

Enclosure

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TECHNICAL EVALUATION REPORT
THREE MILE ISLAND 1
EVALUATION OF REVISED TMI-1 RESPONSE TO GL 81-12
ALTERNATE SAFE SHUTDOWN CAPABILITY

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1.0 INTRODUCTION

By two letters, both dated February 10, 1987, GPU Nuclear (GPUN) Corporation, the licensee for Three Mile Island Generating Station, Unit 1 (TMI-1) submitted a revised response to Generic Letter 81-12 as clarified by NRC letter dated May 10, 1982. The licensee committed to a revision of the fire emergency procedure requiring the dispatch of operators to implement manual actions to achieve safe shutdown in certain fire areas or zones. In a letter to the licensee dated September 7, 1988, the NRC requested additional information to complete the review of the February 10, 1987 letters. The licensee responded by letter dated November 14, 1988 to each of the five issues in the Request for Additional Information (RAI). A meeting was held on March 22, 1989 between GPUN and the NRC to discuss questions concerning the TMI-1 response to GL 81-12. During this meeting, all but two open questions were resolved and the licensee provided responses to the NRC regarding these remaining two open items in GPUN letter C311-89-2068 dated June 19, 1989.

This evaluation provides a review of the original submittal and of the licensee's response to issues of concern with regard to the requirements of Generic Letter 81-12.

1.1 Background

The information required by GL 81-12 as clarified by NRC letter of May 10, 1982 is comprised of ten areas, identified as 1a through 1j, for which a response is needed to support alternative shutdown capability as it is discussed in Section III.G.3 of 10 CFR 50 Appendix R. The licensee is required to identify those areas in the plant where alternative shutdown capability (ASC) will be necessary and then provide the following abbreviated list of information for the identified areas:

- 1a. list of systems or portions of systems for ASC.
- 1b. list equipment, components, circuit functions of normal shutdown systems and for ASC along with ASC component/circuit location.
- 1c. provide drawings of ASC piping and electrical connections to normal shutdown systems and breaker/isolation device locations.
- 1d. verify that ASC changes/modifications do not degrade safety systems.
- 1e. verify development of appropriate ASC initiation procedures.
- 1f. verify adequate manpower to follow ASC procedures and fulfill fire brigade requirements.
- 1g. provide commitment to perform adequate ASC acceptance tests.
- 1h. provide technical specifications and limiting conditions of operation for any equipment needed for ASC that is not already covered by such documents.
- 1i. confirm functional adequacy of any new equipment relied upon for ASC.
- 1j. verify and provide summaries of repair procedures and onsite material inventories for cold shutdown systems.

In the February 10, 1987 submittals, the licensee responded to each of the aforementioned requirements for information. Some of the responses referenced the TMI-1 FHAR, emergency procedures, or other previous submittals.

2.0 EVALUATION

The TMI-1 submittal of February 10, 1987 generated a number of concerns which were transmitted to the licensee as an RAI dated September 7, 1988. These concerns, the licensee's response and the subsequent evaluation are addressed in the following sections of this report. Several concerns raised during the initial evaluation were also being investigated by a parallel NRC Electrical Systems Branch review. These concerns are identified at the end of this TER and will ultimately be resolved by the Electrical Systems Branch.

2.1 List of systems or portions of systems for ASC

As required by item 1a. of GL 81-12, the licensee provided a list of all systems and portions of systems which are necessary for remote shutdown capability. This list is comprised of 16 systems and/or subsystems and applies to all remote shutdown fire areas. The licensee has met this requirement, item 1a, for GL 81-12.

2.2 ASC equipment, component, and circuit function list and location

GPUN letter 5211-87-2028 responded to this item in its Table 2 which lists, by system, the location and identification of equipment, power source, isolation switch, control switch, and cables required for ASC. This table also cross-references this information by fire area. The Fire Hazards Analysis Report for TMI-1 includes attachments which provide detailed descriptions of ASC components, equipment location, and circuit routings as well as the function of circuits for normal and remote shutdown systems. This submittal fulfills item 1b. of GL 81-12.

