 1981 [9] and March 11, 1981 [10] covering valve control circuitry and solid state protection system circuitry, respectively.

In December 1981, a draft technical evaluation report was provided to PGE for comment and proposed actions, if any. PGE responded to the issues identified in that draft report in a letter dated March 12, 1982 [11]. This response included schematic drawings indicating significant revisions from those used in the original review as well as explanatory information concering operations at the Trojan plant. This evaluation is based on information provided in all identified submittals.

This document addresses only the electrical, instrumentation, and control design aspects of containment ventilation isolation (CVI) and other engineered safety features.

2. REVIEW CRITERIA

The primary intent of this evaluation is to determine if the following NRC staff criteria are met for the safety signals to all ESF equipment:

- Criterion 1. In keeping with the requirements of General Design Criteria (GDC) 55 and 56, the overriding* of one type of safety actuation signal (e.g., radiation) should not cause the blocking of any other type of safety actuation signal (e.g., pressure) for those valves that have no function besides containment isolation.

- Criterion 2. Sufficient physical features (e.g., key lock switches) are to be provided to facilitate adequate administrative controls.

- Criterion 3. A system level annunciation of the overridden status should be provided for every safety system impacted when any override is active. (See NRC Regulatory Guide 1.47.)

Incidental to this review, the following additional NRC staff design criteria were used in the evaluation:

- Criterion 4. Diverse signals should be provided to initiate isolation of the containment ventilation system. Specifically, containment high radiation, safety injection actuation, and containment high pressure (where containment high pressure is not a portion of safety injection actuation) should automatically initiate CVI.

- Criterion 5. The instrumentation and control systems provided to initiate the ESF should be designed and qualified as safety-grade equipment.

- Criterion 6. The overriding or resetting+ of the ESF actuation signal should not cause any valve or damper to change position.

In this review, Criterion 6 applies primarily to other related ESF systems, because implementation of this criterion for containment isolation has been reviewed by the Lessons Learned Task Force, based on the recommendations in NUREG-0578, Section 2.1.4. Automatic valve repositioning upon reset

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*Override: the signal is still present, and it is blocked in order to perform a function contrary to the signal.

+Reset: the signal has come and gone, and the circuit is being cleared in order to return it to the normal condition.

may be acceptable when containment isolation is not involved. The acceptability of repositioning upon reset will be determined on a case-by-case basis. Acceptability will be dependent upon system function, design intent, and suitable operating procedures.

3. TECHNICAL EVALUATION

3.1 CONTAINMENT VENTILATION ISOLATION SYSTEM DESIGN DESCRIPTION

3.1.1 General System Design

The containment ventilation isolation (CVI) system is a portion of the solid state protection system consisting of a printed circuit board, designated a SAF-OUT device, which processes inputs from either the safety injection (SI) output device or the containment radiation monitor and produces an output to actuate master and slave relays (and associated contacts) to shut the 54-in containment purge and exhaust isolation valves and the 8-in containment hydrogen vent valves. PGE has indicated that all instrumentation and control systems to initiate ESF are safety-related (i.e., safety grade). Containment purge and exhaust isolation valves are currently maintained closed during plant operation.

3.1.2 Logic Circuits for Trip, Seal-in, and Reset

Containment ventilation isolation at the Trojan plant is initiated through two separate electrical trains, A and B. Each train consists of automatic and manual inputs processed through solid state protection system logic circuitry to actuate a relay logic component actuation system. The outboard, motor-operated, valves in the purge supply and exhaust lines are actuated by Train A. The inboard, solenoid-operated, valves are actuated by Train B.

Initiation signals for each electrical train are arranged to provide an isolation signal based on the following inputs:

- Automatic isolation
  - SI actuation
  - Containment high radiation
- Manual isolation
  - Manual SI initiation
  - Manual CVI initiation.

The automatic SI signal is derived from any of the following:

- o Low pressurizer pressure (2 of 3)
- o High containment pressure (2 of 3)
- o High steam line differential pressure (2 of 3, any loop)
- o High steam line flow (2 of 4 loops) coincident with either low-low Tavg or low steam line pressure.

As shown in Figure 1, SI actuation (automatic and manual) and high radiation CVI initiation signals are combined to provide a single input to a logic device (SAF-OUT board) in each electrical train. These output devices consist of a "resettable" solid state latching circuit with a power conditioning output circuit and are each used to drive a master relay coil. The contacts of the master relay control the latching-type slave relays, which have contacts in the individual control circuits for the solenoid and motor operators used to position ESF valves and dampers.

A manually operated "RESET" pushbutton actuates the unlatch coils of the slave relays and provides a "reset" signal to the solid state logic circuit. A "reset" signal causes the SAF-OUT logic circuit to remove the actuation signal from the master relay and to go to a signal-blocking mode until all initiating signals have been removed (e.g., measured isolation parameter value returns to normal). Thus, the "reset" feature of the solid state protection system SAF-OUT logic unit behaves as an override which defeats all automatic signals if initiated with an actuation signal present. The manual SI actuation signal automatically actuates the CVI system and thus is affected by this override. The manual CVI signal, however, is downstream of the CVI SAF-OUT board and thus is not affected by an override of the CVI logic.

