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United States Nuclear Regulatory Commission
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Gentlemen:

ATWS MITIGATION SYSTEM ACTUATION CIRCUITRY
SALEM GENERATING STATION
UNIT NOS. 1 AND 2
DOCKET NOS. 50-272/50-311

Public Service Electric and Gas Company (PSE&G) submitted plant specific information related to the Salem ATWS Mitigation System Actuation Circuitry (AMSAC) via PSE&G letters NLR-N87136 dated July 31, 1987 and NLR-N87231 dated December 24, 1987. As a result of a phone call between Mr. R. Steven of NRC/NRR and PSE&G personnel on January 25, 1988, Appendix A of the July 31, 1987 has been revised. A copy of that revision is attached. The revision specifically addresses NRC concerns related to the isolation devices on the output side of the AMSAC and are noted by a vertical bar on the side of the page.

Should you have any questions, do not hesitate to contact us.

Sincerely,

Steven E Miltenberger

Attachment

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February 26,1988

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USNRC Licensing Project Manager

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USNRC Senior Resident Inspector

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APPENDIX A
AMSAC ISOLATION DEVICES

Electrical independence of AMSAC from the existing Reactor Trip (RTS) is provided through several means for the Salem Generating Station. Class 1E powered isolation devices are provided to electrically isolate the protection circuits in the process protection cabinets from control grade circuits outside the same cabinets. A block diagram showing the relationship of AMSAC to the existing RST is provided in Figure 4 which details the AMSAC/RTS connections and points of isolation.

The steam generator narrow range level inputs to AMSAC are derived from existing isolated signals from the process protection system. These signals are provided from differential pressure transmitters to the process protection cabinet and then from the protection cabinet to the control cabinets and finally to AMSAC. This arrangement does not require the use of new isolators to provide electrical independence of these instrument channels from the existing RTS. However, to prevent overloading of the existing current loops, several isolators of the existing type were added.

For measuring turbine load at the first stage, Public Service Electric and Gas (PSE&G) has elected to utilize the existing turbine impulse chamber pressure transmitters, transmitter power supplies, and isolators associated with the 7100 process protection system. As with the narrow range steam generator inputs, the isolated signals are from the RTS which have been routed through the control cabinets.

Isolation is provided in the process protection cabinet for the signals used as input for AMSAC. As reported in the Westinghouse Protection System Noise Tests (Rev. 2, 1975), these isolation devices, which are powered by a class 1E source, have been tested to demonstrate that the device is acceptable for its application. The purpose of the tests was to determine whether or not protection circuitry could be perturbated to the extent that protective action would be prevented by the pick-up or presence of credible interference on control wiring in close proximity to protection wiring within the process control racks. The system was subjected to tests that included noise susceptability, output cable voltage faults (maximum credible voltages; 118 VAC, 250 VDC), magnetic interferences and light emitting diode verification. The acceptance criteria for these tests were (a) noise would not degrade the ability of the protection systems to provide the necessary action and (b) noise which causes initiation of protective actions would be reported and evaluated in a case basis. Since the protection system operation was not degraded, no evaluation had to be made.

As mentioned, the subject of interferences that could negate protective actions was covered in various tests carried out for Diablo Canyon, for the Westinghouse 7100 Series Process control System Noise Tests. This report includes a series of tests that were performed before any faults or circuitry abnormalties were applied. These tests were carried out to demonstrate that a credible perturbation in the control wiring would not degrade protection action or be reflected back into the protection wiring. Any of these interferences (i.e., noise, crosstalk, etc.) that would be generated by AMSAC falls under the same category as those tested for in the test report. Since AMSAC is separate from the reactor protection system and the cable is not routed in an area that exceeds the 118 VAC 250 VDC test limits, any interference from AMSAC would not affect the reactor protection system. Under all tested conditions the protection circuitry operated as intended. The test showed conclusively that electrical interference imposed into the isolator output wiring (control wiring) is not a consideration as to the proper operation of the perturbated channel nor any adjacent channels. The recordings verified that the interference imposed onto the control wiring was not induced into the protection wiring. The magnitude of the electrical interference introduced into the system and the stringent test procedures far exceeded any conditions that would be present in actual plant operations.