2.3 ASC piping-electrical connection drawings and breaker/isolation device location

The licensee provided instrument loop and elementary diagrams of the remote shutdown systems. Component locations and required electrical power supplies are included in the TMI-1 FHAR drawings. GPUN letter 5211-87-2028 includes fire area locations of circuit breakers, isolation devices, and control switches for the remote shutdown systems. In addition, the FHAR includes logic diagrams of the shutdown mechanical systems. The aforementioned information acceptably meets the requirements for item 1c. of GL 81-12.

2.4 Verification that ASC related safety system changes do not degrade the existing safety systems

The licensee has stated that the only safety system changes which could potentially degrade existing safety system functions are the addition of ASC related circuit isolation devices. These devices are new class 1E qualified and designed into the system so as not to degrade the existing safety functions. Administrative procedures and keylock controls are in place to prevent accidental interface or effect upon the plant safety function. The licensee has adequately addressed the issue of potential safety system degradation, item 1d., in GL 81-12.

2.5 ASC initiation procedures and operator action summary

The licensee provided two procedures, EP 1202-37, "Cooldown From Outside the Control Room" and EP 1202-31, "Fire" which describe the procedures and operator actions for alternate shutdown. Procedure EP 1202-31 delineates detailed operator instructions for detecting a fire and specific actions for a fire in each fire area or zone. Procedure EP 1202-37 provides instructions to the operators in the event of fire or smoke damage disabling plant control in the control room. Both immediate and follow up actions are described in detail. These procedures have been reviewed and the reviewer has concluded that these two procedures both address the use of alternative shutdown capability in the case of postulated fires in different fire areas or zones of the plant which incapacitate the normal shutdown systems. Therefore, the licensee has satisfactorily complied with the requirements of item 1e. of GL 81-12.

2.6 Adequacy of manpower for ASC procedures and fire brigade

In the licensee's submittal letter 5211-87-2028, it was asserted that walkdowns have confirmed that available manpower within the limitations of the Technical Specifications is sufficient for ASC which is based upon the availability of five operators. The Technical Specifications also require a fire brigade independent of the operators. On the basis that a realistic walkdown has been conducted, requirement item 1f. of GL 81-12 has been satisfied.

2.7 Commitment to perform an adequate acceptance test of alternate shutdown capability

This subject, item 1g. of GL 81-12, is discussed in detail in section 2.13.

2.8 ASC equipment Technical Specifications and Limiting Conditions of Operation

The licensee proposed Technical Specifications for ASC equipment by letter dated January 29, 1987. Although item 1h of GL 81-12 indicates that Technical Specifications are needed for ASC equipment, GL 86-10 dated April 24, 1986 implies that ASC Surveillance and Limiting Conditions for Operation requirements should be incorporated into the next FSAR along with all other elements of the fire protection program. It was on this basis that the NRC staff requested the licensee to withdraw its amendment request. Subsequently, on August 2, 1988, the staff issued GL 88-12 clarifying its positions in GL 86-10 and specifically requiring licensees to retain any Technical Specifications relating to the safe shutdown capability following a fire. Therefore, the licensee is hereby requested to resubmit proposed Technical Specifications consistent with the future revision to the B&W Standard Technical Specifications once approved by the staff.

2.9 Functional adequacy of new ASC equipment

In letter 5211-87-2028, the licensee has stated that the only new components for ASC are circuit isolation and control devices. Their operation is confirmed during startup and test activities as well as during the integrated test which was performed on March 22, 1987 and is further discussed in Section 2.13 of this report. On this basis, the licensee's submittal, item 11. of GL 81-12 has been satisfied.

2.10 Cold shutdown system repair procedures and onsite material storage

The licensee provided procedure 1420-Y-30, "Repair of Appendix R Cold Shutdown Circuits" and a list of materials which will be stored in a controlled manner onsite which would be needed to effect these repairs. The procedure describes a detailed step-by-step repair of each specific circuit needed to enable cold shutdown. Repair materials and tools are also listed for each circuit as well as drawings indicating cable routing and location. In addition, GPUN letter 5211-87-2028 includes attached Table 5 which delineates materials and tools stored onsite for cold shutdown circuit repair. Based on the aforementioned information, the licensee has met the requirements of item 1j. of GL 81-12.