3.1.3 Individual Valve Control Circuits

Control circuits for motor-operated (full voltage reversing motor controllers) purge supply and exhaust valves, shown in Figure 2, are designed to be opened only by actuation of an individual valve control switch. Valve control switches have contacts in both the opening and closing relay circuits, which are open whenever the switch is in its neutral/normal position. Since these switches are spring returned to neutral, with the closing contact bypassed by the appropriate slave relay contact when an isolation signal is present, manual switch motion is necessary to energize the opening coil following the clearing of the isolation signal. Further, a normally closed slave relay contact in the "open" relay circuit prevents momentary valve motion should the local control switch be placed in the open position with a CVI signal present.

As shown in the control switch development of Figure 3, control circuits for solenoid-operated purge supply and exhaust valves are also designed to require follow-up manual actuation in order to reopen these valves following the "reset" of an isolation signal. With this circuit arrangement, the local control switch must be repositioned to "open" to reenergize the solenoid operator if the CI contacts are reclosed following a trip.

3.2 CONTAINMENT VENTILATION ISOLATION SYSTEM DESIGN EVALUATION

The CVI system at the Trojan plant does not satisfy Criterion 1. Actuation of the system "RESET" provided for the CVI SAF-OUT device, with an input signal present, will deenergize the master relay and unlatch the slave relays for the purge isolation valves, allowing the valves to be reopened with an isolation signal present. Further, "RESET" actuation will prevent a second isolation signal (e.g., safety injection after containment high radiation) from initiating CVI until the first signal has cleared.

The CVI system at the Trojan plant does not satisfy Criterion 2. No physical features have been provided to facilitate administrative controls to prevent the inadvertent actuation of the CVI "RESET."

The CVI system at the Trojan plant does not satisfy Criterion 3. No annunciation of the overridden status of the CVI actuation system is provided.

The CVI system at the Trojan plant satisfies Criterion 4. Containment purge supply and exhaust are isolated on safety injection actuation (high containment pressure, high steam line differential pressure, low pressurizer pressure, or high steam line flow) or a containment high radiation signal.

The CVI system at the Trojan plant partially satisfies Criterion 5. PGE has stated that all instrumentation and control systems provided to initiate ESF are safety-related (i.e., safety grade) and referenced the Trojan FSAR Sections 7.1 and 7.3 for further information concerning compliance. The Trojan FSAR provides a detailed description of system design features with respect to safety design criterion (e.g., IEEE Std 279) indicating that, in general, these systems do meet accepted safety requirements for design, qualification, and testing. The containment high radiation detectors and associated circuitry, however, have not been designed as safety-grade equipment.

The CVI system at the Trojan plant satisfies Criterion 6.

3.3 OTHER ENGINEERED SAFETY FEATURE SYSTEM CIRCUITS

In addition to the review of valves and dampers associated with the CVI system (i.e., purge supply and exhaust valves) previously described, the design of other ESF systems with manual override features was audited by performing a detailed circuit analysis of spray actuation, containment isolation, and feedwater isolation.

3.3.1 Description of Other Engineered Safety Feature System Circuits

3.3.1.1 General System Design

Initiation signals for ESF systems and components are combined in solid state logic circuits. For other than a simple "OR" gate, logic circuits are provided in printed circuit boards designated UNIVERSAL BOARD. The logic of these boards can be selected by external connections to produce output signals based on AND, OR, 2-out-of-3, or 2-out-of-4 combinations of input signals. The output of the universal logic circuits is used to drive SAF-OUT boards as previously described. SAF-OUT signals control power to master relays which, in turn, control slave relays. Slave relay contacts operate in the control circuit for individual valves, dampers, and other ESF equipment. Manual ESF initiation, where provided, directly energizes the appropriate master relay regardless of the status of the associated SAF-OUT device. Manual system

"RESET," where provided, operates (as previously described) to unlatch associated slave relays and block the output of associated SAF-OUT devices if a safety signal is present. PGE has indicated that all instrumentation and control systems provided to initiate ESF are safety related.

3.3.1.2 Logic Circuits for Trip, Seal-in, and Reset

In general, other ESF systems are actuated automatically by signals associated with appropriate plant parameters and may be initiated manually through momentary contact push buttons. Manual initiation is accomplished regardless of the state of the associated SAF-OUT device, by directly energizing the appropriate master relay which energizes the associated slave relays. Release of the manual initiation push button deenergizes the master relays but does not unlatch the slave relays. The actuation of momentary contact push button ("RESET") is required to unlatch the slave relays. Table 1 identifies the provisions for manual initiation, automatic initiation, and reset for each ESF system.

As discussed in Section 3.1.2, concerning the operation of the SAF-OUT device, the "RESET" feature performs as an override which will override automatic signals but will not preclude manual actuation of the master relay. This feature is of significance when more than one input signal is combined in an OR gate immediately prior to the SAF-OUT board. In such a case, the "RESET" of the SAF-OUT device with one signal present will prevent the reinitiation of a SAF-OUT output signal should a second input signal appear at the OR gate before the first signal clears. This situation does not occur in Trojan ESF circuits, other than CVI as previously discussed, since single parameter initiation signals are used to initiate the containment spray and containment isolation actuation systems and, in the case of the feedwater isolation systems, as shown in Figure 4, a single parameter signal is used to initiate that portion of the system having a pushbutton "reset."

