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SUBJECT: Forwards revised pages to FSAR Section 8.3 re undervoltage protection,per telcon request.Changes will be reflected in FSAR Amend 34.

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November 15, 1983
G02-83-1061

Docket No. 50-397

Director of Nuclear Reactor Regulation
Attention: Mr. A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing
U.S. Nuclear Project No. 2
Washington, D.C. 20555

Dear Mr. Schwencer:

Subject: NUCLEAR PROJECT NO. 2
FINAL SAFETY ANALYSIS REPORT
SECTION 8.3, UPDATE

As requested during a phone conversation between Messrs. R. Auluck and S. Rhow (NRC) and T. Meade and P. Powell (SS), the attached FSAR page changes are provided. The Final Safety Analysis Report will be revised in Amendment 34 to reflect these changes.

Should you have any further questions, please contact Mr. P. L. Powell, Manager, WNP-2 Licensing.

Very truly yours,

G. C. Sorensen

G. C. Sorensen, Acting Manager
Nuclear Safety and Regulatory Programs

PLP/tmh
Attachment

cc: R Auluck - NRC
WS Chin - BPA
S Rhow - NRC
AD Toth - NRC Site

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AND

The primary undervoltage sensing scheme for the 4.16 kV Class 1E distribution system utilizes instantaneous undervoltage relays to start the Division 1, 2, and 3 standby diesel generators immediately upon loss of voltage at their associated 4.16 kV Class 1E switchgear buses. These relays also energize timers which allow the system to attempt to establish supply from the startup source (if the plant is operating from the normal source at the time) or verify that voltage loss is maintained (if the plant is operating from the startup source initially).

In the event that voltage loss is maintained for two seconds, the Division 1 and/or 2 timers trip the Class 1E bus normal/startup source breakers, institute load shedding, and energize additional two-second and five-second timers. The second two-second timer is utilized to attempt closing of the backup source breakers; backup transformer undervoltage relays will inhibit breaker closure in the event of backup source undervoltage. The five-second timers are used to inhibit closure of the diesel generator breakers until the system has had time to attempt reestablishment of supply via the backup source.

Since there is no provision for the Division 3 4.16 kV Class 1E bus transfer to the backup source, its diesel generator breaker closes via signals from the single Division 3 three-second timer, which is energized by the bus undervoltage relay.

Refer to 8.3.1.1.8.1.7 and 8.3.1.1.8.2.7 for additional discussion of the standby diesel generator starting and loading systems.

A second level of undervoltage protection is provided to protect against the effects of prolonged degraded voltage which could adversely affect the operation of Class 1E electric motors requiring at least 90% of the nameplate voltage for continuous operation. (See Table 8.3-13.) For this reason, Class 1E bus SM-4, SM-7, and SM-8 voltages are monitored by an additional set of Class 1E undervoltage relays. Three static type undervoltage relays are provided for each bus and are connected to monitor all three line voltages (i.e., phases AB, BC, and CA). The arrangement utilizes a 2-out-of-3 logic to preclude the possibility of spurious voltage loss signal and facilitate testing.

DIVISION 1 AND

THE PRIMARY UNDERVOLTAGE SCHEME FOR THE DIVISION 3 4.16 KV CLASS 1E BUS UTILIZES INSTANTANEOUS UNDERVOLTAGE RELAYS WHICH ENERGIZE TWO SECOND TIMERS. IN THE EVENT THAT VOLTAGE LOSS IS MAINTAINED FOR TWO SECONDS THESE TIMERS TRIP THE PREFERRED SOURCE BREAKER, AND ENERGIZE ADDITIONAL TWO SECOND TIMERS. THESE TIMERS START THE HPCS DIESEL GENERATOR AND [illegible] LOSS OF VOLTAGE IN THE CONTROL ROOM. THE DIESEL-GENERATOR SUPPLY BREAKER WILL THEN CLOSE AFTER THE DIESEL HAS REACHED RATED FREQUENCY AND VOLTAGE.

