
Safety Evaluation Report

related to the operation of
**Grand Gulf Nuclear Station,
Units 1 and 2**

Docket Nos. 50-416 and 50-417

Mississippi Power & Light Company
Middle South Energy, Inc.
South Mississippi Electric Power Association

**U.S. Nuclear Regulatory
Commission**

Office of Nuclear Reactor Regulation

October 1984



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ABSTRACT

This report supplements the Safety Evaluation Report (NUREG-0831) issued in September 1981 by the Office of Nuclear Reactor Regulation of the U.S. Nuclear Regulatory Commission with respect to the application filed by Mississippi Power & Light (MP&L) Company, Middle South Energy, Inc., and South Mississippi Electric Power Association as applicants and owners, for licenses to operate the Grand Gulf Nuclear Station, Units 1 and 2 (Docket Nos. 50-416 and 50-417, respectively). The facility is located on the east bank of the Mississippi River near Port Gibson in Claiborne County, Mississippi. This supplement provides information on the NRC staff's evaluation of requests for exemptions to NRC regulations pursuant to the Commission's direction in CLI-84-19, dated October 25, 1984.

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1 INTRODUCTION AND GENERAL DISCUSSION

1.1 Introduction

In September 1981, the U.S. Nuclear Regulatory Commission staff (hereinafter referred to as the Commission, NRC, or staff) issued its Safety Evaluation Report (NUREG-0831) regarding the application by the Mississippi Power & Light (MP&L) Company, Middle South Energy, Inc., and South Mississippi Electric Power Association (licensees, hereinafter collectively referred to as licensee) for licenses to operate the Grand Gulf Nuclear Station, Units 1 and 2 (hereinafter referred to as Grand Gulf), Docket Nos. 50-416 and 50-417. The Safety Evaluation Report (SER) was supplemented in December 1981 by Supplement 1, which documented the resolution of several outstanding issues in further support of the licensing activities. On June 15, 1982, the staff issued Supplement 2 to the Safety Evaluation Report (SSER 2) in which it addressed those outstanding items required to be resolved before a low-power license for Unit 1 was issued. In addition, on June 16, 1982, an operating license, NPF-13, was issued to allow Unit 1 to operate at power levels not to exceed 5% of rated power. In July 1982, the staff issued Supplement 3 to the Safety Evaluation Report (SSER 3) in which it addressed those issues remaining from previous supplements and the report of October 1981 from the Advisory Committee on Reactor Safeguards (ACRS). In May 1983, the staff issued Supplement 4 to the Safety Evaluation Report (SSER 4) that addressed primarily issues that required further evaluation before authorizing operation of Unit 1 above 5% of rated power. Supplement 5 to the Safety Evaluation Report (SSER 5) addressed the remaining issues from Supplement 4 that required further evaluation before authorizing operation of Unit 1 above 5% of rated power. Supplement 6 to the Safety Evaluation Report (SSER 6) addressed open items from previous supplements and resolution of problems in the Technical Specifications before authorizing operation of Unit 1 above 5% of rated power.

This report, Supplement 7 to the Safety Evaluation Report (SSER 7), documents the NRC staff's evaluation and findings for exemptions from regulatory requirements in Appendices A and J to 10 CFR 50 that were granted by an order (49 FR 35448) issued on the same day the Commission issued the amendment authorizing full-power operation for Grand Gulf Unit 1 (Amendment No. 13, to NPF-13, dated August 31, 1984). In CLI-84-19, the Commission directed the staff to issue a separate full-power license containing the same terms and conditions as Amendment 13 that would supersede the amended low-power license. The Commission also directed the staff to incorporate into the new license the exemptions granted by the August 31, 1984, order so that the issuance of the separate license would supersede the order granting exemptions to Appendices A and J to 10 CFR 50. Accordingly, this supplement documents the NRC staff's evaluation and findings justifying the grant of these exemptions.

In addition, SSER 7 contains the NRC staff evaluation of Grand Gulf Unit 1 for compliance with Appendix H to 10 CFR 50. In the SER, dated September 1981, the staff determined that the granting of an exemption to Paragraph II.B of Appendix H was justified. This supplement evaluates Grand Gulf Unit 1 for compliance with the July 26, 1983, revision to Appendix H.

Each of the following sections of this supplement is numbered the same as the corresponding section of the SER and Supplements 1, 2, 3, 4, 5, and 6. Each section is supplementary to and not in lieu of the discussion in the SER and Supplements 1, 2, 3, 4, 5, and 6.