3.3.1.3 Individual Valve Control Circuits

Valve control circuitry provided for motor-operated valves in ESF systems at the Trojan plant is, in general, designed with spring return to neutral

Table 1

ESF	Manual Initiation	Auto Initiation Signal	"RESET"
Containment Spray	Yes	High-High Containment Pressure (2 of 4)	Yes
Containment Isolation	Yes	Safety Injection[a]	Yes
Feedwater Isolation	No	Safety Injection[a]	Yes[b]
		High-High Steam Generator Level (2 of 3) from Any Steam Generator	
		Low Tavg (2 of 4) Coincident with Reactor Trip	

a. Either manual or automatic.
b. "RESET" push button provided for low Tavg trip.
Steam generator water level trip "RESET" in test mode only.
Safety injection trip "RESET" in test mode or at SI output device.

individual valve control switches. Switch contacts are located in series with each motor controller reversing relay and are open when the switch is in the normal or neutral position. Each switch contact is paralleled by an "a" contact from its associated reversing relay to provide signal seal-ins until valve travel is complete or the corresponding torque switch is actuated. ESF slave relay contacts in the appropriate closing (motor-reversing) circuit shunt the associated "close" switch contacts to energize the reversing relay when the slave relay is energized. Some controllers have push buttons which allow local valve cycling. Figure 2 provides a simplified schematic representation of the control circuitry for a valve closed on ESF initiation. Valves which are opened on ESF initiation (e.g., containment spray ring header isolation valves) are wired similarly with the slave relay contacts in parallel with the control switch contacts in the opening circuit.

Control circuits for solenoid-operated valves in Trojan ESF systems are provided in two schemes. The basic scheme is a series/parallel arrangement similar to that in Figure 3. In this arrangement, the ESF slave relay contacts are installed in series with one set of contacts from the manual control switch. A second set of switch contacts, which momentarily close when the switch is held in the open position, are installed in parallel with a solenoid "a" contact. Either of these contacts must be closed to provide power to the solenoid operator. A second arrangement is depicted in Figure 5. In this arrangement, a solenoid position switch contact is provided in a hold-in loop in series with the ESF slave relay contact and control switch contact which, upon spring return to normal, remains in the state required by the last manual operation. This circuit is paralleled by a switch contact which is closed only when the control switch is held in the open position.

3.3.2 Evaluation of Other Engineered Safety Feature System Designs

Control circuitry in ESF systems at the Trojan plant, other than the CVI system, meets the intent of Criterion 1. In cases where the ESF signal can be overridden in the solid state protection system circuitry (i.e., through the use of a push button "RESET" operating on the SAF-OUT device), this override affects only a single trip parameter (e.g., high-high containment pressure for containment spray initiation, safety injection for containment isolation, and low Tavg for a portion of the feedwater isolation system). The "RESET" of the SI SAF-OUT board does block multiple signals (input to the SI SAF-OUT board is provided by either high containment pressure, high steam line differential pressure, low pressurizer pressure, or high steam line flow), but this output performs functions other than containment isolation (e.g., pump starts) and has been identified by the NRC staff to be beyond the scope of this review.

In several instances, hand switch overrides are provided in individual valve control circuitry which can override an ESF signal. Such arrangements occur in motor operator controllers not provided with ESF slave relay contacts in both reversing coil circuits. Similarly, one solenoid operator control scheme provides a manual switch contact which will bypass the ESF slave relay contact. All such arrangements found in the review, however, employ either momentary contact push buttons or spring return to normal switches which result in an override situation only when the push button is depressed or the hand switch is held in the override position. Upon release of these push buttons or hand switches, the associated valve will return to the position required by the ESF signal. Further, as discussed with respect to the SAF-OUT "RESET," these local switches do not, with the exception of devices actuated by safety injection actuation, override multiple parameter input signals (i.e., the switch contacts bypass only a single set of slave relay contacts).

System level (i.e., "RESET") and local overrides at the Trojan plant do not satisfy Criterion 2. No physical features have been provided to facilitate the administrative control of switches or push buttons which could continuously (e.g., "RESET" push button) or momentarily override an ESF signal.

System level overrides at the Trojan plant do not satisfy Criterion 3. There is no indication that the use of a system level override (e.g., "RESET" of containment spray initiation, feedwater isolation, or containment isolation) will be annunciated to indicate the overridden status of that system.

Criterion 4 does not apply to other ESF systems. A discussion of compliance with the criterion in the case of containment ventilation systems is provided in Section 3.2.

ESF systems other than CVI at the Trojan plant satisfy Criterion 5. This conclusion is based on the Licensee's statement that "all instrumentation and control systems provided to initiate ESF are safety-related (i.e., safety grade)" and on the review of the Trojan FSAR.

ESF instrumentation and control systems at the Trojan plant do not fully satisfy Criterion 6. For feedwater control and bypass valves, the ESF slave relay contacts are in series with a solenoid operator (i.e., no control switch provided). In such an arrangement, the reset of an ESF signal will cause the associated valve to change automatically to the position determined by their respective hand controllers.

4. CONCLUSIONS

The electrical, instrumentation, and control design aspects of ESF systems at the Trojan plant were evaluated against NRC design criteria. Areas of apparent noncompliance with these criteria were identified on the basis of schematic drawings provided by the Licensee. The following section identifies the extent of compliance with each criterion, PGE's position and, where appropriate, additional information concerning these criteria, and conclusions and recommendations.