THE DIVISION 3 SECOND LEVEL UNDERVOLTAGE PROTECTION UTILIZES A TWO OUT OF TWO SCHEME TO PRECLUDE THE POSSIBILITY OF SPURIOUS TRIPPING.

In the event of sustained bus undervoltage (87.3% of nominal bus voltage lasting more than 8 seconds), the second level of undervoltage protection automatically trips the feeder breaker connecting the normal/startup sources to their respective 4.16 kV Class 1E buses. For Divisions 1 and 2 this action results in loss of bus voltage, thereby starting the diesel generators, initiating load shedding and energizing the three bus transfer timers mentioned in the primary undervoltage scheme above. In this case, however, the first two-second timer is bypassed. The second two-second timer permits closing of the backup source breaker and the five-second timer permits closing of the diesel generator breaker assuming a failure of the backup source breaker to close. Closure of the backup source and diesel generator breakers is permitted if the source voltage is at least 94% of normal.

Should the degraded voltage condition exist on the backup power source while the source is supplying the load, the second level undervoltage relays would then isolate that source, again initiating the sequence of events described for the secondary undervoltage sensing scheme above. However, closing of backup feeder breakers, as part of that sequence of events, is blocked.

For Division 3, the second level of undervoltage protection trips the normal/startup source breaker, thereby causing a loss of bus voltage. ~~From this point on, the primary undervoltage relay takes over and the ensuing sequence of events will be the same as in the case of the loss of offsite power discussed above.~~ THIS ENERGIZES THE SECOND TWO-SECOND TIMER WHICH RESULTS IN DIESEL START AND SUBSEQUENT SUPPLY TO DIVISION 3 FROM THE DIESEL-GENERATOR.

When the Class 1E buses SM-7 and SM-8 are being fed from the turbine generator, the possibility of sustained undervoltage is not considered credible due to response characteristics of the voltage regulator and protection equipment for the unit.

The scheme described assures a power source within the acceptable voltage limits for the Class 1E loads at all times. Circuit design allows for testing of the individual relays, one at a time, without disrupting the protective function.

8.3.1.1.3 120/240 Volt (Non-Class 1E) Plant Uninterruptible Power System

The non-Class 1E plant uninterruptible power system supplies 120/240 V AC to station services where uninterruptible power is required, such as for plant, computer and plant instrumentation (e.g., DEH cabinet). This source of power is necessary for plant operational loads, but does not supply ESF loads. Power is distributed via a single phase, three wire, grounded neutral system.

Failure of the non-Class 1E uninterruptible power system has no adverse effect on station safety since no ESF loads are supplied from this system.

The plant uninterruptible power system receives its power from a static inverter-static switch arrangement fed both from a 250 V DC station battery (float source) and from a 480 V AC Class 1E MCC (preferred source) as shown on Figure 8.3-2. During faults on the uninterruptible power system the static switch will automatically transfer loads to a regulated alternate source, which supplies sufficient fault current to blow the circuit fuse and clear the fault.

A manual bypass switch is also provided to bypass the entire plant uninterruptible power system and transfer load to an unregulated bypass source. This will allow for maintenance and inspection of the system.

8.3.1.1.4 120/208 Volt Non-Class 1E Instrumentation Power System

Power is supplied to non-Class 1E plant instrumentation at 120/208 V AC via a three phase, four wire, grounded neutral distribution system. This distribution system supplies power to the 115 V AC transversing incore probe (TIP) of the neutron monitoring system and other non-Class 1E instrumentation loads.

Failure of the noncritical instrumentation power system has no adverse effect on station safety since no ESF loads are supplied from this system.

Alarm and fault detection equipment is provided to alert the operator of possible trouble. All equipment associated with the 120/208 V non-Class 1E instrumentation power system is readily accessible for inspection and maintenance on a routine basis in accordance with the manufacturer's recommendation.

