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Jersey Central Power & Light Company

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MEMBER OF THE
General Public Utilities Corporation
GPU ELECTRIC POWER COMPANIES SYSTEM

November 7, 1975

Director of Nuclear Reactor Regulation
Attn: Mr. George Lear, Chief
Operating Reactors Branch #3
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Lear:

SUBJECT: OYSTER CREEK NUCLEAR GENERATING STATION
DOCKET NUMBER 50-219
ECCS MODIFICATIONS

Your letter dated September 25, 1975, identified additional information that you require to complete your review of the subject modifications proposed to overcome recently identified single failures that could be postulated to affect ECCS performance.

The additional information is provided in the attached responses to your questions. In conjunction with response 2D, we have enclosed the "Oyster Creek ECCS Modification Criteria for Physical Separation and Electrical Independence of Safety Related Equipment and Circuits". In this regard, the internal separation criterion 6.4.2 does not apply to existing relay panels 18A and 18B, implementation of which is scheduled for the next refueling outage.

The ECCS modification as described in our June 24, 1975, and July 15, 1975, submittals, in compliance with License Amendment No. 8, is scheduled for implementation during our upcoming seven week condenser retubing outage scheduled for December 27, 1975.

Very truly yours,

I. R. Finfrock, Jr.
Vice President

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Attachments

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QUESTION 1

Review the specific equipment arrangement within your plant to determine whether or not any valve motors will be submerged following a LOCA. If any valve motors will be submerged, provide the following:

A. Identify the valves that will be submerged;

B. Evaluate the potential consequences of flooding of the valves for both short term and long term ECCS functions and containment isolation;

C. Propose an interim solution while necessary modifications are being designed and implemented; and

D. Propose design changes to solve the potential flooding problem.

RESPONSE

There are no valves within the Oyster Creek primary containment that would become submerged as a result of a postulated loss of coolant accident. Because of the design of the Mark I containment any water released into the drywell would drain to the torus. The drywell floor is at elevation 10'3". The bottom of the vent header draining to the torus is at elevation 12'9". Therefore, there would be only 2'6" of water in the bottom of the drywell and this would be the only accumulation of water in the drywell. There are no motor-operated valves in this region of the drywell.

QUESTION 2A

With regard to Attachment II to your letter of July 15, 1975, provide the following:

A. Quantify the following:

(1) Minimum voltage during present starting sequence for each diesel generator,

(2) Minimum voltage for each diesel generator during normal starting sequence after the proposed modifications have been made, and

(3) Minimum diesel generator voltage during the starting sequence if one diesel fails after the proposed modifications have been made.

RESPONSE 2A(1)

The calculated minimum voltage during the present starting sequence for each diesel generator for the load profile submitted as Page 4-3 of Attachment II to our July 15 letter is about 60% of the no-load voltage. In operation, the voltage dip is much less severe than the calculation predicts because of actual small time differences in breaker reclosing.

RESPONSE 2A(2) and 2A(3)

The loading sequence for the modified system is shown in Table 1, attached, for single diesel operation. The following changes have been made to the load sequence which was described on page 4-3 of Attachment II to our July 15, 1975 submittal entitled "ECCS Modification - Core Spray Electrical Crossconnect":

a. The closed cooling water pumps will be started 110 seconds after the bus is energized to insure that there will be no coincident start with core spray pumps.

b. The control rod drive (CRD) pumps will be started 60 seconds after the bus is energized ~~for the~~ for the same reason as described in

QUESTION 2A (Continued)

"a" above. After the proposed modifications have been made, the maximum voltage dip will be 28% for a diesel generator. This is the same for the normal starting sequence and for a starting sequence when one diesel fails. This conclusion is reached because the greatest voltage dip occurs when the primary core spray pump (500 hp nameplate) is energized. Because the regulator excitation (generator field current) is initially low and the required increase is greatest for this transient, the transient voltage dip will be the most severe. In this case, the load increases by 128% whereas for subsequent loadings the greatest percentage increase is 44%. In Table 1, the percentage load increases are listed for each new load. Also listed are the calculated percentage voltage dips.