As a result of the staff's review and pursuant to the Commission's direction in CLI-84-19, the following will be incorporated into the full-power operating license for Grand Gulf:

	<u>Section</u>	<u>License Condition</u>
(1) Exemptions to Appendices A and J to 10 CFR 50	6.2.6 8.3.1	2.D

Copies of this supplement are available for public inspection at the Commission's Public Document Room at 1717 H Street, NW, Washington, D.C. and at the Hinds Junior College, George M. McLendon Library, Raymond, Mississippi 39154. Copies of this report also are available for purchase from the sources indicated on the inside front cover.

5 REACTOR COOLANT SYSTEM AND CONNECTED SYSTEMS

5.3 Reactor Vessel

5.3.1 Reactor Vessel Materials

Evaluation of Compliance with Appendix H, 10 CFR 50

In the SER, the staff determined that the requirements of Appendix H had been met except for the surveillance material requirement of paragraph II.B of Appendix H. Since publication of the SER, a revision to Appendix H became effective on July 26, 1983.

Paragraph II.B in the earlier version of Appendix H required that the surveillance material be determined based on the requirements of the 1973 edition of the American Society for Testing and Materials (ASTM) Standard E-185. The revised Appendix H requires that surveillance materials comply with the requirements of the edition of ASTM E-185 that was current on the issue date of the ASME Code to which the reactor vessel was purchased. Since the Grand Gulf Unit 1 reactor vessel was procured to an edition of the American Society of Mechanical Engineers (ASME) Code earlier than 1973, the revised Appendix H permits the surveillance program to comply with the 1970 edition of ASTM E-185. The materials placed in the surveillance capsules comply with the requirements of the 1970 edition of ASTM E-185. Thus, the staff concludes that the licensee complies with the revised Appendix H requirements for Grand Gulf Unit 1 and that an exemption from Appendix H is not required.

6 ENGINEERED SAFETY FEATURES

6.2 Containment Systems

6.2.6 Containment Leakage Testing

Testing of primary reactor containment leakage at Grand Gulf Unit 1 is required by Appendix J of 10 CFR 50 and by the plant's Technical Specifications. Paragraph III.D.2(b) of Appendix J details three explicit airlock testing requirements that are to be included in the Technical Specifications.

Paragraph III.D.2(b)(ii) of Appendix J requires that airlocks opened during periods when containment integrity is not required by the plant's Technical Specifications shall be tested at the end of such periods at not less than the peak containment internal accident pressure, P_a . Technical Specification

4.6.1.3.b.2 requires only that an overall airlock leakage test be conducted at P_a when maintenance has been performed on the airlock that could affect the airlock sealing capability. Thus, this specification does not comply fully with the testing specified in Appendix J.

The other two explicit airlock tests required by paragraph III.D.2(b) of Appendix J are met by the licensee. Paragraph III.D.2(b)(i) requires that containment airlocks be demonstrated operable by conducting a leak test every 6 months when containment integrity is required by pressurizing the interior of the airlock to P_a (the calculated peak containment internal pressure under design-basis accident conditions, 11.5 psig for Grand Gulf) and verifying the leakage rate is within its limit. Technical Specification 4.6.1.3.b.1 corresponds to and complies with this portion of Appendix J. Paragraph III.D.2(b)(iii) requires an airlock test within 3 days after the airlock has been opened (or at least once every 3 days for openings more frequently than every 3 days) and specifies that an airlock seal test fulfills the 3-day test requirements. Technical Specification 4.6.1.3.a corresponds to and complies with this portion of Appendix J.

By letters dated July 28 and August 7, 1984, the licensee requested an exemption from paragraph III.D.2.(b)(ii) of Appendix J for the operating term of the plant. The licensee provided information to support the request and concludes that it is advantageous to allow operation of the plant without performing the full-pressure test required by paragraph III.D.2(b)(ii) because the testing would extend the duration of plant outages by half a day or more several times a year.

The staff has evaluated the licensee's requested exemption from paragraph III.D.2(b)(ii). Whenever the plant is in cold shutdown (Mode 4) or refueling (Mode 5), containment integrity is not required. However, if an airlock is opened during Modes 4 and 5, paragraph III.D.2(b)(ii) of Appendix J requires that an overall airlock leakage test at not less than P_a be conducted before plant heatup and startup (i.e., entering Mode 3). The existing airlock doors

are so designed that a full-pressure test (i.e., P_a of 11.5 psig) of an entire airlock can be performed only after strong backs (structural bracing) have been installed on the inner door. Strong backs are needed because the pressure exerted on the inner door during the test is in a direction opposite to the accident pressure.

If the periodic 6-month test of paragraph III.D.2(b)(i) and the test required by paragraph III.D.2(b)(iii) are current, no maintenance has been performed on the airlock and the airlock is properly sealed, there should be no reason to expect the airlock to leak excessively just because it has been opened in Mode 4 or Mode 5.

