

STATUS OF EVALUATIONS AND MODIFICATIONS OF
DIESEL GENERATOR STATUS ANNUNCIATOR SYSTEMS AT
VARIOUS U. S. NUCLEAR POWER PLANTS

Benjamin M. Shindell
EG&G, Inc.

Robert P. Rumble
LLL

October 1979



This is an informal report intended primarily for internal or limited external distribution. The opinions and conclusions stated are those of the author and may or may not be those of the Laboratory.

This work was supported by the United States Nuclear Regulatory Commission under a Memorandum of Understanding with the United States Department of Energy.

ABSTRACT

This report documents the current status of evaluations and modifications to the diesel generator status annunciators in a number of U. S. nuclear power plants. These modifications may be required in order to:

- (1) Ensure that all conditions which might render the diesel generators incapable of automatic starting are annunciated in the control room.
- (2) Ensure that the wording on the control room annunciator clearly indicates to the operator that the diesel generator is unavailable if such is the case.
- (3) Separate disabling and non-disabling annunciation.

This report is supplied as part of the Selected Electrical, Instrumentation, and Control Systems Issues Program being conducted for the U. S. Nuclear Regulatory Commission by Lawrence Livermore Laboratory.

FOREWORD

This report is supplied as part of the Selected Electrical, Instrumentation, and Control Systems Issues (SEICSI) Program being conducted for the U. S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Division of Operating Reactors, by Lawrence Livermore Laboratory, Field Test Systems Division of the Electronics Engineering Department.

The U. S. Nuclear Regulatory Commission funded the work under the authorization entitled "Electrical, Instrumentation and Control System Support," B&R 20 19 04 031, FIN A-0231.

Part of this work was performed by EG&G, Inc., Energy Measurements Group, San Ramon Operations, for Lawrence Livermore Laboratory under U. S. Department of Energy contract number DE-AC08-76NV01183.

TABLE OF CONTENTS

	<u>Page</u>
1. INTRODUCTION	1
2. EVALUATION OF THE DIESEL GENERATOR STATUS ANNUNCIATORS	3
3. CONCLUSIONS	7
APPENDIX SUMMARY OF THE EVALUATION OF THE DIESEL GENERATOR STATUS ANNUNCIATORS AT VARIOUS U. S. NUCLEAR POWER PLANTS	9
1. Cooper Station	11
2. Palisades	12
3. Cook, Units 1 and 2	13
4. Trojan.	14
5. Maine Yankee	15
6. Vermont Yankee.	16
7. Pilgrim, Unit 1	17
8. Browns Ferry, Units 1, 2, and 3	18
9. Humboldt Bay, Unit 3	19
10. Three Mile Island, Unit 1	20
11. Millstone, Unit 1	21
12. Millstone, Unit 2	22
13. Salem, Unit 1	23
14. Calvert Cliffs, Units 1 and 2	24
15. Kewaunee	25
16. Oyster Creek, Unit 1	26
17. Yankee Rowe	27
18. Duane Arnold	28
19. Rancho Seco, Unit 1	29
20. La Crosse	30
21. Haddam Neck	31

STATUS OF EVALUATIONS AND MODIFICATIONS
OF
DIESEL GENERATOR STATUS ANNUNCIATOR SYSTEMS
AT
VARIOUS U. S. NUCLEAR POWER PLANTS

Benjamin M. Shindell
EG&G, Inc., Energy Measurements Group, San Ramon Operations

Robert P. Rumble
Lawrence Livermore Laboratory, Livermore

1. INTRODUCTION

By letter dated November 28, 1977, the U. S. Nuclear Regulatory Commission (NRC) requested a number of nuclear power plant licensees* to review the circuitry of and wording on their diesel generator status annunciators and to provide the following information:

- (1) All conditions which render the diesel generators incapable of responding to an automatic start signal.
- (2) The wording on the annunciator panel for each of the conditions listed in (1) above.
- (3) Any other alarm signal which causes each panel listed in (2) above to alarm.

*A list of the licensees and their respective plants is given in Section 2.

2. EVALUATION OF THE DIESEL GENERATOR STATUS ANNUNCIATORS

All of the licensees who received the NRC request for information on diesel generator status annunciators replied. These licensees and their respective plants are as follows:

<u>LICENSEE</u>	<u>PLANT</u>
1. AEP Corporation	Cook 1
2. Alabama Power Company	Farley 1
3. Arkansas Power and Light Company	Arkansas 1 Arkansas 2
4. Baltimore Gas and Electric Company	Calvert Cliffs 1 Calvert Cliffs 2
5. Boston Edison Company	Pilgrim 1
6. Carolina Power and Light Company	Brunswick 1 Brunswick 2 Robinson 2
7. Commonwealth Edison Company	Dresden 1 Dresden 2 Dresden 3 Quad Cities 1 Quad Cities 2 Zion 1 Zion 2
8. Connecticut Yankee Atomic Power Company	Haddam Neck
9. Consolidated Edison Company of New York, Inc.	Indian Point 1 Indian Point 2
10. Consumer Power Company	Big Rock Point 1 Palisades
11. Dairyland Power Cooperative	Lacrosse

<u>LICENSEE</u>	<u>PLANT</u>
31. Public Service Company of Colorado	Ford St. Vrain
32. Public Service Electric and Gas Company	Salem 1
33. Rochester Gas and Electric Corporation	Ginna
34. Sacramento Municipal Utility District	Rancho Seco
35. Southern California Edison Company	San Onofre 1
36. Tennessee Valley Authority	Browns Ferry 1 Browns Ferry 2 Browns Ferry 3
37. Toledo Electric Company	Davis-Besse 1
38. Vermont Yankee Nuclear Power Corporation	Vermont Yankee
39. Virginia Electric and Power Company	North Anna 1 Surry 1 Surry 2
40. Wisconsin Electric Power Company	Point Beach 1 Point Beach 2
41. Wisconsin Public Service Corporation	Kewaunee
42. Yankee Atomic Electric Company	Yankee Rowe

The correspondence between the NRC staff and the various licensees on the subject of diesel generator status annunciators was evaluated using the NRC staff position criteria given in Section 1. Some of the licensees identified problems as a result of the review and proposed changes and schedules for their implementation. Other licensees replied that no problems existed and their replies satisfied the NRC staff. Most

3. CONCLUSIONS

An evaluation was made of the diesel generator status annunciators at various U. S. nuclear power plants. The conclusions and recommendations for each individual nuclear power plant evaluated are contained in the last two columns of each page in the Appendix. In those cases where the licensee has indicated that it does not use a lock-out relay to shutdown the diesel generator and where we have used the notation "NOTE 2", we recommend that the NRC Inspector witness the next diesel generator test to ascertain that there is no step of the shutdown procedure which could leave the diesel generators incapable of responding to an automatic start signal and which is not annunciated in the control room.

