UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

JAN 21 1981

MEMORANDUM FOR: Thomas M. Novak, Assistant Director
for Operating Reactors
Division of Licensing

FROM: Paul S. Check, Assistant Director
for Plant Systems
Division of Systems Integration

SUBJECT: SPURIOUS AUTOMATIC SWITCHOVER OF ECCS FROM THE INJECTION MODE TO THE RECIRCULATION MODE

On December 5, 1980, a spurious Engineered Safety Features Actuation System (ESFAS) actuation occurred at the Davis-Besse Nuclear Plant Unit 1, causing a transfer of pump suction for the ECCS and containment spray pumps from the Borated Water Storage Tank (Injection phase) to the containment emergency sump (Recirculation phase). This was the fourth spurious switchover to occur at Davis-Besse this year. Spurious switchovers have occurred at other operating reactor facilities, (ANO-2, September 16, 1978). Spurious switchover of ECCS and containment spray pump suction to a dry containment sump can result in pump damage and possible loss of safety functions resulting in potentially unacceptable safety consequences.

Our review of these events has concluded that plants utilizing a de-energize to actuate ESFAS actuation logic and which have a two-battery power supply system or plants that are allowed to place ESFAS channels in the tripped condition for a prolonged period of time are particularly susceptible to spurious switchovers on certain single failures. Therefore, we recommend issuance of the enclosed proposed IE Bulletin which addresses this concern.

Please keep us informed of actions taken on this matter.

Original Signed by
Paul S. Check

Paul S. Check, Assistant Director
for Plant Systems
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PROPOSED IE BULLETIN

AUTOMATIC SWITCHOVER FROM THE INJECTION TO THE RECIRCULATION MODE

Description of Circumstances

On December 5, 1980 a spurious Engineered Safety Features Actuation System (ESFAS) actuation occurred at the Davis-Besse Nuclear Power Plant, Unit 1 causing a transfer of pump suction for the ECCS and containment spray systems from the Borated Water Storage Tank (Injection phase) to the containment emergency sump (Recirculation phase). Spurious switchover of ECCS and containment spray pump suction to a dry containment sump can result in pump damage and possible loss of safety functions resulting in potentially unacceptable safety consequences.

The December 5, 1980 switchover was caused by the tripping of BWST low level bistables in ESFAS channels 1 and 3 during investigations by the licensee to determine the cause of the existence of 120 Vac on the ± 15Vd.c. and 24Vd.c. power supply common for these channels (See IE Information Notice 80-44, dated December 16, 1980). This investigation resulted with completion of the "selective 2-out-of-4" de-energize to actuate logic employed at Davis-Besse for initiation of ESFAS level 5 (automatic transfer of ECCS and containment spray pump suction from the BWST to the containment emergency sump). The plant was in hot shutdown at the time. This was the fourth spurious switchover to occur at Davis-Besse this year. Spurious switchovers have occurred at other operating reactor facilities (ANO-2, September 15, 1978).

The ESFAS level 5 actuation logic at Davis-Besse consists of two actuation channels. Actuation Channel 1 receives inputs (from all 4 sensing/instrument channels) via logic Channels 1 and 3. Similarly, actuation Channel 2 receives inputs from logic Channels 2 and 4. Each ESFAS logic channel utilizes a 2-out-of-4 trip logic and is powered from a separate vital bus. Davis-Besse utilizes a de-energize to trip actuation logic, such that upon a loss of power from a vital bus, the corresponding ESFAS channel will automatically go to the tripped condition. Therefore, a loss of power to any two instrument channels will cause an inadvertent switchover and possible loss of the ECCS and containment spray safety functions.

The four 120 Vac ESFAS buses at Davis-Besse are supplied via inverters from four 125 Vdc vital buses. These buses are fed from two 250 Vdc center tapped station batteries. It appears that plants with a two battery power supply system and a 2-out-of-4 de-energize to actuate logic are particularly susceptible to inadvertent switchovers. For example, a postulated accident (which includes a loss of offsite power) coupled with a single failure (loss of a battery) could cause premature switchover.

In addition, Davis-Besse is at present allowed to place any one ESFAS instrument channel for a prolonged period in the tripped condition, thereby placing both actuation channels in a 1-out-of-3 de-energize to trip configuration. Under these circumstances, certain single failures (such as loss of power to any untripped instrument channel) will cause an inadvertent ESFAS level 5 actuation.

This problem of inadvertent switchover appears to be inherent to PWRs as BWRs use a different transfer arrangement.

Actions To Be Taken By Licensees:

For all PWR facilities with a construction permit or an operating license:

1. Determine whether switchover of the ECCS and containment spray systems from the injection mode to the recirculation mode at your facility is performed automatically. If switchover is performed automatically, review the actuation logic and associated power source configuration to assure that, for a design basis accident (which may include loss of offsite power) in conjunction with any single failure (such as loss of a battery), an inadvertent automatic switchover will not occur at your facility.

2. If your Technical Specifications allow any Engineered Safety Feature channel to be placed in the tripped state for prolonged period of time, review the actuation logic at your facility to determine whether the tripped channel coupled with a single failure (such as loss of inverter, vital bus, or lower level power supply) can cause an inadvertent switchover.

3. If either potential for inadvertent switchover is found to exist at your facility, describe your proposed modifications or other corrective actions planned to resolve the problem.

Please respond within 60 days of receipt of this Bulletin.