A Class 1E supervisory control system is provided between the main control room and the standby service water pumphouses to monitor ~~and control~~ operation of Class 1E standby service water equipment. The system is divided into three separate and independent divisions (Division 1, 2, and 3) corresponding to the three service water system equipment divisions. Separate equipment is provided for ~~supervision of electrical equipment of~~ each division; there is no sharing of equipment or connections between divisions. Failure of equipment in one supervisory division does not affect supervisory equipment of other divisions.

Each supervisory control division is a two-way type, incorporating multiplexing line sharing, continuous scanning modules (with solid state logic) and output relays.

8.3.1.1.8 Standby AC Power System

The standby AC power source for the plant consists of three diesel generator sets, each one serving ESF loads in its associated Division (1, 2, 3), their attendant air starting and fuel supply systems, and automatic control circuitry. The diesel generator sets supply power to those electrical loads which are required to achieve safe cold shutdown of the plant and/or mitigate the consequences of a design basis event coincident with a loss of all offsite AC power. Tables 8.3-1, 8.3-2, and 8.3-3 list the equipment and loads supplied by each generator for both cases. The individual loads are determined on the basis of nameplate rating of the motors used.

Each diesel generator (with its auxiliaries) is housed in a separate room as shown in Figure 8.3-15. The separating walls are designed as three-hour NFPA fire barriers and will provide missile protection in the event of explosion or failure of rotating equipment. Each room is provided with its own ventilation and lighting systems. Design provisions ensure that flooding in one diesel generator room does not jeopardize the operation of the other diesel generators. The power, instrumentation, and control cabling associated with the diesel generators is contained in cable trays and conduits which meet the separation criteria detailed in 8.3.1.4. All equipment for these systems is identified as indicated in 8.3.1.3.

8.3.1.1.8.2.6 Fuel Oil System

Figure 8.3-22 shows the fuel oil system. The fuel oil system consists of two mutually redundant fuel oil systems external to the engine fuel manifolds, either of which is capable of supplying fuel oil to the engine. Each system, from the day tank to the fuel manifolds, contains a fuel supply line, a strainer, a fuel oil pump, a duplex filter, a pressure gage, and relief and check valves. One of the fuel pumps is mechanically driven by the engine and the other by a 120 V DC motor. The system has a common return to the day tank.

Refer to 9.5.4 for additional details of the fuel oil system.

8.3.1.1.8.2.7 Automatic Starting and Loading System

In the event of loss of offsite sources of power to the onsite power system, the HPCS diesel generator set is automatically started and loaded by controls and circuitry which are independent of those used to start and load the Division 1 and Division 2 units. Control power for the diesel generator unit is supplied from its own 125 V DC system which consists of a battery with its own battery charger (see 8.3.2.1.2).

The diesel generator starting logic and starting signals (shown on Figures 8.3-18a and 8.3-18b) are described as follows:

a. The diesel generator starts immediately upon receipt of ~~4.16 kV Class 1E bus (SM-4) undervoltage signals or~~ LOCA signals (reactor low water level and/or high drywell pressure).

b. Upon sustained loss of bus SM-4 voltage the bus is automatically isolated from the upstream non-Class 1E system. AND TH[illegible] STARTED.

c. After the diesel generator has attained approximately normal frequency and voltage, its breaker automatically closes (if unit start was initiated by bus SM-4 undervoltage), picking up loads as indicated in Table 8.3-3. LOCA signals do not initiate automatic breaker closure.

Preoperational testing will include demonstrating the required reliability of the WNP-2 standby diesels by means of a start/load test described in Regulatory Guide 1.108. Since Divisions 1 and 2 diesel generators are similar, each will undergo a 35 start/load test. Division 3 (HPCS) ~~will undergo~~ a 69 start/load test.