LLL:1980-1

APPENDIX

SUMMARY OF THE EVALUATION OF THE DIESEL GENERATOR STATUS ANNUNCIATORS AT VARIOUS U. S. NUCLEAR POWER PLANTS

1. Cooper Station
2. Palisades
3. Cook, Units 1 and 2
4. Trojan
5. Maine Yankee
6. Vermont Yankee
7. Pilgrim
8. Browns Ferry, Units 1, 2, and 3
9. Humboldt Bay, Unit 3
10. Three Mile Island, Unit 1
11. Millstone, Unit 1
12. Millstone, Unit 2
13. Salem, Unit 1
14. Calvert Cliffs, Units 1 and 2
15. Kewaunee
16. Oyster Creek, Unit 1
17. Yankee Rowe
18. Duane Arnold
19. Rancho Seco, Unit 1
20. La Crosse
21. Haddam Neck
22. Turkey Points, Units 3 and 4
23. Zion, Units 1 and 2
24. San Onofre, Unit 1
25. Peach Bottom, Units 2 and 3
26. Crystal River, Unit 3
27. Beaver Valley, Unit 1
28. Brunswick, Units 1 and 2
29. Fitzpatrick, Unit
30. Nine Mile Point, Unit 1
31. Point Beach, Units 1 and 2
32. Fort Calhoun
33. R. E. Ginna, Unit 1
34. Arkansas
35. Monticello
36. Prairie Island, Units 1 and 2
37. Hatch, Unit 1
38. Surry, Units 1 and 2
39. St. Lucie, Unit 1
40. Indian Point, Units 1 and 2
41. Dresden, Unit 1
42. Dresden, Units 2, 3, and 4
43. Quad Cities, Units 1 and 2
44. H. B. Robinson, Unit 2
45. Davis-Besse, Unit 1
46. J. M. Farley

1. COOPER STATION

DOCKET NO.: 50-298

SECOND DOCKET NO.:

LAST ACTION

Licensee proposed modification in its May 19, 1978 letter to add annunciators in the control room for items a, b, c, and d of letter from NRC (Lear) to licensee dated April 18, 1978.

RESPONSE

NRC DOR approved proposed modification in its letter dated March 2, 1979.

NEXT ACTION

None.

FINAL ACTION

NRC should verify modification complete.

NOTE 1, March 2, 1979.

3. COOK, UNITS 1 & 2

DOCKET NO.: 50-315

SECOND DOCKET NO.: 50-316

LAST ACTION

Staff review of licensee response to initial inquiry has been completed, and the following actions should be taken by the licensee:

- 1) Annunciate the control knife switch open position.
- 2) Determine if a manual shutdown lockout relay exists.
- 3) Verify that an annunciator is provided to clearly indicate when the D/G control switch is not in the automatic position.

RESPONSE

None.

NEXT ACTION

NRC should inform the licensee of the staff position.

FINAL ACTION

NRC should verify that the licensee has implemented the staff position.

5. MAINE YANKEE

DOCKET NO.: 50-309

SECOND DOCKET NO.:

LAST ACTION

Licensee was requested by NRC letter of July 6, 1978 to:

- 1) Verify that all shared annunciators for disability conditions cannot be cleared until all abnormal conditions are corrected.
- 2) Verify if the D/G is provided with a manual shutdown lockout relay. An alarm should be provided which is worded to clearly indicate the D/G is incapable of an auto start when the relay is not set.

RESPONSE

Licensee responds by letter dated August 4, 1978 that:

- 1) Item 1 has been verified.
- 2) There is no manual shutdown lockout relay provided.

NEXT ACTION

- 1) None.
- 2) NRC should review the schematic diagram of the as-built system in the field to verify that no manual shutdown lockout relay exists.

FINAL ACTION

- 1) None.
- 2) Document results of the NRC review.

NOTE 1, August 22, 1978.

7. PILGRIM, UNIT 1

DOCKET NO.: 50-293

SECOND DOCKET NO.:

LAST ACTION

Licensee was requested by NRC letter of September 15, 1978 to:

- 1) Provide a separate alarm for each valve/switch on a single shared alarm (with reflash capability) for all affected devices with wording clearly indicating that the D/G is incapable of an automatic start.
- 2) Provide confirmation that all shared annunciators for the D/G disabling conditions cannot be cleared in the control room until all abnormal (disabling) conditions are corrected. Provide a description of any exceptions and the corrective measures to be initiated.
- 3) Provide information sufficient to verify that an alarm is provided which clearly indicates when the D/G control switch is not in the automatic position.

RESPONSE

Licensee responded by letter dated October 20, 1978 that:

- 1) Functionally testing the D/G after maintenance and daily checking the position of the shut-off valves provide adequate assurance that the D/G will not be left in an inoperable mode due to the incorrect positioning of the air start shutoff valve. No modification is necessary.
- 2) During the emergency mode, all shared annunciators for D/G disabling conditions cannot be cleared in the control room until all abnormal (disabling) conditions are corrected. During the test mode, these conditions can be cleared in the control room after acknowledging the trouble alarm of the local control panel. During the emergency mode, these controls are bypassed and alarmed in the local panel and the control room on a common alarm.
- 3) Even if a switch is not in the automatic position, it will not prevent an automatic start.

NEXT ACTION

- 1) The Licensee should be informed to implement the NRC staff position.
- 2) None.
- 3) If the D/G is in the test mode and the shutdown relay is energized (e.g., by pushing the normal post-test shutdown button), it appears that the alarm can be cleared in the control room after the local alarm is cleared. Can the local alarm be cleared without clearing the shutdown relay? If so, an automatic start could be blocked if the local alarm were cleared without first reverting the shutdown relay and the operators were not aware of it. This should be reviewed and corrected if such conditions exist.

FINAL ACTION

- 1) NRC should verify and document the modifications installed.
- 2) None.
- 3) The results of review should be documented and the licensee informed of the final disposition.