However, the staff also concludes that to ensure the airlock is properly sealed, the licensee shall substitute a seal leakage test that satisfies the requirements of paragraph III.D.2(b)(iii) of Appendix J for the full-pressure test of paragraph III.D.2(b)(ii) before entering Mode 3 if the door has been opened while in Mode 4 or 5, provided no maintenance has been performed on an airlock that has been opened in Mode 4 or Mode 5. Whenever maintenance has been performed on an airlock, the requirements of paragraph III.D.2(b)(ii) shall be met by the licensee. Therefore, under the foregoing conditions, an exemption from the requirements of paragraph III.D.2(b)(ii) of Appendix J following normal door opening is justified and acceptable for Grand Gulf Unit 1.

Accordingly, the staff has determined that, pursuant to 10 CFR 50.12, the exemption is authorized by law, will not endanger life or property or the common defense and security, and is otherwise in the public interest. Therefore, the Commission should grant an exemption from the requirements of paragraph III.D.2(b)(ii), Appendix J, 10 CFR 50, for the containment airlock testing following normal door opening during periods when containment integrity is not required for the term of the operating license, provided that instead of the full-pressure test required by paragraph III.D.2(b)(ii), the licensee shall, before entering operating modes requiring containment integrity, perform a seal leakage test that satisfies the requirements of paragraph III.D.2(b)(iii), and provided that no maintenance has been performed on the airlock.

8 ELECTRIC POWER SYSTEMS

8.3 Onsite Emergency Power Systems

8.3.1 Alternating Current Power System

The requirements for the onsite electric power supply system are specified in General Design Criterion (GDC) 17 of Appendix A, 10 CFR 50, which requires, in part, that these systems shall have sufficient independence, redundancy, and testability to perform their safety function assuming a single failure. GDC 17 further requires that the onsite electric power systems, without benefit of the offsite system, provide sufficient capacity and capability to ensure that certain specified vital functions are maintained in the event of postulated accidents. The onsite power system at Grand Gulf includes three separate diesel generators designated as supplying power for Division 1, 2, and 3 emergency buses. Section 16.3.1 of Supplement 6 to the Safety Evaluation Report identified three components of the diesel engines at Grand Gulf Unit 1 that do not fully comply with the requirements of GDC 17. These are (1) the emergency override of the test mode for the Division 3 (high-pressure core spray (HPCS) system) diesel engine, (2) the second level of undervoltage protection for the Division 3 (HPCS) diesel engine, and (3) the generator ground overcurrent trip function for the Division 1 and 2 (standby) diesel generators. These will be discussed separately in the subsequent sections.

Division 3 (HPCS) Diesel Generator Test Mode Emergency Override

The diesel generator design is required to include an emergency override of the test mode to permit response to bona fide emergency signals and to return the control of the diesel generator to the emergency standby mode. The emergency override feature is required to ensure availability of the diesel generators should a loss-of-coolant accident (LOCA) signal occur during periodic testing. This has its basis in the requirements of GDC 17 for redundant available onsite emergency power sources for postulated accidents. The licensee did not provide this design feature on the Division 3 (HPCS) diesel generator. The licensee has committed to provide this design feature for the Division 3 diesel generator at the first refueling outage.

In the interim, by letters dated July 28 and August 2 and 7, 1984, the licensee requested a partial exemption from GDC 17 permitting it to defer meeting the reliability requirements for the Division 3 (HPCS) diesel generator test mode emergency override until startup following the first refueling outage. The licensee provided the following information to support the request.

The design of Division 3 does not incorporate the test mode emergency override feature. Division 3 is dedicated solely to the HPCS system, from which 90% of the load is consumed by the HPCS motor. In the event of an emergency core cooling system (ECCS) actuation signal coincident with a loss of the preferred power source, the Division 3 diesel generator would start and accelerate to rated voltage and frequency, tie to the bus, and accept the entire HPCS load at once

by block sequencing (the diesel generator would then be in isochronous mode). If the diesel generator were tied to the bus in parallel with the preferred source (droop mode) when these events occurred, the diesel generator would still respond as required.

The HPCS pump is a high-pressure system required for reactor coolant makeup for small-break LOCAs where reactor pressure is maintained. The licensee indicates in the submittals that substantial protective features currently exist for Division 3 diesel generator protection. The likelihood of a small-break LOCA coincident with loss of offsite power and failure of the Division 3 diesel generator because of a lack of these additional protective features during the first cycle of operation is extremely small. If the HPCS system should fail (due to a postulated single failure or a failure associated with a lack of the additional protective features), the reactor core isolation cooling (RCIC) system is available for such small breaks to provide high-pressure core makeup and, if necessary, the automatic depressurization system would reduce reactor pressure to allow the low-pressure ECCS to provide makeup. Therefore, the licensee concludes this exemption can be granted without endangering life and property.