TABLE 1

DIESEL GENERATOR LOADING SEQUENCE AND TRANSIENT VOLTAGE

	Time	Horsepower Loads Nameplate	Horsepower Loads Increased Steady Load	Horsepower Loads Total Steady Load	Percentage Load Increase (nameplate increase to operating load)	Calculated Percentage Voltage Drop	Comments
SGBTS, Lighting, Misc.	0	390	390	390			Small effect, mostly resistance load
Primary Core Spray	1	500	462	852	128	28	Most Severe
Primary Booster	5	300	285	1137	35	15	
Secondary Core Spray	11	500	462	1599	44	24	For second diesel failure
Secondary Booster	16	300	285	1884	19	11	For second diesel failure
Containment Spray	45	300	237	2121	16	11	Conservative Approximation
CRD	60	250	252	2373	12	9	Conservative Approximation
Emergency S. W.	85	400	405	2778	17	14	Conservative Approximation
Closed Cooling Water	110	200	176	2954	7	7	Conservative Approximation
Service Water	120	250	252	3206	8	9	Conservative Approximation

QUESTION 2B

Describe how the voltages presented in response to item 2A, above, were determined and provide the details of the test program which will be used to verify the calculations after the modifications have been completed.

RESPONSE

The transient voltage drop was calculated by accepted methods as contained in the Electrical Transmission and Distribution Reference Book, Westinghouse Electric Corporation, 1950, Chapter 6 by C. P. Wagner.

Important assumptions were that motor inrush currents are 600% of nameplate current at 0.25 power factor and rated voltage, steady loads are at a power factor of 0.85, and exciter response is fast compared with the transient time constant of the generator (magnetic amplifier type voltage regulator) which justifies the use of the direct axis transient reactance (x_d') of the generator for determining the voltage drop. Sufficient time exists at each loading for voltage recovery prior to the next loading.

After completion of the modifications system operational tests will be conducted. Each diesel will be automatically started and loaded using a simulated loss of off-site power and ECCS initiation signals. For each diesel generator, this will be conducted for both the normal load starting sequence and the condition for which the other diesel generator is assumed to have failed. Transient bus voltages will be recorded and compared with the calculational results. It has been concluded that normalization of calculational results for the purpose of extrapolation to LOCA conditions is unnecessary because the most severe transient voltage dip during this test should be the same as for an actual LOCA situation. This conclusion is based on the observations that:

QUESTION 2B (Continued)

(1) The most severe transient occurs when the first major pump is started.

(2) The transient response of the regulator/exciter/generator is dependent on the starting in-rush current required to accelerate the motor. In-rush current is insensitive to the hydraulic load.

QUESTION 2C

Quantify the electrically-operated valve motor minimum operating voltage (at which these motors will deliver rated torque), identify all valve motors which have an undervoltage rating which is less than the proportional reduction in diesel generator voltage stated in response to item 2A(3) above, and describe the qualification testing which assures that the valves which are required for safety will function in the accident environment.

RESPONSE

The electrically operated valve motors for core spray isolation valves V-20 - 15, 40, 21, and 41 will deliver sufficient operating torque at a minimum operating voltage of 290 volts. This represents approximately a 40% voltage drop. The greatest calculated percentage voltage drop presented in the response to question 2A(3) is 28%. This indicates that the valves will operate during a core spray initiation. These valves are the only motor operated valves required to operate in order to deliver core spray to the reactor vessel under accident conditions.

The thermal overload contacts and heaters of these valves have been bypassed so that in the event of a momentary voltage drop, any increase in current will not cause the thermal overloads to trip the motors.

These valves are located outside containment and will not experience a change in environment under loss-of-coolant accident conditions.

QUESTION 2D

Provide a description of the criteria which will be used to maintain the physical separation and electrical independence of the modified core spray systems.

RESPONSE

The criteria which address the physical separation and electrical independence of the modified core spray system are attached for your review.

OYSTER CREEK ECCS MODIFICATION
CRITERIA FOR PHYSICAL SEPARATION AND ELECTRICAL INDEPENDENCE OF SAFETY RELATED EQUIPMENT AND CIRCUITS

1.0 SCOPE

The scope of this document is the physical separation of the safety related circuits and equipment which will be installed as part of the Oyster Creek Emergency Core Cooling System (ECCS) modification.

2.0 PURPOSE

The purpose of this document is to establish criteria for separation of circuits and equipment in order to implement the independence requirements of IEEE Std. 279-1971 and IEEE Std. 308-1974.

3.0 DEFINITIONS

3.1 Acceptable

ECCS demonstrated through analysis to be capable of providing core cooling under the conditions of a design basis event.

3.2 Barrier

A device or structure which provides structural shielding or flame retardant qualities interposed between safety related equipment or circuits and a potential source of damage so as to limit the damage to the safety related systems to an acceptable level.

3.3 Design Basis Event

A postulated LOCA which may occur in a core spray line and which may be coincident with a loss of offsite power.

3.4 Enclosure

An identifiable housing such as a cubicle, compartment, terminal box or panel used for electrical equipment or cables.

3.5 Flame Retardant

Capable of preventing the propagation of a fire or its effects beyond the area of influence of the energy source that initiated the fire.