9. HUMBOLDT BAY, UNIT 3

DOCKET NO.: 50-133

SECOND DOCKET NO.:

LAST ACTION

Licensee was requested by NRC letter of April 18, 1978 to:

- 1) Identify the D/G disabling conditions not clearly annunciated in the control room (control switch not in the automatic position).
- 2) Determine if the D/G is provided with a manual shutdown lockout relay.
- 3) Provide confirmation that shared annunciators for the D/G disabling conditions cannot be cleared in the control room until all of the abnormal (disabling) conditions are corrected.

RESPONSE

Licensee responded by letter of May 19, 1978:

- 1) The wording for this annunciator, which alarms if the control switch is not in the automatic position, will be changed to "EMERGENCY ENGINE GENERATOR DISABLED".
- 2) The D/G is provided with an emergency-stop relay which is energized and locked-in when overspeed engine water high temperature or low oil pressure sensors exceed their setpoints. Activation of this relay initiates an emergency shutdown by opening a contact in the engine ignition circuitry to shut down the engine. The licensee will add a modification to monitor this relay and annunciate it on the annunciator in item (1) above.
- 3) The annunciator is not capable of being cleared or reset unless all of the abnormal conditions associated with it are corrected. Resetting these annunciators cannot be accomplished in the control room and requires that an operator be dispatched to take corrective action.

NEXT ACTION

- 1) NRC should verify that the wording has been changed.
- 2) NRC should review the schematic diagram or the as-built system in the field to verify that no manual shutdown lock-out relays exist. NRC should verify that the modification is installed. NOTE 2.
- 3) None.

FINAL ACTION

- 1) NRC should document the results of the inspection.
- 2) The results of the NRC review should be documented.
- 3) None.

11. MILLSTONE, UNIT 1

DOCKET NO : 50-245

SECOND DOCKET NO.:

LAST ACTION

Licensee was requested by NRC letter to:

- 1) Propose modifications resulting from the review.
- 2) Determine if the D/G are provided with a manual shutdown lockout relay.
- 3) Verify that an alarm is provided which clearly indicates when the D/G control switch is not in the automatic position.

RESPONSE

Licensee responded by letter of May 12, 1978 that:

- 1) It proposes to add a separate annunciator for the D/G to distinguish between disabling and nondisabling conditions.
- 2) The D/G is provided with manual shutdown lockout relays. Alarms are provided which indicate when these relays are not reset. The main control room alarms will be modified as necessary to clearly indicate that the D/G is incapable of an automatic start if the relays are not reset.
- 3) No alarm exists for the D/G because there is no control switch which could prevent the D/G from responding to an automatic start.

NEXT ACTION

- 1) NRC should verify that the licensee has implemented the modifications.
- 2) NRC should verify that the licensee has implemented the modifications.
- 3) None.

FINAL ACTION

- 1) The results of the verification should be documented.
- 2) The results of the verification should be documented.
- 3) None.

13. SALEM, UNIT 1

DOCKET NO.: 50-272

SECOND DOCKET NO.:

LAST ACTION

Licensee was requested by NRC letter to:

- 1) List any D/G disabling condition not clearly annunciated in the control room with the relay test switches in test position.
- 2) D/G breaker control switch in "PULL TO LOCK OUT" position.
- 3) Provide an alarm if a manual shutdown lockout relay exists. The alarm should be worded to clearly indicate that the D/G is incapable of an automatic start when the relay is not reset.

RESPONSE

Licensee responded by letter of August 2, 1978 that:

- 1) The test switches will be modified so that whenever the contacts of the switch are operated which could prevent the automatic start of the D/G, an alarm will appear on the auxiliary annunciator. The alarm will be appropriately worded to alert the operator of such a condition.
- 2) It proposes to change the control switch to a spring-return switch.
- 3) The manual lockout of the D/G is accomplished with a lockout switch.

NEXT ACTION

NRC should verify that:

- 1) An alarm has been added to the auxiliary annunciator for the relay test switch so that the condition is also annunciated in the control room and the wording on this annunciator is in accordance with the NRC staff position.
- 2) NRC should verify that the test switches have been modified and that the annunciator wording is in accordance with staff position.
- 3) NRC should verify that no manual shutdown lockout relays exist and that the lockout switch is annunciated in the control room.

FINAL ACTION

- 1) NRC should verify the wording and document the completion of the modification.
- 2) NRC should verify the wording and document the completion of the modification.
- 3) NRC should verify all of the annunciators to ensure that those required to be in the control room are not located in an auxiliary or control console.

NOTE 1, September 8, 1978.

15. KEWAUNEE

DOCKET NO.: 50-305

SECOND DOCKET NO.:

LAST ACTION

Licensee was requested by NRC letter dated March 29, 1977 to:

- 1) List all of the conditions that render the D/G incapable of responding to any automatic emergency start signal.
- 2) Provide information sufficient to determine if the D/G is provided with a manual shutdown lockout relay.

RESPONSE

- 1) Licensee responded by letter of June 9, 1977 that the design of the D/G annunciation scheme was reviewed to ensure that all of the conditions which could prevent operation of the D/G are properly monitored and that such monitoring and annunciation is compatible with the design intent.
- 2) Per phone conference on April 25, 1979 between Mark March and Lenny Olshan, there are no manual lockout relays on the system, only automatic relays which are annunciated on the control panel as "ENGINE - START RUN FAILURE".

NEXT ACTION

- 1) It is the NRC staff position that all of the conditions which could prevent operation of the D/G are clearly annunciated in the control room.
- 2) None.

FINAL ACTION

- 1) NRC should verify the annunciators to ensure that those required to be in the control room are not located in an auxiliary or control console. The results should be documented.
- 2) None.

17. YANKEE ROWE

DOCKET NO.: 50-29

SECOND DOCKET NO.:

LAST ACTION

Licensee was requested by NRC letter to:

- 1) List any D/G disabling conditions not clearly annunciated in the control room with the emergency stop not reset.
- 2) List any D/G disabling conditions not clearly annunciated in the control room with the emergency restart control switch in the "OFF" position.
- 3) Determine if the D/G's have a manual shutdown lockout relay.