4.1 CRITERION 1

4.1.1 Existing Conditions

The "RESET" feature of the SSPS SAF-OUT device in the CVI subsystem will override an existing safety signal (i.e., safety injection or high radiation) and block actuation by a second safety signal until the first has cleared. This situation is not consistent with NRC staff Criterion 1.

4.1.2 Licensee Position

The CVI system operates two sets of valves, that is, the containment purge supply and exhaust valves, and the hydrogen vent supply and exhaust valves.

The containment purge supply and exhaust valves have been maintained shut during power operations. Further, PGE will provide technical specifications requiring that these valves be shut and inoperable during Operating Modes 1 through 4.

Hydrogen vent supply and exhaust valves may be opened during Operating Modes 1 through 4, although their use will be restricted to times when such operation is required. (The hydrogen vent supply valves are currently maintained closed during these operating modes, but this constraint will be removed in the future when these valves are replaced by valves with non-resilient seals.) These valves, however, receive isolation signals from both the CVI and CIS subsystems. This arrangement, combined with present and proposed plant operating procedures, eliminates potential consequences which form the basis for Criterion 1, as follows:

- Safety injection (SI) as initial signal. The operator's actions to establish manual control of the plant are expected to begin with SI reset. If SI is indeed reset first, this signal will be removed as an input to the CVI subsystem and subsequent operation of the CVI reset pushbutton will act as a true reset and not block a high radiation signal should it occur. If however, the CVI subsystem is reset initially, the existing SI signal at the CIS subsystem will prevent repositioning of the hydrogen vent valves.

- High radiation as initial signal. It is highly unlikely that an operator will reset CVI with a high radiation signal present since the only reason to reset CVI would be to open containment ventilation valves and this would not be done if a high radiation condition existed in the containment. If CVI were reset, however, this action would not prevent a subsequent SI signal from shutting the hydrogen vent supply and exhaust valve via the CIS subsystem. Since the containment purge supply and exhaust valves are required by technical specifications to be inoperable during Operating Modes 1 through 4, they could not be opened upon reset of the CVI subsystem. During plant Operating Modes 5 and 6, when these valves could be opened, plant parameters and the SSPS arrangement are such that an SI signal cannot be generated.

Plant operating procedures will be modified such that resetting of CVI will not be allowed when a valid high radiation signal is present unless this action is necessary during post-accident conditions. If a high radiation signal has been determined to be erroneous, the affected radiation monitor channel will be deenergized prior to resetting CVI.

4.1.3 Conclusions and Recommendations

ESF circuitry installed at the Trojan plant does not conform to Criterion 1 since the overriding of one type of safety actuation signal will cause the blocking of another type of safety actuation signal until the first signal clears. PGE has established and an independent review has confirmed, however, that with the present circuitry supplemented by certain administrative controls, it is highly unlikely that an incident similar to that providing the basis for this criteria will occur. Specifically, PGE has established that a combination of technical specifications (maintaining the containment purge supply and exhaust valves shut during Operating Modes 1-4) and operator training will prevent a situation where, in the absence of multiple errors, a containment isolation valve may fail to respond to an isolation signal. This situation can be summarized as follows:

A. In order for an isolation valve to fail to shut in response to containment high radiation condition subsequent to conditions leading to a SI signal:

   1. In the case of the containment purge supply and exhaust valves, CVI must be reset without resetting SI (procedural violation). The supply and exhaust valves must be opened (a technical specification violation)

   2. In the case of the hydrogen vent supply and exhaust valves, both CVI and CIS must be reset without resetting SI (procedural violation).

B. In order for an isolation valve to fail to shut in response to conditions leading to an SI signal subsequent to containment high radiation conditions:

   1. In the case of the containment purge supply and exhaust valves; CVI must be reset with a high radiation signal present (procedural violation). The supply and exhaust valves must be opened (technical specification violation)

   2. In the case of the hydrogen vent and supply and exhaust valves, operator action cannot prevent isolation upon SI actuation.

Of the four cases identified, the only case not protected by either technical specification (A1, B1) or ESF circuitry (B2) is that case involving the failure of the hydrogen vent supply and exhaust valves to close in response to a containment high radiation condition subsequent to being opened following the override of an SI signal. In this case, two separate operator actions, in addition to opening these valves, are necessary. Each of these actions, resetting CVI and resetting CIS without resetting SI, is not consistent with expected operator actions following an SI signal. They are apparently not, however, prevented by procedural controls at the Trojan plant.

Based on the foregoing, it is apparent that the issue is whether circuitry supplemented by administrative controls provides a level of protection (or safety) equivalent to the hardware protection specified by the NRC staff in

Criterion 1. Such a determination is not within the scope of this evaluation. It is recommended, however, that this issue be resolved in conjunction with Criteria 2 and 3. If the Licensee provides additional procedural controls requiring that SI be reset prior to resetting CVI and supports this and other proposed procedural controls with adequate physical features and override annunciation in conformance with Criteria 2 and 3, it is felt that the objectives of Criterion 1 can be accomplished.

4.2 CRITERION 2

4.2.1 Existing Conditions

ESF "RESET" pushbuttons at the Trojan plant are not provided with physical features to facilitate administrative controls.