The staff has evaluated the consequences of deferring the implementation of this design feature for the first operating cycle. The staff finds that the chance of a LOCA occurring with a loss of offsite power concurrent with a failure of one of the other diesel generators during the small time period of Division 3 (HPCS) diesel generator testing (a few days total) over the first operating cycle (18 months) is low. The staff thus concludes that the lack of the emergency override feature on the Division 3 (HPCS) diesel generator does not represent a significant hazard to the health and safety of the public over the first operating cycle. Therefore, until startup following the first refueling outage, the requested exemption from GDC 17 should be granted.

Division 3 (HPCS) Diesel Generator Undervoltage Protection

The Division 3 power supply that provides power for the HPCS system is required to have two levels of undervoltage protection similar to the Division 1 and 2 power supplies. The second level of undervoltage protection (degraded voltage) is to ensure protection against degraded offsite power to prevent damage to safety-related equipment and to ensure quality power by switching to diesel generators under degraded offsite power conditions. The basis for this level of undervoltage protection is derived from the requirement of GDC 17 that the onsite power systems have adequate capacity and capability to provide power for systems necessary to accommodate postulated events.

In the as-built design for the Division 3 bus, only one level of protection is provided (loss of voltage at 72%); degraded voltage protection is not provided. The licensee has committed to provide the second level undervoltage protection for Division 3 by the first refueling outage.

In the interim, by letters dated July 28 and August 2 and 7, 1984, the licensee requested a partial exemption from GDC 17 permitting it to defer meeting the reliability requirement for the Division 3 (HPCS) diesel generator undervoltage protection until startup following the first refueling outage. To support the request, the licensee states that, although Grand Gulf is equipped with a third

division of electrical power, Division 3 is dedicated to the HPCS system. The HPCS motor and all HPCS auxiliaries, except motor-operated valves (MOVs), have overcurrent protection that will prevent damage from persistent undervoltage. The MOVs have a minimum 75% voltage operating capability by design specification. Considering design margin that is typically included, the licensee believes with a high degree of confidence that MOV operation will occur in the 72 to 75% voltage range. The licensee further considers the likelihood of the undervoltage being between 72 and 75% for a period long enough to damage the valve motors to be extremely small.

The licensee states that the only other equipment connected to the Division 3 bus that will be adversely affected by undervoltage is the Division 3 battery charger, which is affected at less than 85% of nominal voltage. The Division 3 batteries will handle the direct current (dc) load for at least 4 hours, which the licensee believes will provide ample time to recognize undervoltage conditions.

The HPCS pump is a high-pressure system required for reactor coolant makeup for small-break LOCAs where reactor pressure is maintained. The licensee indicates in the submittals that substantial protective features currently exist for Division 3 diesel generator protection. In addition, the likelihood of a small-break LOCA coincident with loss of offsite power and failure of the Division 3 diesel generator because of a lack of these additional protective features during the first cycle of operation is extremely small. If the HPCS system should fail (as a result of postulated single failure or a failure associated with a lack of the additional protective features), the RCIC system is available for such small breaks to provide high-pressure core makeup and, if necessary, the automatic depressurization system would reduce reactor pressure to allow the low-pressure ECCS to provide makeup. Therefore, the licensee concludes this exemption can be granted without endangering life and property.

The staff has evaluated the consequences of deferring the implementation of this design feature for the first operating cycle. The staff finds that there is little likelihood of a degraded grid event requiring the HPCS concurrent with a single failure of one of the other diesel generators and a failure of the operator to take action to trip the offsite breaker to the HPCS bus manually (which allows the HPCS diesel generator to start and load) during the first operating cycle. The staff thus concludes that the lack of second level (degraded grid) undervoltage protection does not represent a significant hazard to the health and safety of the public over the first operating cycle. Therefore, until startup following the first refueling outage, the requested exemption from GDC 17 should be granted.

Standby Diesel Generator Trip Functions

All diesel generator protective trips are required to be bypassed except for diesel engine overspeed and generator differential current. Any other trips retained must use coincident logic to avoid spurious trips. The basis for this feature is derived from the GDC 17 requirement to minimize loss of emergency power concurrent with loss of offsite power. Bypassing diesel generator trips, which are comparatively of lesser importance than the functioning of the emergency power source under accident conditions, meets this requirement. The

Division 1 and 2 (standby) diesels at Grand Gulf do not have this design feature for generator ground overcurrent that either provides coincident logic or bypasses this trip under accident conditions.