RESPONSE

Licensee responded by letter of May 10, 1977 that:

- 1) It proposes to add a new annunciator window ("D/G DISABLING CONDITION") to alarm on this condition and other equipment failure-type disabling conditions.
- 2) It proposes to add a new annunciator window ("DIESEL RESTART PROGRAM CS OFF").
- 3) The information provided is not sufficient to determine if the D/G's are provided with a manual shutdown lockout relay.

NEXT ACTION

- 1) NRC should verify that this modification has been completed and, at the same time, check if this condition has reflash capability.
- 2) The NRC staff position is that this condition should be annunciated as a D/G disabling condition with reflash capability and, if so, the licensee should be informed.
- 3) NRC should verify that no manual shutdown lockout relays exist. If such relays exist, an alarm should be provided which is worded to clearly indicate that the D/G is incapable of an automatic start when the relay is not reset.

FINAL ACTION

- 1) NRC should document the results of the review.
- 2) NRC should confirm that a mispositioned control switch is alarmed as a disabling condition and document the review.
- 3) NRC should document the results of the review.

NOTE 1, May 2, 1978.

19. RANCHO SECO, UNIT 1

DOCKET NO.: 50-312

SECOND DOCKET NO.:

LAST ACTION

Licensee was requested by NRC letter to:

- 1) Review the status annunciator for D/G disabling conditions not clearly annunciated in the control room.
- 2) The information provided is not sufficient to determine if the D/G are provided with a manual shutdown lockout relay.

RESPONSE

Licensee responded by letter of May 16, 1977 that:

- 1) Licensee proposes to add an annunciator worded "DSL GEN AUTO START INOPERABLE" to alarm on all disabling conditions including equipment failures.
- 2) Later NRC discussions with licensee staff determined that the D/G are provided with manual shutdown lockout relays with alarms. An engineering safety feature signal will override the lockout and automatically reset the lockout relay.

NEXT ACTION

- 1) In making the review, the licensee assumed the following conditions:
 - a) All supporting systems and equipment are properly aligned.
 - b) There are no abnormal or defective mechanical or electrical components or systems, the failure or abnormal operation of which could not be detected without actually attempting to start or operate the emergency generating units.
 - c) The D/G unit had performed satisfactorily on its last automatic start test and no work had been done on the units since the performance of the tests.

The NRC staff position on the above is:

- a) An alarm should be provided for any equipment that could block an auto start if mispositioned.
 - b) None.
 - c) The NRC does not wish to accept the assumption that this is only valid if the technical specification requires a test after all maintenance.
- 2) None.

FINAL ACTION

- 1) NRC should verify that the assumed conditions do not present any abnormal or non-annunciated conditions. NRC should document results of the review.

2) None.

NOTE 1, May 24, 1978.

21. HADDAM NECK

DOCKET NO.: 50-213

SECOND DOCKET NO.:

LAST ACTION

Licensee was requested by NRC to review the alarm circuitry and D/G control circuits for the D/G's to:

- 1) Identify all conditions which are not clearly annunciated in the control room.
- 2) Determine if the D/G are provided with a manual shutdown lockout relay.
- 3) Verify that an alarm is provided which clearly indicates when the D/G control switch is not in the automatic position.

RESPONSE

The licensee responded by letter of May 16, 1977 that:

- 1) It proposes to add an annunciator for each D/G to alarm a disabling condition.
- 2) Per conversation with PM on April 25, 1979, there are no manual shutdown lockout relays.
- 3) Per conversation with PM on April 25, 1979, two new alarms will be wired to indicate when either emergency D/G is incapable of responding to an automatic start signal.

NEXT ACTION

- 1) NRC should verify that the licensee has implemented the modifications.
- 2) NRC should verify that there are no manual shutdown lockout relays from the schematic diagram or the as-built system.
- 3) NRC should verify that these modifications have been incorporated and that the annunciation meets the staff position.

FINAL ACTION

- 1) NRC should document the results of the review.
- 2) NRC should document the results of the review.
- 3) NRC should document the results of the review.

23. ZION, UNITS 1 & 2

DOCKET NO.: 50-295

SECOND DOCKET NO.: 50-304

LAST ACTION

Licensee was requested by NRC letter of March 29, 1977 to identify the D/G disabling conditions not clearly annunciated in the control room.

RESPONSE

Licensee responded by letter of May 11, 1977 that the results of its review do not indicate any conditions which might lead to a misinterpretation of the operational status of the D/G.

NEXT ACTION

NRC should draft a letter informing the licensee that its response is inadequate and requesting a more explicit response.

FINAL ACTION

None.

NOTE 1, September 29, 1978.

25. PEACH BOTTOM, UNITS 2 & 3

DOCKET NO.: 50-277

SECOND DOCKET NO.: 50-278

LAST ACTION

Licensee was requested by NRC to review the alarm circuitry and D/G control circuits for the D/G's.

RESPONSE

Licensee's response by letter of May 16, 1977 listed all of the alarm circuits and the annunciation for each alarm.

NEXT ACTION

NRC should request that one annunciator be identified as D/G disabled, in addition to a separate annunciator for each disabling condition. This annunciator should be tied to all disabling conditions.

FINAL ACTION

None.

NOTE 1, April 12, 1979 and June 9, 1978.

27. BEAVER VALLEY, UNIT 1

DOCKET NO.: 50-334

SECOND DOCKET NO.:

LAST ACTION

Licensee was requested by NRC to:

- 1) List the disabling conditions not clearly annunciated in the control room.
- 2) Provide information sufficient to determine if the D/G's are provided with a manual shutdown lockout relay.

RESPONSE

Licensee responded by letter of May 18, 1977 and discussions with NRC on May 30 and June 5, 1978 that:

- 1) It identified two conditions--D/G control switch not in the automatic position and D/G breaker control not in the automatic position. It proposes to change the wording on the control room annunciators, but it failed to state what the new wording would be.
- 2) A condition was listed as "START LOCKOUT RELAYS NOT RESET" but no information was provided on manual shutdown lockout relay.

NEXT ACTION

- 1) NRC should check the wording to be certain that it clearly indicates the D/G will not automatically start.
- 3) NRC should review the schematic diagram or the as-built system in the field to verify that no manual shutdown lockout relays exist.

FINAL ACTION

- 1) NRC should document the results of the review.
- 2) NRC should document the results of the review.

NOTE 1, August 17, 1978.