Isolation is also provided at the output of AMSAC for isolating the non-class 1E AMSAC circuits from the class 1E final actuator circuits. For the Salem Units, the AMSAC outputs are provided from separate relay panels within the AMSAC cabinet. Separation of the train A and B circuits within the AMSAC cabinet is achieved through a combination of metal barriers, conduit and distance. Power for the output relay isolation devices is provided from an AMSAC internal power distribution system contained within the AMSAC cabinet and is not subject to voltages exceeding tested voltages.

A series of tests have been performed to determine the isolation capability of the AMSAC output relay (Struthers-Dunn). The acceptance criteria for these tests were (a) the leakage path resistance/impedance would not be greater than one megohm to satisfy isolation requirements, (b) the leakage current would not exceed one milliampere to satisfy the dielectric requirements, and (c) the fault voltage would not degrade isolation (normal operation would be acceptable).

For one of these tests, the relays had been tested with the maximum credible fault (MCF) of 590 VAC applied to the relay coil in the transverse mode (Figure 5). A closed contact was connected to a strip chart to determine the duration of the relay actuation (if any) during application of a fault to the relay coil and to measure the resulting induced voltage on the contact. A second normally closed contact was connected to a DVM to measure induced voltage on the contact for tests on relays 2 and 3. The fault voltage and induced voltage were measured and recorded. The results are as follows:

Relay #	Time for coil to open	DVM Reading (volts)	Record Reading (volts)
1	19.45	not observed	0.731
2	19.92	0.618	0.774
3	20.40	1.40	1.032

The normally open contact closed as expected; no induced voltage was observed. These results demonstrate that the relay provides isolation for the MCF specified. DC voltage was not tested since AC voltage was considered to be more limiting.

The relays clearly demonstrated their isolation capability by limiting any propagation of the faulted conditions from the non-1E coil to the 1E contact to a negligible value. This induced contact voltage (maximum of 1.4 volts) is determined to be well below industry standard pickup and dropout voltages for components typically utilized in the plant circuits.

Additionally, the SER requires that the isolation devices comply with the environmental qualifications and with the seismic qualifications which were the basis for plant licensing since they act as the boundary between safety related and nonsafety related circuitry. For the Salem configuration, the AMSAC input isolation devices which were added to the 7100 process protection system are identical to the existing devices which were reviewed as part of the plant's original licensing basis. The qualification of the AMSAC output isolation device has been performed in accordance with the current Westinghouse seismic qualification program. This program has developed and implemented to meet the requirements of IEEE 344-1975, "IEEE Recommended Practices for Seismic Qualification of Class 1E Electrical Equipment for Nuclear Power Generating Stations" for Westinghouse supplied instrumentation and control systems. Also, the qualification of the AMSAC output relays has been performed for a mild environment based upon a material analysis of the relay. The methodology for qualification is contained in WCAP-8587 Rev. 6-A "Methodology for Qualifying Westinghouse WRD Supplied NSSS Safety Related Electrical Equipment" and is Westinghouse's interpretation of the requirements of IEEE-323 1974, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations."

It is required that measures be taken to protect the safety systems from electrical interference (i.e., electrostatic coupling, EMI, crosstalk, etc.) that may be generated with AMSAC circuitry. These measures for Salem are precautions in grounding of the AMSAC cabinet and internal circuits. Also, the circuitry is in a free standing cabinet which would contain any generated noise.

The Class 1E loads operated by the isolation relay contacts are powered from a Class 1E source. The plant specific details of the wiring configuration can be found on the the PSE&G elementary drawing if needed.

In summary, it has been demonstrated that the isolation devices used to isolate the safety related circuitry from the nonsafety related circuitry for AMSAC meet the requirements of the AMSAC SER Appendix A. Through various tests and analyses it has been verified that the devices will provide electrical isolation.