2.11 Manual Actions

2.11.1 Discussion

The licensee initially identified three fire areas where alternate shutdown capability is needed to achieve safe shutdown. These three areas are: CB-FA-3c (ESAS Room), CB-FA-3d (Relay Room), and CB-FA-4b (Control Room). The alternative shutdown capability for these three rooms, in the form of a remote shutdown system, is located outside the relay room (CB-FA-3d) and Control Room (CB-FA-4b). A list of 16 systems was provided for the three areas which provide the shutdown capability. For each of these systems, a table of components and equipment of the normal shutdown systems, fire disabling areas, remote shutdown system equipment, location of circuit isolating devices, control devices, process monitoring instrument indication, and power supply sources was developed by the licensee. Attachment 3-6 of the TMI-1 Fire Hazards Analysis Report (FHDR) presents the location of the shutdown equipment and the circuit routings. The licensee verified adequate separation of remote shutdown equipment and/or circuits from the remote shutdown fire areas.

A number of valves requiring manual actions were identified for a fire in the three aforementioned areas. In most cases, the time required for these manual actions is two hours or greater. However, three actions are identified as being required in 30 or 45 minutes. Two of these actions, closing valve DH-V-5A and opening valve IC-V-3 are required within 45 and 30 minutes, respectively for a fire in area CB-FA-3c. A concern was raised to the licensee regarding these two manual actions since they must be performed in two different buildings (Control Building and Auxiliary Building) and two different elevations (322' and 281'). The licensee was asked to provide a manpower-time study to show that sufficient manpower is available to perform these two manual actions within the required time limit. The licensee's response of November 14, 1988 was to cite a presentation made to the NRC on February 5, 1987. This presentation provided the results of an actual test of operator manual action timing for a fire in either fire zone FH-FZ-1 or FH-FZ-5. In both cases, all manual actions were completed in less than seven minutes. The NRC accepted these manual actions and an exemption was granted to the technical requirements of 10 CFR 50 Appendix R Section III.G.2 in a letter to the licensee dated March 19, 1987. The licensee asserts that the number and location of manual actions required for these two fire areas constitute a more time consuming scenario than that required for CB-FA-3c.

2.11.2 Evaluation

A fire in Fire Area CB-FA-3c may require the operator to leave the control room and perform manual operations in two different rooms at Elevation 322' and Auxiliary Building Elevation 281' within 30 and 45 minutes respectively. These operations are necessary to ensure alternate shutdown capability. The licensee has demonstrated that a fire in either FH-FZ-1 or FH-FZ-5 requiring more manual actions at three different rooms and elevations and including a more time consuming task of manually operating a handwheel required less than seven minutes in an actual test. These results and the reliance on manual actions was accepted by the NRC in a letter dated March 19, 1987. The important factors in this evaluation are: test of manual action time for a fire in FH-FZ-1/FH-FZ-5, the large margin in time between that required and actually needed to complete these manual actions, and the determination that a fire in CB-FA-3c would require fewer and less time consuming manual actions in 30/45 minutes. Based on the aforementioned factors, the licensee's response to this concern is judged to be acceptable and this issue is resolved.

2.12 Fire Hazards Analysis Report (FHAR) and Procedures

2.12.1 Discussion

The licensee's submittal refers to portions of the FHAR and Emergency Procedure (EP) 1202-31 and 1202-37 in their response to GL 81-12. At the time of the submittal, February 10, 1987, the licensee referred to Revision 7 of the TMI-1 FHAR and revision 26 of EP 1202-31. Subsequent revisions have been made and a concern was raised as to the effect of these revisions on the submittal. The licensee's response indicated that the FHAR is currently up to Revision 10 and EP 1202-31 is at Revision 34 while EP 1202-37 is at Revision 36. A discussion of these revisions was provided in their response. The effect of these revisions on the GL 81-12 submittal, after taking into account those changes accepted by the NRC in a letter dated September 7, 1988, fall into one of three categories: addition of a fourth area requiring alternate shutdown, instrumentation change due to upgrade modifications, and typographical errors.

Health Physics and Lab Area (CB-FA-1) has been identified as a fourth area where alternate shutdown capability is required for achieving safe shutdown. This change has been reflected in the FHAR and appropriate procedures and approved by the NRC. Instrumentation upgrade modifications have resulted in changes to the table of remote shutdown system components. A number of typographical errors were discovered and corrected regarding switch numbers and component designation. Finally, plant modifications have resulted in the deletion of some drawings which no longer apply to TMI-1.