Description of Division 3 test:

To accomplish this test, supply of 4.16 kV Class 1E bus SM-4 ~~will be~~ transferred to the startup source. Under this condition, the diesel generator ~~will be~~ synchronized to the 230 kV startup source and loaded via manual adjustment of the unit speed controls to at least 50% of continuous rating and operated at this level for at least one hour. Sixty-four (64) such tests ~~will be~~ accomplished. In addition, 5 tests ~~will~~ involve loading the diesel with the existing bus loads including the HPCS pump motor.

Significant parameters such as voltage, frequency, operating temperature, acceleration times, and other pertinent functions ~~will be~~ monitored throughout the duration of the test and recorded.

Valid tests and failures ~~will be~~ based on the criteria of Regulatory Guide 1.108, Section 2.e. Failures considered are limited to those caused by malfunction of the diesel generator set only. Failures caused by malfunctions in the test equipment, external circuitry, or loads are not considered attributable to the reliability of the diesel generator set. Provisions are made to determine the cause of any malfunction or excess wear and to classify it as a valid failure of the equipment being tested or an external non-valid failure. Such determination of cause and classification of failure will be fully supported by documentation.

3. on a restart with an initial engine temperature equal to the continuous rating, full load engine temperature;

c. Carry the design load for 2000 hours;

d. Maintain voltage and frequency within limits that will not degrade the performance of any of the loads composing the design load below their minimum requirements, including the duration of transients caused by load application or load removal;

e. Withstand any anticipated vibration and overspeed conditions. There is no flywheel coupled with the HPCS diesel generator. The generator and exciter are designed to withstand 25% overspeed without damage.

The HPCS diesel generator has continuous and short-term ratings consistent with the requirements of Section 5.1 of the Standard.

Mechanical and electrical system interactions between the HPCS diesel generator unit and other units of the standby power supply, the nuclear plant, the conventional plant, and the Class 1E electrical systems are coordinated so that the HPCS diesel generator units' design function and capability are realized for any design basis event except failure of the HPCS diesel generator unit.

The qualification requirements of IEEE Standard 323-1971 are met by test and on operating experience on similar equipment in similar environment in other plants.

8.3.1.2.2 Tests and Inspection

The auxiliary AC power system is designed to permit periodic testing and inspection of the system as a whole and of the operability and functional performance of the components in accordance with General Design Criterion 18. Preoperational testing, as described in Chapter 14, will be performed to verify that all components, automatic and manual controls, and sequences of operation of the standby power system function as required. Preoperational testing of redundant portions of the onsite electrical power system to verify proper load group assignments is performed in accordance with NRC Regulatory Guide 1.41, Revision 0. Voltage values at Class 1E high and low voltage buses ~~will be~~ WERE measured and compared to the design values, to demonstrate correct transformer tap settings, during the preoperational testing phase of the plant.

8.3.1.2.4.3.2 Secondary Undervoltage Sensing

Static Class 1E undervoltage relays with definite time delay located in each of the redundant Division 1 and Division 2 4.16 kV Class 1E switchgear units are utilized for detection of sustained degraded voltage in the offsite power system. This protection scheme is designed to compliment the primary undervoltage scheme described above.

The trip setpoint of each relay is 3631 volts, corresponding to 87.3 percent of nominal bus voltage and 90.8 percent of nominal motor voltage. Trip setpoint selection is based upon insuring 90 percent of motor nominal voltage at the motor terminals, including allowance for feeder voltage drop. The relay automatically resets when the bus voltage exceeds 89.9% of nominal rating.

Eight seconds of time delay is provided to permit override of motor starting dip. The duration of motor starting voltage dip is very short lived - in the order of 2 to 5 seconds. The second level of undervoltage relays will not, therefore, initiate actions for this condition.

The relays operate to isolate the degraded source and initiate the sequence of events to select the next available source. Circuit design precludes spurious voltage loss signal and allows for testing of the individual relay, one at a time, without disrupting the protective function.