29. FITZPATRICK, UNIT 1

DOCKET NO.: 50-333

SECOND DOCKET NO.:

LAST ACTION

Licensee was requested by NRC to list the disabling conditions not clearly annunciated in the control room.

RESPONSE

Licensee responded by letter of May 17, 1977 listing all conditions which are annunciated and alarmed in the control room. There are no other conditions that render a D/G incapable of responding to an automatic emergency start signal that is not alarmed in the control room. No modifications will result from this review.

NEXT ACTION

NRC staff position is that all annunciators which have disabling conditions should also be annunciated "D/G DISABLED" and all disabling conditions should be separated from nondisabling conditions.

FINAL ACTION

NRC should review the implementation for compliance to the staff position and document the review.

NOTE 1, April 12, 1978.

31. POINT BEACH, UNITS 1 & 2

DUCKET NO.: 50-266

SECOND DOCKET NO.: 50-301

LAST ACTION

Licensee was requested by NRC to provide information sufficient to determine if the D/G's are provided with a manual shutdown lockout relay.

RESPONSE

Licensee's response by letter of May 16, 1977 listed that the 86 lockout on the output breaker can energize thereby tripping the breaker, and annunciating in control room "EMERGENCY DIESEL 601 OR 602 TRIP OR LOCKOUT".

NEXT ACTION

NRC should verify that there are no manual shutdown lockout relays from the schematic diagram or the as-built system.

FINAL ACTION

NRC should document the results of the review.

NOTE 1, April 13, 1978.

33. R. E. GINNA, UNIT 1

DUCKET NO.: 50-244

SECOND DOCKET NO.:

LAST ACTION

Licensee was requested by NRC letter of March 29, 1977 to:

- 1) Provide information concerning possible nonalarmed conditions which might render the D/G's incapable of automatic start.
- 2) Licensee was requested by NRC letter dated April 4, 1978 to determine if the D/G's are provided with a manual shutdown lockout relay.

RESPONSE

Licensee responded by letter of April 27, 1978:

- 1) D/G local/remote control switch in local position is annunciated in the existing system and will be annunciated in the proposed system as a "DIESEL GENERATOR INOPERATIVE" condition.
- 2) No response.
- 3) Low lube oil pressure is annunciated in the existing system and will be annunciated in the proposed system as a "DIESEL GENERATOR INOPERATIVE" condition.

NEXT ACTION

NRC responded by letter of September 18, 1978 that the licensee had provided acceptable responses.

- 1) NRC should verify that the wording has been changed.
- 2) NRC should verify that no manual shutdown lockout relays exist that are alarmed to clearly indicate that the diesel generator would not start automatically if required during an emergency.
- 3) We agree with the reasons stated in item 4 of your letter that the low lube oil pressure trip needs not be bypassed when a safety injection signal is present.

FINAL ACTION

NRC should document the review and verify that all of the modifications proposed by the licensee have been completed, and document those results.

NOTE 1, September 18, 1979.

35. MONTICELLO

DOCKET NO.: 50-263

SECOND DOCKET NO.:

LAST ACTION

Licensee was requested by NRC to list the D/G disabling conditions not clearly annunciated in the control room.

RESPONSE

Licensee responded by letter that no disabling conditions were identified that are not clearly annunciated in the control room. Certain nondisabling conditions, however, shared the "D/G NOT IN AUTO" window with other disabling conditions.

NEXT ACTION

The NRC staff position is that the nondisabling conditions should be transferred to the "D/G TROUBLE" window. Thus, the operator can be assured that the "D/G NOT IN AUTO" alarm is a positive indication that the D/G is disabled.

FINAL ACTION

NRC should document the results of the review.

37. HATCH, UNIT 1

DOCKET NO.: 50-321

SECOND DOCKET NO.:

LAST ACTION

Licensee was requested by NRC to:

- 1) List the disabling conditions not clearly annunciated in the control room and the proposed modification resulting from the review.
- 2) The information provided is not sufficient to determine if the D/G's are provided with a manual shutdown lockout relay.

RESPONSE

Licensee responded by letter of May 18, 1977 that:

- 1) It would add an alarm for this condition, but it did not specify the wording to be used on the annunciator window. The disabling condition generator differential lockout relay not reset is annunciated as "GEN. OR STA. SERV. TRANSF. ID DIFF. AUX. TRIPPED".
- 2) The licensee should be requested to supply the information.

NEXT ACTION

- 1) NRC should verify that the wording clearly indicates that the D/G is incapable of an automatic start.
- 2) NRC should evaluate the response and make recommendations as necessary.

FINAL ACTION

- 1) NRC should document the results of the review.
- 2) NRC should document the results of the review.

NOTE 1, May 17, 1978.

39. ST. LUCIE, UNIT 1

DOCKET NO.: 50-335

SECOND DOCKET NO.:

LAST ACTION

Licensee was requested by NRC letter of May 8, 1978 to:

- 1) Verify that all shared annunciators for the disability conditions are unable to be cleared until all abnormal conditions are corrected.
- 2) Verify that if a U/G is provided with a manual shutdown lockout relay, an alarm should be provided which is worded to clearly indicate the D/G is incapable of an automatic start when the relay is not set.

RESPONSE

Licensee responded by letter of June 7, 1978 that:

- 1) No annunciator for a disabling condition clears before the condition is corrected.
- 2) The lockout relay will inhibit a start attempt unless the condition leading to the lockout is corrected and the lockout relay is reset. The lockout is annunciated and the annunciator will not clear unless the lockout relay is reset.

NEXT ACTION

- 1) None.
- 2) NRC should verify that the annunciator is worded to clearly indicate that the D/G is incapable of an automatic start when the relay is not reset.

FINAL ACTION

- 1) None.
- 2) NRC should document the results of the review.

NOTE 1, September 7, 1978.

41. DRESDEN, UNIT 1

DOCKET NO.: 50-010

SECOND DOCKET NO.:

LAST ACTION

Licensee was requested by NRC letter of April 18, 1978 to provide alarms for the following conditions which the licensee has confirmed can result from normal routine periodic testing or maintenance:

- 1) Manual air shutoff valve placed in the closed position.
- 2) Bus tie breaker between the D/G and its emergency bus placed in the test position.
- 3) Improper D/G governor droop setting.