4.2.2 Licensee Position

The operation of the "RESET" pushbutton is controlled by licensed and trained operators using approved operating procedures. Further, inadvertent operation of a "RESET" pushbutton will not affect the operational status of an ESF system (i.e., following reset, an individual valve control switch operation will be required to change a component's status; in cases where two electrical trains are involved, such as redundant containment isolation valves, a second reset and control switch actuation will be required to change system status). Based on these considerations, additional physical features to facilitate administrative control for SSPS "RESET" pushbuttons are not necessary.

4.2.3 Conclusions and Recommendations

The Licensee does not agree with the requirements set forth in Criterion 2 on the basis that operator training and control system circuitry is sufficient to prevent inadvertent alteration of fluid system status via instrumentation reset switches. Based on our understanding of the staff's concern to ensure that any safety system override is performed only under appropriate supervisory control, the current situation does not meet the intent of this criterion. Suitable physical features should be installed to support the administrative control of SSPS "RESET" switches associated with the actuation of CVI subsystem valves and dampers..

4.3 CRITERION 3

4.3.1 Existing Conditions

RESET switches will override the output of a SAF-OUT device if actuated with an input signal present. System level annunciation of such a condition has not been provided.

4.3.2 Licensee Position

Regulatory Guide 1.47 requires annunciation at a system level when the protection system or system controlled by it are bypassed or made inoperable. Proper use of the "RESET" feature does not render the SSPS inoperable, nor does it bypass or prevent any ESF system from performing its necessary function. The "RESET" feature is used only after the SSPS has responded to an accident and after an ESF system has responded to the SSPS signal. Proper use of the "RESET" feature does not have an adverse impact on safety systems and should not require annunciation.

4.3.3 Conclusions and Recommendations

The Licensee does not agree with the requirement set forth in Criterion 3 on the basis that this existing "RESET" feature does not bypass or render inoperable any ESF systems and thus does not require annunciation in accordance with Regulatory Guide 1.47. The NRC staff's concern is to ensure that the overridden status of any safety system is annunciated; thus, the present situation does not meet the intent of this criterion. Suitable system level annuciation should be provided to indicate the overridden status of the CVI SAF-OUT device (i.e., when the CVI master relay is deenergized with a safety signal present).

4.4 CRITERION 4

Criterion 4 is satisfied at the Trojan plant.

4.5 CRITERION 5

4.5.1 Existing Conditions

The ESF system at the Trojan plant partially satisfies Criterion 5. The containment high radiation subsystem circuitry and components are not designed and qualified as safety-grade equipment.

4.5.2 Licensee Position

The containment high radiation detection system is not the primary circuit provided for actuating CVI. As discussed in the FSAR, the primary means of actuating CVI is the SI portion of the ESF system which is composed of safety-grade equipment. Current Standard Review Plans (SRP 6.2.4), Branch Technical Positions (BTP CSB 6-4), and the Clarification of TMI Action Plan Requirements (NUREG-0737) do not require that radiation monitors be safety grade.

4.5.3 Conclusions and Recommendations

The Licensee does not agree with the requirement set forth in Criterion 5 on the basis that such a requirement is not evident in other published NRC staff positions or regulations. Based on our understanding of the staff current positions that diverse (i.e., Criterion 4) and highly reliable (Criterion 5) equipment be provided to initiate CVI, the containment high radiation detective system should be upgraded as necessary to satisfy design and qualification requirements for safety-grade equipment.

4.6 CRITERION 6

4.6.1 Existing Conditions

Criterion 6 is satisfied at the Trojan plant for all ESF-actuated valves and dampers except the feedwater flow control and feedwater bypass flow control valves. Control circuitry for these valves consists of ESF slave relay contacts in series with the solenoid operator. With this arrangement the reshutting of the slave relay contacts, consequent to "RESET" of the low Tavg subsystem or clearance of the SI and steam generator high water level signals and the reset of the reactor trip breakers will cause these valves to return to the positions established by the feedwater control system.

4.6.2 Licensee Position

Modifications to the feedwater flow control valves and feedwater bypass flow control valves are unnecessary. While these valves will return to the positions determined by their respective hand controllers upon RESET, this action will not affect feedwater system isolation. Feedwater isolation will be maintained by the feedwater isolation valves, bypass isolation valves, and, in the case of reverse flow, by the feedwater check valves.

4.6.3 Conclusions and Recommendations

ESF circuitry at the Trojan plant does not conform to Criterion 6 since the resetting of certain feedwater isolation signals will cause the feedwater flow control and bypass flow control valves to change position. This condition, however, could be found acceptable by NRC staff, considering the explanatory information provided to supplement Criterion 6, on the basis of the following (refer to Figure 4):

- o If feedwater system isolation is initiated by either SI or high steam generator water level (SGWL), the feedwater flow control valves cannot be reset via a "RESET" pushbutton. Clearance of the initiating signal is required.
- o Both SI and SGWL signals will also trip the main feed pumps and feedwater isolation valves, neither of which will change position as a result of initiating signal clearance.
- o When either SI or SGWL signals are accompanied by or followed by a reactor trip, the feedwater flow control valves will not reposition until the initiation signal has cleared and the reactor trip reset.