Another issue was raised regarding EP 1202-37 Revision 28 and the interpretation of a sustained loss of seal injection. No clear definition of time was presented with the term, "sustained". Also, the responsibility for deciding to trip the reactor coolant pumps (RCPs) was not delineated in this procedure. Finally, a concern was raised as to the physical indication that valve RC-V-1 had failed open in this procedure. The licensee has revised procedure EP 1202-37 to reflect recent remote shutdown panel modifications that preclude the need to identify a sustained loss of seal injection and trip the RCPs. The term, "sustained" was defined as immediate by the licensee and the responsibility for tripping the RCPs was assigned to either the Shift Supervisor or Shift Foreman in this response. It was also stated that valve RC-V-1 failing open would result in a rapid depressurization of the RCS. The licensee has committed to revise EP 1202-37 to provide specific guidance on the indication resulting from the valve RC-V-1 failing open.

2.12.2 Evaluation

The licensee identified any changes resulting from revisions to the TMI-1 FHAR and applicable procedures on the submittal in response to GL 81-12. All significant effects (fourth alternate shutdown area CB-FA-1, fire induced loss of HVAC, and the addition of the letdown line to the list of high-low pressure interfaces) have previously been reviewed and accepted by the NRC in a letter to the licensee dated September 7, 1988. The remaining changes are either typographical or reflect instrumentation upgrade modifications which do not impact the GL 81-12 submittal. Therefore, this concern has been adequately addressed by the licensee.

The issue regarding EP 1202-37 Revision 28 was addressed by the licensee in a later revision which eliminated the need to trip RCPs upon a sustained loss of seal injection since recent modifications to the remote shutdown system now ensure the ability to immediately restore seal injection. In addition, the licensee explained that the indication of a stuck open valve RC-V-1 would be evident to the operators by a rapid depressurization of the RCS. This concern regarding EP 1202-37 Revision 28 has been satisfactorily resolved by a revision to the procedure reflecting a remote shutdown upgrade and an explanation of the physical indication of valve RC-V-1 failing open. Although the method for indicating failed open valve RC-V-1 is found to be acceptable, the licensee was advised that more guidance should be provided to the operator. In GPUN letter C311-89-2068 dated June 19, 1989, the licensee has committed to include rapid RCS depressurization in Item 13.k of EP 1202-37 Revision 36 to ensure a clearer instruction. Based on the aforementioned licensee responses and commitments, this issue is judged to be acceptable and this issue is resolved.

2.13 Alternate Shutdown Capability Acceptance Test

2.13.1 Discussion

Item 8G of the licensee's February 10, 1987 submittal for GL 81-12 discussed the performance of an acceptance test for alternate shutdown capability some time in the future without a detailed test description, procedure, or schedule. In response to this concern, a test description was subsequently submitted in a letter dated February 19, 1987, of a test to be performed on March 22, 1987. This test was subsequently accepted by the NRC in Inspection Report 87-09 dated June 23, 1987. NRC inspectors reviewed the licensee's test procedure (TP 683/1, Revision 0) and witnessed the test concluding that all acceptance criteria and licensing commitments had been met and no unacceptable conditions had been identified.

2.13.2 Evaluation

Based on the development of an appropriate test procedure and completion of this acceptance test demonstrating alternate shutdown capability along with the acceptance of the procedure and test results by NRC inspectors, documented in Inspection Report 87-09, this concern has been adequately resolved by the licensee and item 1g. of GL 81-12 is satisfied

2.14 Overcurrent Protection

2.14.1 Discussion

The February 10, 1987 licensee submittal responding to GL 81-12 includes a reference to three other letters submitted by GPUN regarding the subject of fire induced cable failures resulting in misoperation or no operation of the alternative shutdown method. One of these letters, 5211-87-2013, dated January 26, 1987 discussed an overcurrent protection study performed for Train B of the IE buses. This letter then states that a similar study was not performed for Train A because, "... both trains were designed, installed and maintained to the same standards for identical loads." A concern was raised regarding whether the identical equipment (i.e. model, manufacturer, response characteristics, etc.) and same functions was in each train. Any such differences can have a significant effect on the results of an overcurrent protection study. In the November 14, 1988 response, the licensee stated that the two trains are made up of the same equipment including manufacturer, model, and rating and serve the same power demands. In addition, the licensee referenced GPUN letter 5211-87-2070, dated March 20, 1987 which provides the results of a comprehensive short circuit and coordination review of all TMI-1 buses.