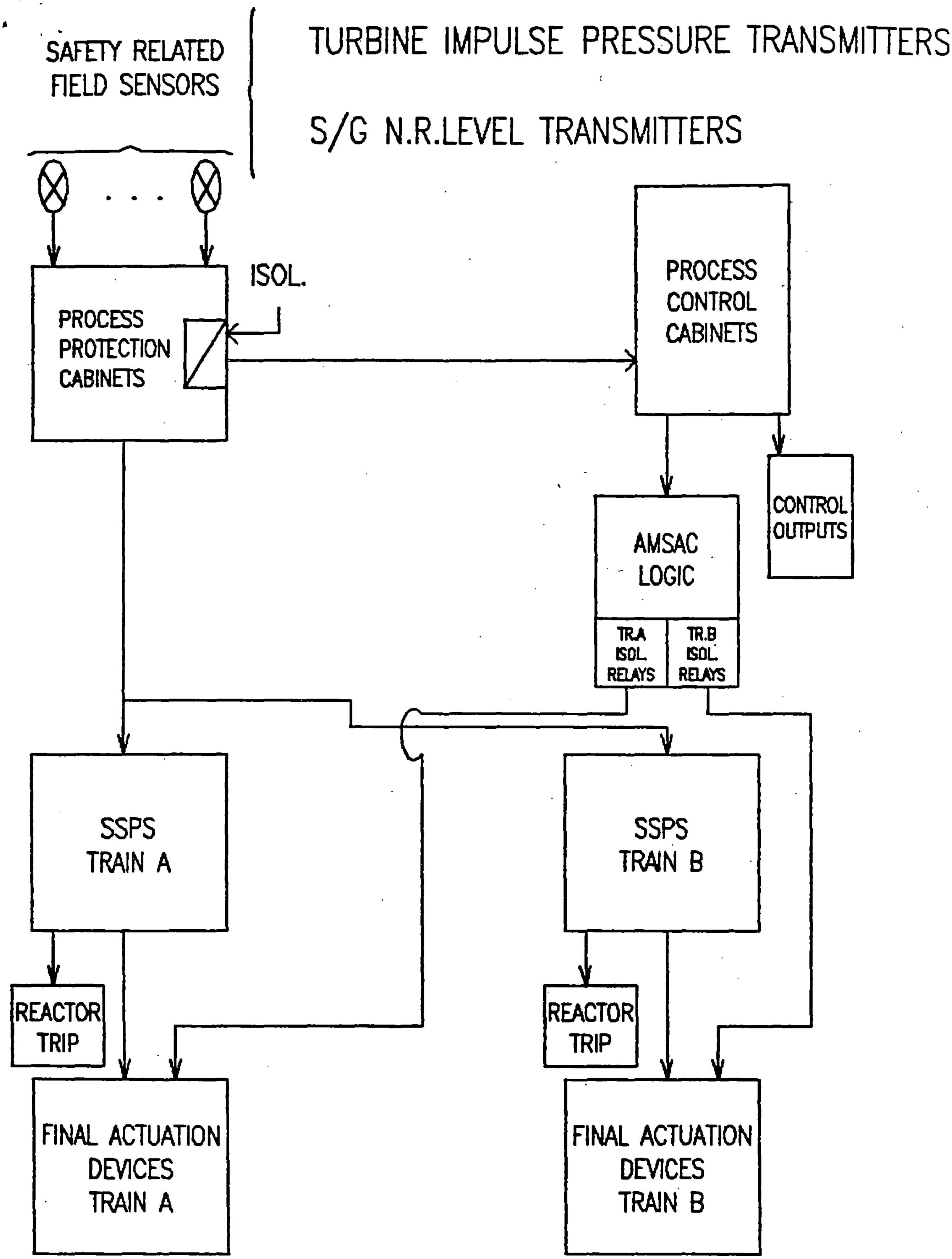

FIGURE 4: RPS - AMSAC BLOCK DIAGRAM