- If feedwater isolation is initiated by low Tavg in conjunction with a reactor trip, the feedwater flow control valves and bypass flow control valves will reposition upon use of a pushbutton RESET. This action will not, however, cause the repositioning of the feedwater or feedwater bypass isolation valves and thus will not affect flow to the steam generators. Further, this subsystem is provided as an operational aid to prevent excessive cooldown. It is not provided to mitigate an accident following which the position of these control valves is critical (e.g., main steam line break) and which is not accompanied by the ESF signal (i.e., safety injection) provided for that accident. The classification of this signal as an operator aid rather than as an engineered safety feature, even though it is included in the SSPS system, is supported by the fact that low Tavg in conjunction with reactor trip will not trip the turbine or main feed pumps and thus cannot be considered a steam generator (i.e., safety-related) isolation signal.

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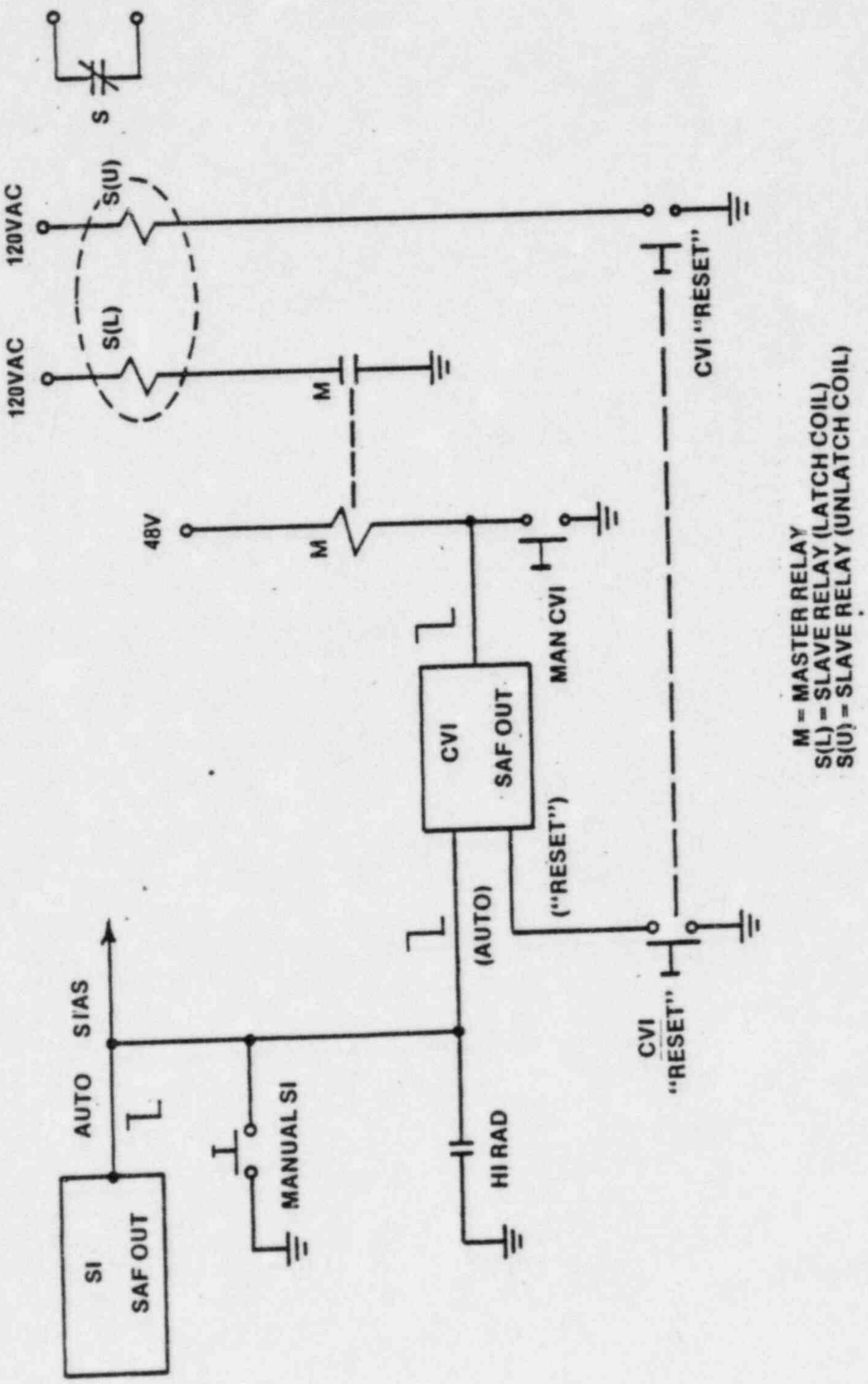
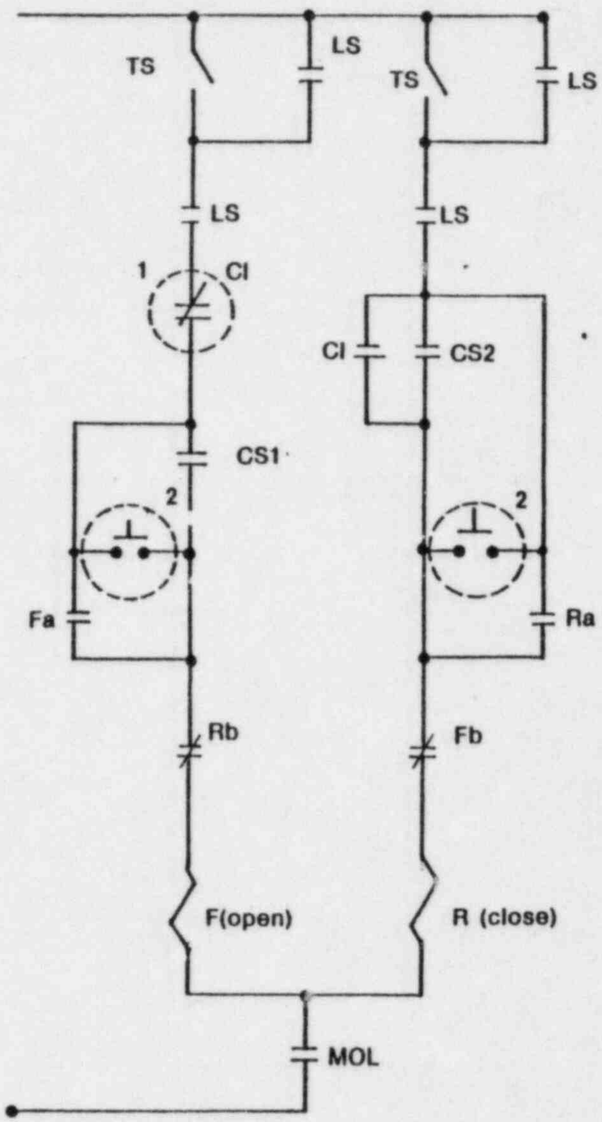