RESPONSE

Licensee's response by letter of May 10, 1978 that:

- 1) It would install an alarm for the manual air shutoff valve placed in the closed position.
- 2) It would install an alarm for the bus tie breaker between the D/G and its emergency bus placed in test position.
- 3) It would either modify the procedure for D/G testing to preclude changing the D/G governor droop setting or install an alarm for improper droop setting.

NEXT ACTION

- 1) NRC should verify that the licensee has installed the alarm.
- 2) NRC should verify that the licensee has installed the alarm.
- 3) NRC should verify that the licensee has changed the operating test procedure for the droop setting or that an alarm has been added.

FINAL ACTION

- 1) NRC should review these actions and document the results of the review.
- 2) NRC should review these actions and document the results of the review.
- 3) NRC should review these actions and document the results of the review.

NOTE 1, June 13, 1978.

43. QUAD CITIES, UNITS 1 & 2

DOCKET NO.: 50-254

SECOND DOCKET NO.: 50-265

LAST ACTION

Licensee was requested by NRC to list the D/G disabling conditions not clearly annunciated in the control room.

RESPONSE

Licensee responded by letter of May 27, 1977 identifying the following conditions that:

- 1) Manual air shutoff valve placed in the closed position.
- 2) Bus tie breaker between the D/G and its emergency bus placed in the test position.
- 3) Improper D/G governor droop setting.
- 4) Control switch in the "STOP" position.
- 5) Local selector switch in the "LOCAL" position.
- 6) Did not provide information on manual shutdown lockout relay.

NEXT ACTION

1,2,3) The staff position is if these conditions can result from normal routine periodic testing or maintenance, they should be alarmed to clearly indicate a D/G automatic start is blocked.

4,5) The staff position is that this wording could be confusing. The D/G automatic start and automatic start blocked annunciators should be in separate windows.

6) Are the D/G's provided with a manual shutdown lockout relay? If a manual shutdown lockout relay exists, an alarm should be provided which is worded to clearly indicate the D/G is incapable of an automatic start when the relay is not reset.

FINAL ACTION

NRC should review all of the actions proposed by licensee and document the results of the review.

45. DAVIS-BESSE, UNIT 1

DOCKET NO.: 50-346

SECOND DOCKET NO.:

LAST ACTION

Licensee was requested by NRC letter of March 6, 1979 to respond to the NRC staff positions that:

- 1) All shared annunciators for disability conditions should be able to be cleared until all abnormal conditions are corrected.
- 2) If a D/G is provided with a manual shutdown lockout relay, an alarm should be provided which is worded to clearly indicate the D/G is incapable of an automatic start when the relay is not set.
- 3) An alarm should be provided which clearly indicates when the D/G control switch is not in the automatic position.

RESPONSE

Licensee responded by letter of April 9, 1979 that:

- 1) Emergency D/G annunciators are in total compliance.
- 2) The annunciator window which alarms the condition that the safety lockout relay is not reset is presently inscribed "EMER DG TRBL TRIP". This will be reworded as "EMERG DG LOCKOUT-OUT AND TRBL TRIP".
- 3) The D/G voltage regulator control switch must be in the "ON" position for automatic operation. A signal will be added to the annunciator described above, which will cause it to alarm when the voltage regulator control switch is off.

NEXT ACTION

- 1) The NRC staff position is that disabling conditions should not be alarmed on the same annunciator as nondisabling conditions. The existing design should be modified to provide separate annunciators worded to clearly distinguish between these conditions.
- 2) The annunciator should be reworded "EMERG DG LOCK-OUT (P) TRBL TRIP" as these are two separate conditions.
- 3) None.

FINAL ACTION

- 1) NRC should review the staff position with the licensee and document the results of the review.
- 2) NRC should review the wording on the annunciator and document the results.
- 3) None.

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, or any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for any third party's use, or the results of such use, of any information, apparatus, product, or process disclosed in this report, or represents that its use by such third party would not infringe privately owned rights.

Reference to a company or product name does not imply approval or recommendation of the product by the University of California or any United States Government agency to the exclusion of others that may be suitable.



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

August 26, 1982

Docket No. 50-219
LS05-82 -08-059

Mr. P. B. Fiedler
Vice President and Director - Oyster Creek
Oyster Creek Nuclear Generating Station
Post Office Box 388
Forked River, New Jersey 08731

Dear Mr. Fiedler:

SUBJECT: SEP TOPIC VIII-4, ELECTRICAL PENETRATIONS OF REACTOR
CONTAINMENT - OYSTER CREEK NUCLEAR GENERATING STATION

The staff's final safety evaluation report (SER) on this topic for your plant is enclosed. The enclosure supercedes the staff concerns expressed in our March 26, 1981 letter from D. Crutchfield to I. R. Finfrock. Our evaluation is based on our contractor's technical evaluation provided in a July 3, 1980 letter from D. Crutchfield to I. R. Finfrock, which remains unchanged, and additional information provided in an August 2, 1982 letter from P. B. Fiedler to D. M. Crutchfield.

The enclosed SER provides the bases for the staff's position with regard to the acceptability of the electrical penetrations for your facility. The staff has concluded that your commitments to assure that your facility meets current licensing criteria is an acceptable basis for considering this topic complete.

Sincerely,

Dennis M. Crutchfield
Dennis M. Crutchfield, Chief
Operating Reactors Branch No. 5
Division of Licensing

Enclosure:
As stated

cc w/enclosure:
See next page

*PDR
8209070155*

Mr. P. B. Fiedler

cc
G. F. Trowbridge, Esquire
Shaw, Pittman, Potts and Trowbridge
1800 M Street, N. W.
Washington, D. C. 20036

Resident Inspector
c/o U. S. NRC
Post Office Box 445
Forked River, New Jersey 08731

J. B. Lieberman, Esquire
Berlack, Israels & Lieberman
26 Broadway
New York, New York 10004

Commissioner
New Jersey Department of Energy
101 Commerce Street
Newark, New Jersey 07102

Ronald C. Haynes, Regional Administrator
Nuclear Regulatory Commission, Region I
631 Park Avenue
King of Prussia, Pennsylvania 19406

J. Knubel
BWR Licensing Manager
GPU Nuclear
100 Interplace Parkway
Parsippany, New Jersey 07054

Deputy Attorney General
State of New Jersey
Department of Law and Public Safety
36 West State Street - CN 112
Trenton, New Jersey 08625

Mayor
Lacey Township
818 Lacey Road
Forked River, New Jersey 08731

U. S. Environmental Protection
Agency
Region II Office
ATTN: Regional Radiation Representative
26 Federal Plaza
New York, New York 10007

Licensing Supervisor
Oyster Creek Nuclear Generating Station
Post Office Box 388
Forked River, New Jersey 08731

SYSTEMATIC EVALUATION PROGRAM
TOPIC VIII-4
OYSTER CREEK NUCLEAR GENERATING STATION

TOPIC: VIII-4, Electrical Penetrations of Reactor Containment

I. INTRODUCTION

The safety objective of Topic VIII-4, "Electrical Penetrations of Reactor Containment," is to assure that all electrical penetrations in the containment structure are designed not to fail from electrical faults during a high energy line break.