During loss-of-coolant accident, diesel generator power is available to the emergency loads 13 seconds after the sustained degraded grid voltage condition is sensed at the emergency bus. This time delay is derived from the 8-second delay prior to the offsite breaker trip plus a 5-second delay prior to the diesel generator breaker closure. The above time delay is acceptable since during a concurrent loss-of-coolant accident, the emergency core cooling system (ECCS) coolant injection time requirements as specified in Table 6.3-1 are met.

See Figures 8.3-16c and 8.3-17c for the logic diagrams of Divisions 1 and 2 secondary undervoltage protection.

The same voltage trip and time delay setpoints are used for the Division 3 secondary undervoltage relays. For Division 3, however, the diesel generator power is available at the bus 11 seconds after a coincident occurrence of a loss-of-coolant accident and a degraded grid condition. This time delay is equal to the 8-second delay prior to the offsite breaker trip plus a 3-second delay prior to the diesel generator breaker closure.

8.3.2.1.3.3 Chargers

The chargers for each ± 24 V DC load group (four chargers total) are supplied from 120 V AC vital power panels associated with each division. Each charger is capable of carrying the largest combined demand of the various steady state DC loads while simultaneously restoring the battery from 1.75 volts per cell to its rated voltage in 24 hours. The charger size and instrumentation conform to the requirements of IEEE Standard 308-1974 and NRC Regulatory Guide 1.32, (Revision 2). The ± 24 V DC Division 1 (CO-1A, CO-1B) and Division 2 (CO-2A, CO-2B) chargers are rated 25 amperes DC output.

8.3.2.1.4 250 Volt DC (Division 1) System

8.3.2.1.4.1 General

One Class 1E 250 V DC system is provided to supply 120/240 V AC power on an uninterruptible basis to plant controls, instrumentation, computer and communication equipment via a solid state inverter. It also supplies 250 V DC power directly to RCIC, selected RHR and RWCU system motor-operated valves and the turbine auxiliary oil pumps. See Figures 8.3-2 and 8.3-19.

Plant 120/240 V AC loads and turbine oil pump loads are classified as nonessential (Division A). However, because of their importance to plant operations and equipment, they are served from the Class 1E power source via the Division A inverter utilizing prime cables.

The cabling to the main 250 V DC distribution panel, including the panel, battery, charger, and incoming 480 V AC normal source are Class 1E (Division 1).

A spare, unconnected charger of the same rating is provided.