Figure 1. CVI Actuation/Reset



Control Switch Position

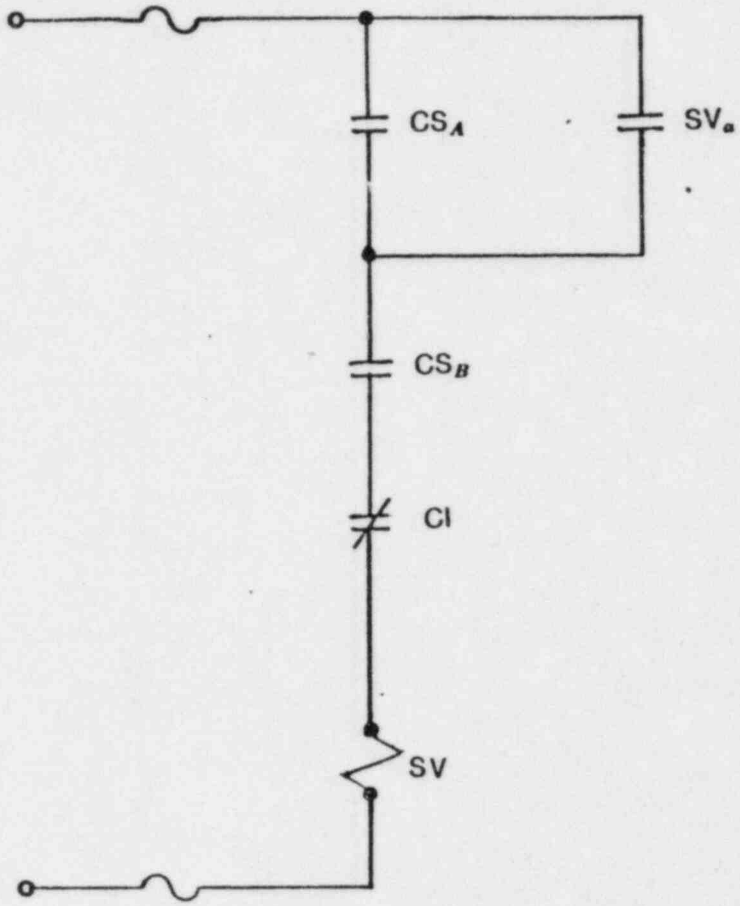
		Normal After		
Contact	Open	Open	Close	Close
1	X			
2				X

Legend

TS = Torque Switch
LS = Limit Switch
CS = Control Switch
CI = Containment Isolation Slave Relay Contact
Fa,b = a,b Contact on F (forward) Relay
Ra,b = a,b Contact on R (reverse) Relay
MOL = Motor Overload Relay Contact(s)

NOTE:
1 = Containment Purge Supply and Exhaust Only
2 = Not Included In All Systems