2.14.2 Evaluation

After reviewing the November 14, 1988 licensee submittal and letter 5211-87-2070, dated March 20, 1987, it was concluded that GPUN had not adequately demonstrated that a separate overcurrent protection study of the A train is not necessary. The licensee characterization of the equipment of both trains as "similar with respect to model, manufacturer, and rating" is not the same as identical. Also, the system characteristics and response to fault and overcurrent conditions is described as "essentially" the same for both trains. The use of these terms in comparing the two trains indicates that there are differences in equipment and system design which could result in the unanalysed train having an unacceptable overcurrent protection ability. The March 20, 1987 letter indicated that, for the train analysed, short circuit levels could be as much as six per cent above the motor

control center bus bracing rating. Although, this six per cent appears to be acceptable, differences in the other train could result in an even higher short circuit current which may result in an unacceptable condition. In a November 14, 1988 response, the licensee stated that the two trains are made up of the same equipment including manufacturer, model, and rating and serve the same power demands. In addition, the licensee referenced GPUN letter 5211-87-2070, dated March 20, 1987 which provides the results of a comprehensive short circuit and coordination review of all TMI-1 buses. Based on the aforementioned licensee information, this concern has been resolved and this issue is accepted.

2.15 Other GL 81-12 Issues not Addressed by the Licensee

A number of issues important to fire protection, 10 CFR 50 Appendix R, and GL 81-12 which were not included in the licensee's submittals are delineated as follows:

1. manufacturer testing of interrupting devices.
2. periodic testing of relays and circuit breakers.
3. periodic moulded case circuit breaker exercises.
4. administrative controls for fuse replacement.
5. means to detect spurious operations other than alarm panel operation.
6. means to prevent fire propagation in common enclosures.

In GPUN letter C311-89-2068 dated June 19, 1989, the licensee responded to each of the above six areas of concern. In accordance with NRC guidance dated May 10, 1982, the licensee has considered manufacturer testing of all new interrupting devices installed for electrical isolation of alternate shutdown system associated circuits. The licensee also stated that existing surveillance procedures provide for periodic testing of relays, circuit breakers, and 480V molded case circuit breakers, whereas 120V molded case circuit breakers are not tested because they are considered to be highly reliable. Administrative controls for fuse replacement are being provided by a revisor to the licensee's Maintenance Procedure 1420-Y-13 "Troubleshoot and Repair of Control, Indication, Lighting, and Power Circuits" which will provide additional guidance to maintenance personnel regarding correct fuse replacement. The licensee stated that existing emergency procedures provide instructions for detecting spurious operations other than alarm panel indication. Finally, the licensee asserted that the FHAR delineated Appendix R design will not be subject to common enclosure fire propagation induced degradation of any Appendix R safe shutdown circuits. This response satisfies these concerns and resolves these issues.

3.0 CONCLUSIONS

The TMI-1 submittal of two letters dated February 10, 1987 in response to GL 81-12 was reviewed and a followup RAI sent to the licensee. The response to this RAI was letters from the licensee dated November 14, 1988 and June 19, 1989. Based on a review of these documents against the requirements of GL 81-12 as clarified by the NRC letter of May 10, 1982, the information provided was found to be in compliance with GL 81-12 with the following exception:

- o lack of Technical Specification Amendment covering alternate shutdown equipment LCOs as required by item 1h of GL 81-12 and GL 88-12.

In addition, the following items remain open pending their resolution by a separate Electrical Systems Branch review:

- o The statistical sampling review of overcurrent protection discussed on page 5 of GPUN letter 5211-86-2124 is not in compliance with Generic Letter 81-12. A 100% review of associated circuits overcurrent protection is required.
- o Regarding GPUN letter 5211-86-2214, coordination of non-safety related interrupting devices is a requirement for demonstrating circuit protection.