As part of the Systematic Evaluation Program (SEP) the NRC staff performed an audit, comparing sample containment electrical penetrations in SEP facilities with current licensing criteria for protection against fault and overload currents following a postulated accident.

II. REVIEW CRITERIA

The review criteria are presented in Section 2.0 in an EG&G Report titled, "Electrical Penetrations of the Reactor Containment." In addition, in licensing new plants, the staff requires compliance with the recommendations of Regulatory Guide 1.63 or an acceptable alternative method.

For each containment electrical penetration, the protective systems should provide primary and backup circuit protection devices to prevent a single failure in conjunction with a circuit overload from impairing containment integrity. The primary and backup protection devices must have trip time vs. current response characteristics which assure protection against penetration failure. The protection devices are to be periodically tested to verify trip setpoints and adequacy of response.

No single failure should allow excessive currents in the penetration conductors that will degrade the penetration seals. Where external control power is used for actuating the protection systems the power for primary and backup breakers should be derived from separate sources, Overcurrent signals for tripping primary and backup system devices should be electrically independent and physically separated.

III. RELATED SAFETY TOPICS AND INTERFACES

The scope of review for this topic was limited to avoid duplication of effort since some aspects of the review were performed under the related Topic III-12, "Environmental Qualification." The related topic report contains the acceptance criteria and review guidance for its subject matter.

Theoretically, there are no safety topics that are dependent on the present topic information for their completion, however, the results of the present topic have a definite impact upon the capability of equipment inside of containment to function after a high energy line break.

IV. REVIEW GUIDELINES

The review guidelines are presented in Section 3.0 of the EG&G Report titled, "Electrical Penetrations of the Reactor Containmentment.

V. EVALUATION

The EG&G Report on this topic states that with a LOCA environment inside containment, the protection for some low voltage and medium voltage penetrations do not conform to the current licensing criteria. However, the licensee has provided additional information in their August 2, 1982 submittal.

The August 2, 1982, letter provides an analysis of the differential protection for the motor generator/pump circuit that is similar to that presented on Millstone 1. This analysis is based, in part, on a generator impedance that is too high to support currents large enough for a sufficient time to damage the penetration.

The licensee also agreed to review the backup protection for the low voltage penetrations and to install new or additional protective devices as needed to satisfy the staff position. Their evaluation is to be completed by December 1982.

VI. CONCLUSION

As a result of our review we have concluded that a suitable program is in place to assure that the low voltage penetrations conform to the current licensing criteria. We also have concluded that the present design of the medium voltage penetrations is acceptable.



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

W. Russell

Docket No. 50-219
LS05-81-03-069

MAR 26 1981

Mr. I. R. Finfrock, Jr.
Vice President - Generation
Jersey Central Power & Light Company
Madison Avenue at Punch Bowl Road
Morristown, New Jersey 07960

Dear Mr. Finfrock:

SUBJECT: SEP TOPIC VIII-4, ELECTRICAL PENETRATIONS OF REACTOR
CONTAINMENT (OYSTER CREEK)

Draft Technical Evaluation Reports (TER) on Topic VIII-4 have been prepared and forwarded to all SEP Licensees for comment. Comments from some licensees (e.g., Northeast Utilities letters dated August 29, 1980 and January 29, 1981) indicated a concern with the model used and assumptions made in the initial conditions and material properties. Unfortunately, most respondents have not provided sufficient technical information nor detailed schematics to support their comments.

Our audit calculations failed to establish that the fault current protection for containment electrical penetrations in SEP facilities is generally adequate. This does not necessarily mean that the protection is inadequate. Our calculations were simplified and conservative so that there is room to improve the result by using more realistic models. In addition, licensee comments have indicated that there may be some errors in our calculations. Nevertheless, our audit did not put the matter to rest and, thus, you are requested to evaluate the adequacy of all electrical penetrations in your facility in accordance with the enclosed position.

Generally, where needed, our position calls for more realistic calculations than were used in our audit. In relation to current licensing criteria, it provides relief from the need for redundant circuit protective devices in certain instances and specifically provides for using fuses as an alternative to circuit breakers. Other straightforward alternatives such as deenergizing circuits are also provided for.

If any instances arise where your calculations cannot demonstrate circuit protection in accordance with our position, you are requested to inform us of your intended corrective actions.

PDR
8/16/81

MAR 26 1981

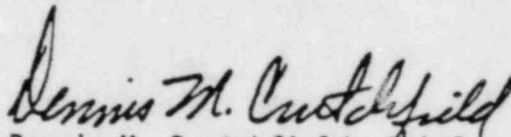
In order to complete our review of Topic VIII-4, please provide a report describing the calculations performed and criteria used for evaluating the penetrations for the specific circuits identified in the staff's previous report within 45 days of receipt of this letter.

The report as a minimum should address the following items:

1. Backup protection for penetrations like #11.
2. Circuit design and theory of operation for differential current protection of pump motor circuits for
 - (a) Motor Faults
 - (b) Conductor Faults at the penetration (single phase and bolted faults).
3. An analysis of how the design of the line relay and differential protection satisfies the single failure criterion for all faults.

The requested information will be used to revise our topic Safety Evaluation Report and will be used in the preparation of the integrated assessment for your plant.