Figure 2. Motor-Operated Valve Control Circuitry



Control Switch Position

	Open	Normal After		Close
		Open	Close	
A	X			
B	X	X		

CI: Containment Isolation Slave Relay Contact

CS: Control Switch Contact

SV: Solenoid Valve Operator

SV$_a$: Solenoid Valve "a" Contact

Figure 3. Solenoid Operator - Scheme 1

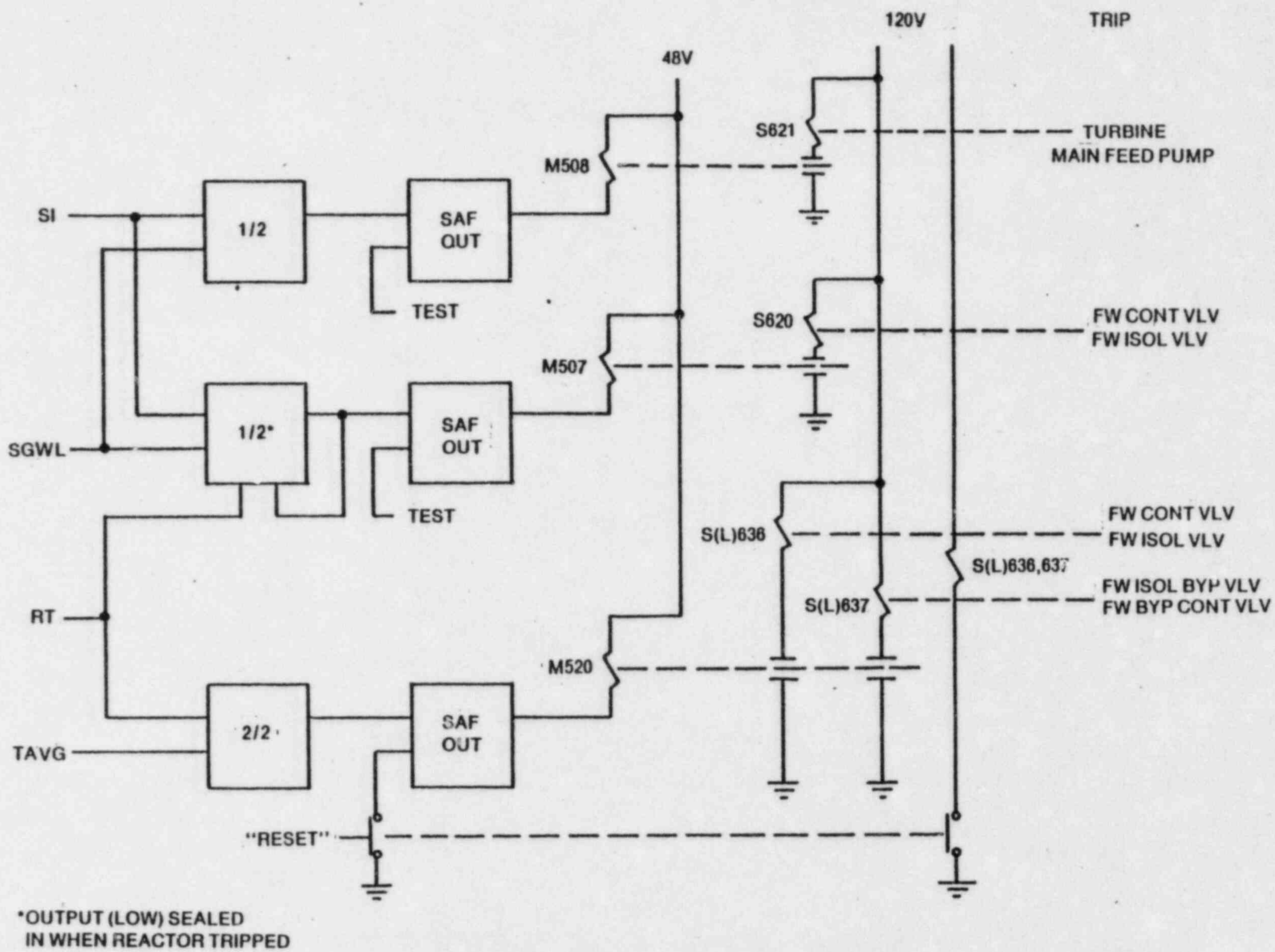
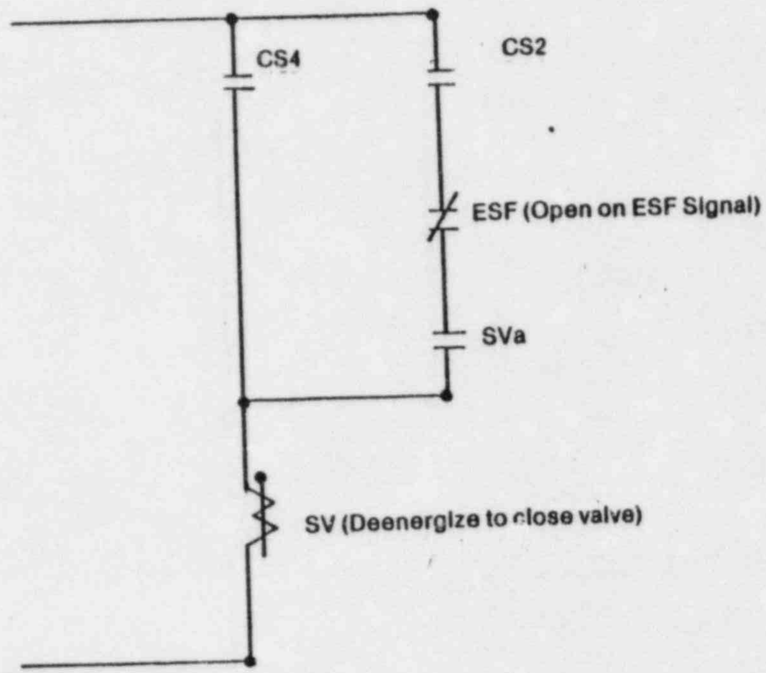


Figure 4. Feedwater Isolation Actuation/Reset



	Control Switch Position			
	Open	Normal After Open	Normal After Close	Close
CS2	X	X		
CS4	X			

Figure 5. Solenoid Operator - Scheme 2