3.6 Raceway

Any channel that is designed and used expressly for supporting wires, cable or busbars. Raceways consist primarily of, but are not restricted to, cable trays and conduits.

3.7 Redundant Equipment or System

An equipment or system that duplicates the essential function of another equipment or system to the extent that either may perform the required function regardless of the state of operation or failure of the other.

3.8 Separation Distance

Space without interposing structures, equipment or without materials that could aid in the propagation of fire or that could disable the ECCS.

4.0 APPLICABLE DOCUMENTS

4.1 The following codes, standards and regulatory guides are applicable to the extent indicated:

4.1.1 Criteria for Protection Systems for Nuclear Power Generating Stations (ANSI N42.7 - 1972) IEEE-279, 1971.

4.1.1.1 Compliance with all paragraphs except those presented in Sections 4.1.1.2 and 4.1.1.3.

4.1.1.2 Non-compliance with paragraphs 4.17 and 4.22.

- Para 4.17 - Manual actuation on a system level will not be provided. Manual actuation of the existing core spray system is accomplished by starting two pumps and opening one isolation valve for each fluid system. The three required switches and associated indicators are grouped together on a panel in the control room. Manual actuation may therefore be readily accomplished and it is not considered necessary or desirable to add an additional switch for system actuation as part of this modification.

- Para 4.22 - Identification of core spray system components and wiring will not be provided. The existing safety systems are not identified by color code or other means. The new work represents only a small part of the entire core spray system and will be entirely in conduit. Color coding the new core spray system conduit would not enable visual verification of the total core spray system separation.

We are only talking about the modification???

4.1.1.3 Paragraph 4.15 is not applicable. There are nc multiple setpoints in the ECCS.

4.1.2 Criteria for Class IE Power Systems for Nuclear Power Generating Stations - IEEE-308, 1974.

4.1.2.1 Compliance with all paragraphs except those presented in Sections 4.1.2.2 and 4.1.2.3.

4.1.2.2 Non-compliance with paragraph 4.5 - Identification of core spray system components and wiring will not be provided. The existing safety systems are not identified by color code or other means. The new work represents only a small part of the entire core spray system and will be entirely in conduit. Color coding the new core spray system conduit would not enable visual verification of the total core spray system separation.

4.1.2.3 The following paragraphs are not applicable - 5.2.3, 5.2.4, 5.2.5, 5.2.6, 5.3, and 5.4. The ECCS modifications discussed herein use existing plant AC and DC generating and distribution networks. Therefore, the design of new power supplies and distribution networks is not required.

4.1.3 Trial Use Standard Criteria for Separation of Class IE Equipment and Circuits (ANSI N41.14) IEEE-384, 1974.

4.1.3.1 Compliance with all paragraphs except those presented in Sections 4.1.3.2 and 4.1.3.3.

4.1.3.2 Non-compliance with paragraphs 5.1.2, 5.6.1, 5.6.3 and 5.6.5.

- o Para 5.1.2 - Identification of core spray system components and wiring will not be provided. The existing safety systems are not identified by color code or other means. The new work represents only a small part of the entire core spray system and will be entirely in conduit. Color coding the new core spray system conduit would not enable visual verification of the total core spray system separation.

- o Para 5.6.1 - The design modification requires no new switchboards. The modification is not in compliance with paragraph 5.6.1 because exception has been taken to referenced paragraph 5.6.3.

- o Para 5.6.3 - Identification of core spray system components and wiring will not be provided. The existing safety systems are not identified by color code or other means. The new work represents only a small part of the entire core spray system. Color coding the new core spray system wires would not enable visual verification of the total core spray system separation.

- o Para 5.6.5 - Only the new non Class IE circuits added by this modification will be in accordance with para 5.6.5.

4.1.3.3 Paragraphs 4.5, 4.6.2, 5.2, 5.3, 5.4, and 5.9 are not applicable.

- Para's 4.5 and 4.6.2 - These paragraphs are not applicable since the modification design discussed herein does not specify associated circuits.

- Para's 5.2, 5.3, and 5.4 - The existing plant standby generating units and DC supplies shall be used unaltered in the current design modification.

- Para 5.9 - The ECCS design modification utilizes existing actuated equipment.

4.1.4 USNRC Regulatory Guide Division 1 - Number 1.75.

4.1.4.1 Compliance with Section C except as presented in Sections 4.1.4.2 and 4.1.4.3.

4.1.4.2 Non-compliance with Section C, parts 1, 6, 10, and 11.

- Section C, part 1 - Interrupting devices actuated by fault current are used as isolation devices in the existing plant design. The core spray modification makes use of these existing devices and the design and single failure analysis will take credit for them. No additional devices of this nature, however, will be added by this modification.