8.3.2.1.4.2 Battery

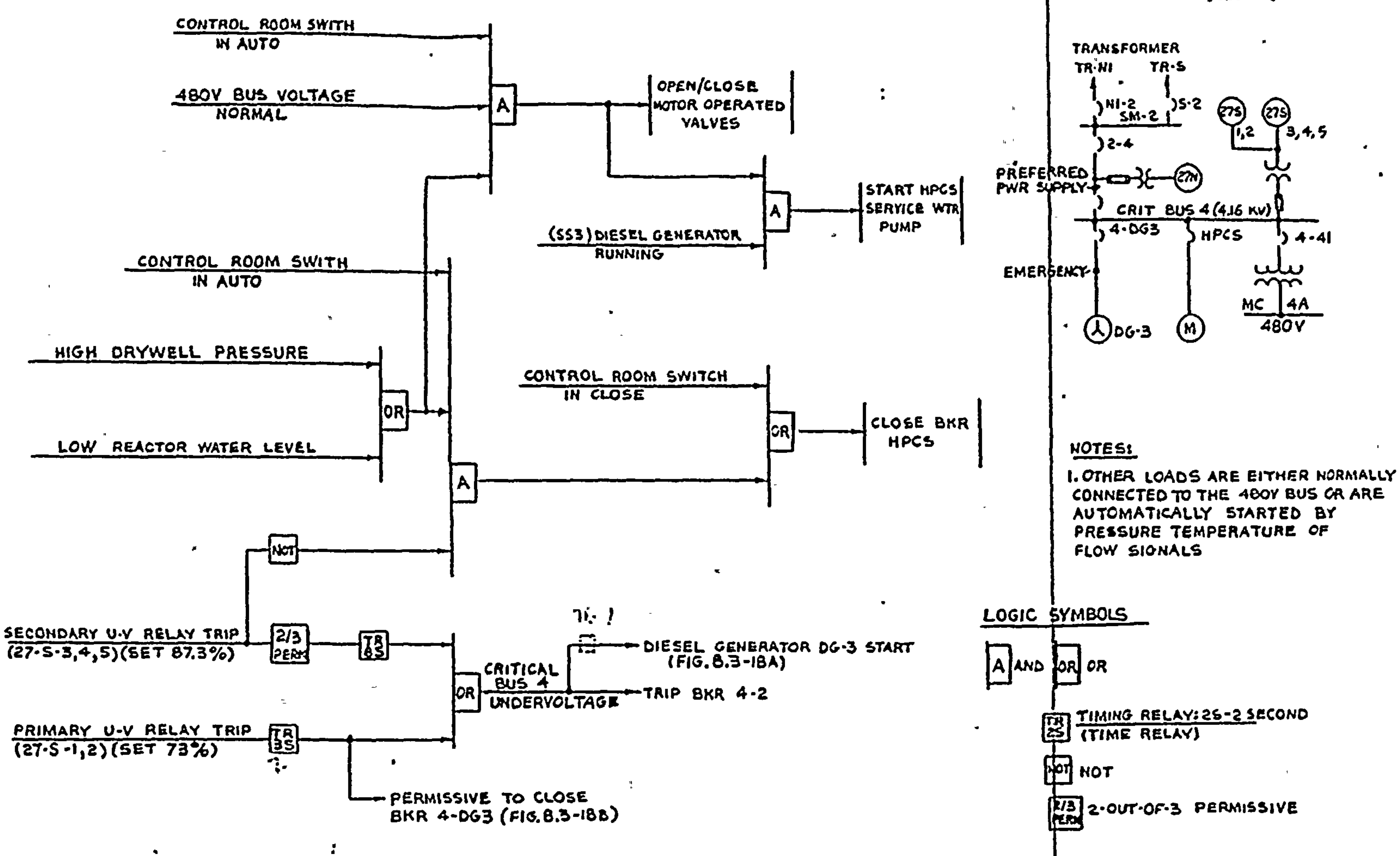
In the event of a loss or interruption of charger 250 V DC output, the battery will maintain power to its DC system loads. The ampere rating and short time rating of the battery is in accordance with IEEE Standard 308-1974. The battery is capable of supplying, for a period of at least two hours, all DC power required to safely shut down the plant and/or to limit the consequences of a design basis accident.

TABLE 8.3-23

Transformer Tap Settings

Transformer	Taps
TR-S	~~-5.0%~~ -2.5%
TR-B	+2.5%
TR-N1	-2.5%
TR-N2	-2.5%
TR-1-11	~~-2.5%~~ 0%
TR-2-21	~~-2.5%~~ [illegible]
TR-3-31	~~-2.5%~~ [illegible]
TR-7-71	~~-2.5%~~ 0%
TR-8-73	~~-5.0%~~ -2.5%
TR-8-81	~~-5.0%~~ [illegible]
TR-8-83	~~-5.0%~~ [illegible]
TR-4-41	~~-2.5%~~ 0%
~~TR-4-53~~	~~-2.5%~~

AMENDMENT NO. 23
February 1982



WASHINGTON PUBLIC POWER SUPPLY SYSTEM NUCLEAR PROJECT NO. 2	CRITICAL BUS 4 UNDERVOLTAGE PROTECTION, BUS TRANSFER, && LOADING SEQUENCE	FIGURE 8.3-18c