The licensee has committed to implement this design change with regard to bypassing or providing coincident logic for the ground overcurrent generator trip. This commitment is to be completed before restart following the first refueling outage.

In the interim, by letters dated July 28 and August 2 and 7, 1984, the licensee requested a partial exemption from GDC 17 permitting it to defer meeting the reliability requirements for the Division 1 and 2 (standby) diesel generator trip functions until startup following the first refueling outage. To support the request, the licensee provided the following information.

The licensee states that the design of the Grand Gulf diesel generator trip system for Divisions 1 and 2 (standby) incorporates four trips that remain in effect during emergency operation. They are:

- (1) Engine overspeed--single channel trip
- (2) Generator differential--single channel trip
- (3) Generator ground overcurrent--single channel trip
- (4) Low lube oil pressure--two out of three logic

The licensee recognizes that the design for Division 1 and 2 diesel generators is not in compliance with the latest version of Regulatory Guide (RG) 1.9, which allows only engine overspeed and generator differential current trips. All other trips should be addressed in one of two ways: either (1) a trip should be implemented with two or more independent measurements for each trip parameter with coincident logic provisions for trip actuation, or (2) a trip should be bypassed under accident conditions. The Grand Gulf design for Division 1 and 2 diesel generators incorporates a generator ground overcurrent trip without coincident logic.

The licensee states that the ground overcurrent trip function responds to slowly developing, relatively low magnitude ground fault conditions, whereas the generator differential current trip function responds to fairly high levels of ground current within the differential protective zone. Outside the differential protective zone, ground relays associated with feeder breakers will actuate and isolate the ground overcurrent fault before the generator ground relay actuates. The emergency safety feature (ESF) 4160- to 480-V transformers are ΔY and therefore will not pass a low voltage ground fault (less than 5 kV) to the generator ground overcurrent protective system. The licensee considers the likelihood of a failure of the generator ground overcurrent trip function, which would cause a trip of the diesel generator when it is required, to be small. The licensee also states that the likelihood of such a trip coincident with a loss of offsite power and a LOCA during the first cycle of operation is extremely small. Therefore, the licensee believes this exemption can be granted without endangering life and property.

The staff has evaluated the consequences of deferring the implementation of this design feature for the first operating cycle. The staff finds that there is little likelihood of a LOCA coincident with the loss of offsite power and both Division 1 and 2 diesel generators to spurious trip on this trip function during the first operating cycle. The staff thus concludes that the lack of this feature on diesel generators for Divisions 1 and 2 does not represent a significant hazard to the health and safety of the public over the first operating cycle. Therefore, until startup following the first refueling outage, the requested exemption from GDC 17 should be granted.

The licensee considers the requested exemptions to GDC 17 to be in the public interest in that any delay in commencement of the power ascension program would cause a day-for-day delay in the attainment of commercial operation and that the health and safety of the public will be adequately protected. Grand Gulf Unit 1 is physically complete in all essential respects and is ready for power ascension to full power. Upon satisfactory completion of the power ascension program in accordance with the license and Technical Specifications, the licensee will place the facility in commercial operation. The requested exemption discussed above is for a limited period. The delay associated with implementing this design change now ranges from several weeks to several months. Thus, the licensee concludes that such delays are unwarranted inasmuch as the public health and safety are adequately protected.

The staff agrees that, because granting the exemptions will not endanger life or property or the common defense and security, the delays that would be encountered to meet the regulation at this time are unwarranted.

Accordingly, the staff has determined that, pursuant to 10 CFR 50.12, the exemptions are authorized by law, will not endanger life or property or the common defense and security and are otherwise in the public interest. Therefore, the Commission should grant until startup following the first refueling outage, a partial exemption from the requirements of GDC 17, Appendix A, 10 CFR 50, for the following:

- (1) emergency override of the test mode for the Division 3 (HPCS) diesel engine
- (2) second level undervoltage protection for the Division 3 (HPCS) diesel engine
- (3) generator ground overcurrent trip function for the Division 1 and 3 (standby) diesel generators

APPENDIX A

CONTINUATION OF CHRONOLOGY

Correspondence cited in this supplement was included in Appendix A of Supplement 6 to the SER (NUREG-0831).

APPENDIX F
NRC REVIEW TEAM

Mr. L. L. Kintner is the NRC Project Manager for this project. Mr. Kintner may be contacted at the U.S. Nuclear Regulatory Commission on 301/492-7038.

The principal NRC staff reviewers for this supplement are:

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