Sincerely,



Dennis M. Crutchfield, Chief
Operating Reactors Branch No. 5
Division of Licensing

Enclosure:
As stated

cc w/enclosure:
See next page

Mr. I. R. Finrock, Jr.

cc

G. F. Trowbridge, Esquire
Shaw, Pittman, Potts and Trowbridge
1800 M Street, N. W.
Washington, D. C. 20036

GPU Service Corporation
ATTN: Mr. E. G. Wallace
Licensing Manager
260 Cherry Hill Road
Parsippany, New Jersey 07054

Natural Resources Defense Council
917 15th Street, N. W.
Washington, D. C. 20006

Steven P. Russo, Esquire
248 Washington Street
P. O. Box 1060
Toms River, New Jersey 08753

Joseph W. Ferraro, Jr., Esquire
Deputy Attorney General
State of New Jersey
Department of Law and Public Safety
1100 Raymond Boulevard
Newark, New Jersey 07012

Ocean County Library
Brick Township Branch
401 Chambers Bridge Road
Brick Town, New Jersey 08723

Mayor
Lacey Township
P. O. Box 475
Forked River, New Jersey 08731

Commissioner
Department of Public Utilities
State of New Jersey
101 Commerce Street
Newark, New Jersey 07102

Gene Fisher
Bureau Chief
Bureau of Radiation Protection
380 Scotts Road
Trenton, New Jersey 08628

Commissioner
New Jersey Department of Energy
101 Commerce Street
Newark, New Jersey 07102

Plant Superintendent
Oyster Creek Nuclear Generating
Station
P. O. Box 388
Forked River, New Jersey 08731

Resident Inspector
c/o U. S. NRC
P. O. Box 445
Forked River, New Jersey 08731

Director, Criteria and Standards
Division
Office of Radiation Programs
(ANR-460)
U. S. Environmental Protection
Agency
Washington, D. C. 20460

U. S. Environmental Protection
Agency
Region II Office
ATTN: EIS COORDINATOR
25 Federal Plaza
New York, New York 10007

ENCLOSURE

POSITION ON PROTECTION OF CONTAINMENT ELECTRICAL PENETRATIONS AGAINST FAILURES CAUSED BY FAULT AND OVERLOAD CURRENTS FOR SEP PLANTS

Introduction

As part of the Systematic Evaluation Program (SEP) the NRC staff performed an audit, comparing sample containment electrical penetrations in SEP facilities with current licensing criteria for protection against fault and overload currents following a postulated accident. The simplified and conservative model used did not show that the SEP facilities meet current licensing criteria nor did it show the existing circuit protection to be adequate. Accordingly, the SEP licensees are requested to demonstrate, using more realistic calculations where necessary, that the circuit protection is adequate in accordance with the position described below.

Background

In licensing new plants, the staff requires compliance with the recommendations of Regulatory Guide 1.63 or an acceptable alternative method.

For each containment electrical penetration, the protective systems provide primary and backup circuit protection devices to prevent a single failure in conjunction with a circuit overload from impairing containment integrity. The primary and backup protection devices have trip time vs. current response characteristics which assure protection against penetration failure. The protection devices are periodically tested to verify trip setpoints and adequacy of response.

No single failure allows excessive currents in the penetration conductors which will degrade the penetration seals. Where external control power is used for actuating the protection systems the power for primary and backup breakers are derived from separate sources. Overcurrent signals for tripping primary and backup system devices are electrically independent and physically separated.

Staff Audit

The safety objective of SEP Topic VIII-4, "Electrical Penetrations of Reactor Containment," is to assure that all electrical penetrations in the containment structure are designed not to fail from electrical faults during a high energy line break (LOCA or secondary system line break).

We have performed preliminary evaluations, on a conservative basis, of the fault current protection for three sample containment electrical penetrations for each of the eleven SEP plants. The entire penetration was assumed to be initially at the peak calculated LOCA temperature. Then, for a given fault current, the time to heat the wire to the limiting material temperature (usually the melting point of the seal material) was calculated. This time was compared to the time for the protective device(s) to interrupt the fault current.

On this basis, several penetrations exceed limiting temperatures if the primary protection device fails. Others do so without postulating primary device failure. Two of the sample penetrations even have melting temperatures less than the peak LOCA temperature and thus exceed the limits of this model even if there is no fault current. (References 1 through 11)

This does not necessarily mean that the penetrations would actually fail.

The analysis was conservative, particularly in assuming that the penetration was initially at the peak calculated containment temperature. The penetrations would not reach such a temperature following an accident. In addition, licensee comments have indicated that there may be some errors in the calculations. (For example, Northeast Utilities letter dated August 29, 1980, Docket No. 50-245, providing comments on the staff calculations for Millstone, Unit 1). Nevertheless, this audit clearly did not put the matter to rest.

Position

Each SEP licensee is requested to evaluate the adequacy of the existing fault current protection for containment electrical penetrations in accordance with the position discussed in more detail below and to propose remedies where needed in order to meet the position.

1. The basic requirement of Regulatory Guide 1.63 that all penetration circuits, Class IE or non-Class IE, be provided with overcurrent protection in conformance with the redundancy and testability requirements of IEEE Std 279-1971 should be met;
2. A single circuit breaker to protect a penetration serving a Class IE circuit or a non-safety circuit containing only components that are qualified to Class IE requirements is acceptable provided that each component of such circuit is qualified to the accident environment;
3. A circuit whose loads inside containment are not required to mitigate the consequences of accidents may be automatically disconnected from its power source on receipt of an accident signal or it may be maintained deenergized by positive means such as those outlined in Branch Technical Position ICSB 18 (PSB) of Appendix 8A to the Standard Review Plan whenever containment integrity is required.

Notes

For the purpose of evaluating the adequacy of protection for containment protection, faults should be postulated up to a bolted cable fault inside containment at the penetration (a bolted three phase fault for three phase circuits). The primary protection device should have a trip time vs. current response characteristic that assures against penetration failure under all fault conditions.

Circuit breakers should be tested periodically to verify their trip setting value and response time. Breakers should be designed to interrupt the maximum possible fault current for the circuit or backup protection fast response current limiting fuses should be provided.

In addition, fuses may be used in lieu of circuit breakers as protective devices. Where fuses are used, documentation of their response characteristics derived from production testing should be available for audit.

It is acceptable to use less conservative models than were used in our preliminary evaluations provided that they address fault currents up to bolted faults and still provide reasonable assurance that the penetration will not fail. For example, a more realistic initial temperature of the containment penetration could be determined rather than assuming the penetration has reached the peak calculated containment atmosphere temperature.

Circuits may be modified to reduce the short circuit current to acceptable values by the use of current limiting devices (such as resistors, isolation transformers, and changing transformer taps) external to the containment.