- Section C, part 6 - If any analysis is required, it will be submitted to the NRC for their review.

- Section C, parts 10 and 11 - Identification of core spray system components and wiring will not be provided. The existing safety systems are not identified by color code or other means. The new work represents only a small part of the entire core spray system and will be entirely in conduit. Color coding the new core spray system conduit would not enable visual verification of the total core spray system separation.

4.1.4.3 Section C, parts 4, 5, 7, 14 and 15 are not applicable.

- Section C, parts 4, 5 and 7 - By design, the ECCS modification does not specify associated circuits.

- Section C, part 14 - The ECCS design modification does not require availability of the air supply for core spray system operation.

- Section C, part 15 - The ECCS design modification does not require additional HVAC or impact on installed systems.

5.0 GENERAL SEPARATION CRITERIA

5.1 Compatibility with Existing Plant

This document does not apply to existing circuits and equipment of the Oyster Creek ECCS. The existing systems are in accordance with "Oyster Creek Project, Separation Practices for Safeguards Systems" by APED Engineering, General Electric Company, Revised November 26, 1968. It is not within the scope of this modification to revise, upgrade or verify the separation provided in existing cable runs or equipment design. The present modification shall be accomplished in such a way that separation and protection now provided for existing circuits and equipment will not be compromised. Where the channel assignment or safety status of existing wiring or equipment is changed because of the ECCS modification, then revisions to the existing plant may be required.

5.2 Required Separation

Separation shall be provided to maintain the independence of sufficient number of circuits and equipment so that the ECCS function required during and following any design basis event can be accomplished. The degree of separation required and the methods of providing separation shall be in accordance with Section 6.

5.3 Equipment and Circuits Requiring Separation

Equipment and circuits requiring separation shall be determined during the design of the ECCS modification and shall be on appropriate drawings created for the modification.

5.4 System Compatibility

Location and routing of new wiring, piping, components, etc., of electrical, instrumentation and mechanical systems shall provide separation such that the required independence of redundant systems is not compromised. For example, electrical circuits shall be routed or protected such that failure of mechanical equipment of one redundant system cannot disable circuits essential to the operation of the other redundant system.

6.0 SPECIFIC SEPARATION CRITERIA

6.1 Wire and Cable

All new wire and cable installed for the ECCS modification shall be of the flame retardant type and not contain PVC insulation.

6.2 Cable Runs

6.2.1 All new cable runs required for ECCS modification will be routed in conduit so as to facilitate adequate separation. Existing cables presently routed in cable tray associated with one safety channel shall not be utilized for circuits of a redundant channel.

6.2.2 Voltage levels of cables of the same channel shall be routed in separate conduits as follows:

(a) Medium Voltage (Power) - 4.16KV
(b) Low Voltage (Power) - up to 480 volts
(c) Control and Instrument Voltage - 125 volts or less

6.3 Conduit Routing

6.3.1 Hazardous Areas

The routing of new conduits shall be reviewed for exposure to potential hazards such as high pressure piping and missiles.

Separation or protection shall be provided appropriate to the damage potential of the hazard to ensure that the consequences of the damage shall not inhibit the function of the Core Spray System.

6.3.2 General Plant Areas

In plant areas where such hazards as missiles, pipe whip and external fire do not represent significant damage potential, the minimum separation between conduits of redundant channels shall be one inch. The minimum distance between new conduits and any existing conduit shall be one inch. The minimum separation between new conduit and existing open cable tray shall be six inches when the conduit is below or to the side of tray and three feet where the conduit is above the tray. In those cases where the minimum separation distances between tray and conduit cannot be maintained, a barrier with a sixty minute fire rating shall be installed.

6.4 Control Panels

6.4.1 Wire

Wire installed in control panels shall be of the flame retardant type and not contain PVC insulation.

6.4.2 Internal Separation

Where wiring or components of redundant channels are located within the same panel, a minimum of six inches separation shall be maintained between them. Where this distance cannot be maintained, a fire barrier with a fifteen minute rating shall be installed. Non-Class IE circuits such as annunciators, etc., shall be electrically isolated from safety related circuits by a relay contact or equivalent means and run in a separate wire bundle or wireway. These criteria for internal separation do not apply to the modifications to existing relay panels 18A and 18B. They are limited to panels 1F/2F and to the new panels which will be installed at a later date to replace relay panels 18A and 18B.

6.5 Analysis

Any circuit routed near or with safety related circuits may have lesser separation requirements if it can be shown by analysis that the safety related circuits are not degraded.