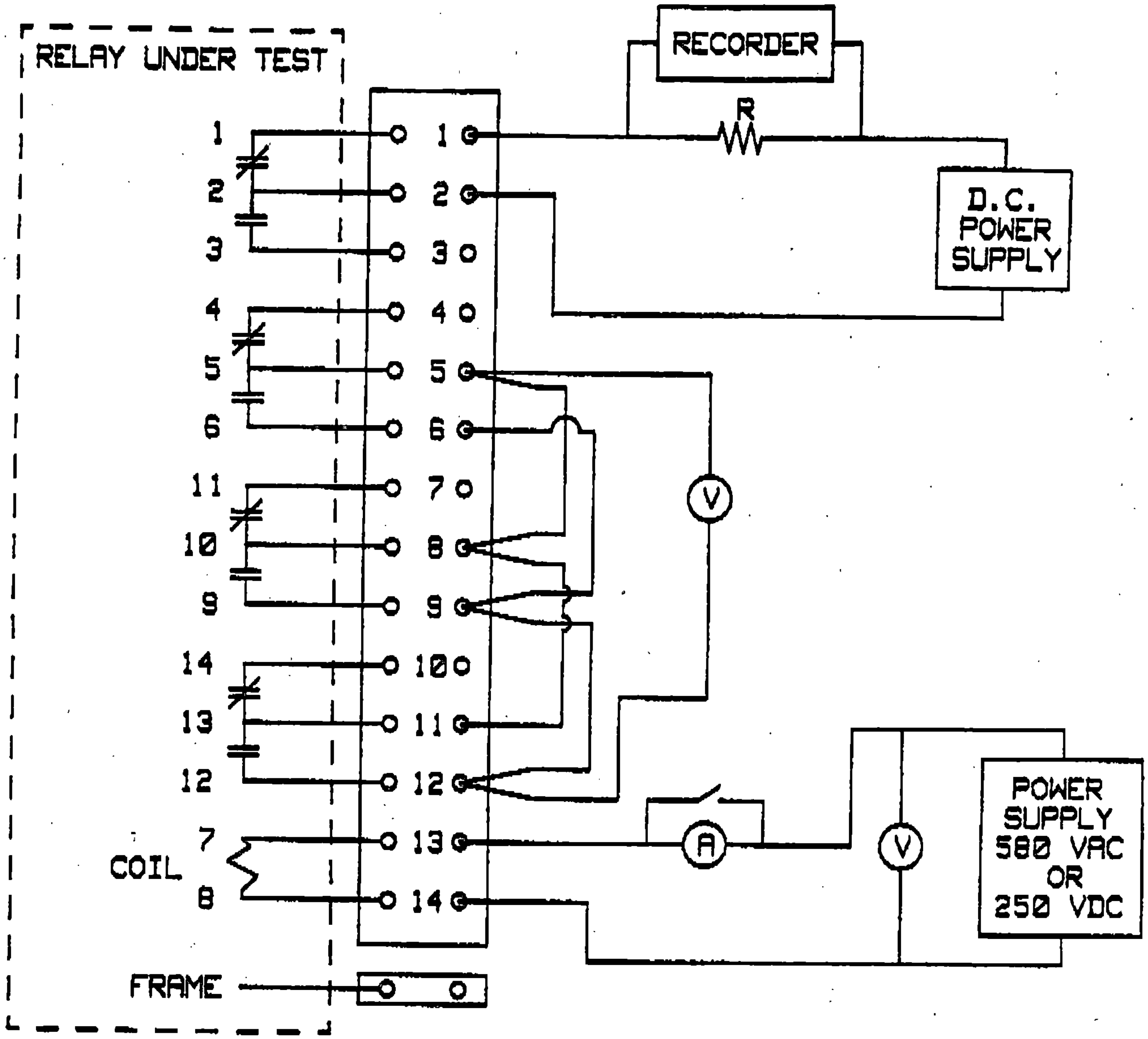

FIGURE 5: COIL TO CONTACT INDUCED VOLTAGE