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INFORMAL REPORT

CONFORMANCE TO REGULATORY GUIDE 1.97, PEACH BOTTOM ATOMIC POWER STATION, UNIT NOS. 2 AND 3

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EG&G

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DISCLAIMER

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ABSTRACT

This EG&G Idaho, Inc., report provides a review of the submittals for Regulatory Guide 1.97, Revision 3, for the Peach Bottom Atomic Power Station, Unit Nos. 2 and 3. Any exception to the guidelines of Regulatory Guide 1.97 are evaluated and those areas where sufficient basis for acceptability is not provided are identified.

Docket Nos. 50-277 and 50-278
TAC Nos. 51117 and 51118

FOREWORD

This report is supplied as part of the "Program for Evaluating Licensee/ Applicant Conformance to RG 1.97," being conducted for the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Division of PWR Licensing-A, by EG&G Idaho, Inc., NRR and I&E Support Branch.

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CONFORMANCE TO REGULATORY GUIDE 1.97
PEACH BOTTOM ATOMIC POWER STATION, UNIT NOS. 2 AND 3

1. INTRODUCTION

On December 17, 1982, Generic Letter No. 82-33 (Reference 1) was issued by D. G. Eisenhut, Director of the Division of Licensing, Nuclear Reactor Regulation, to all licensees of operating reactors, applicants for operating licenses and holders of construction permits. This letter included additional clarification regarding Regulatory Guide 1.97, Revision 2 (Reference 2), relating to the requirements for emergency response capability. These requirements have been published as Supplement No. 1 to NUREG-0737, "TMI Action Plan Requirements" (Reference 3).

Philadelphia Electric Company, the licensee for the Peach Bottom Atomic Power Station, provided a response to Item 6 of the generic letter on January 16, 1984 (Reference 4). Additional information was provided on September 27, 1984 (Reference 5) and on August 5, 1985 (Reference 6). The licensee's submittals address Revision 3 of Regulatory Guide 1.97 (Reference 7).

This report provides an evaluation of this material.

2. REVIEW REQUIREMENTS

Section 6.2 of NUREG-0737, Supplement No. 1, sets forth the documentation to be submitted in a report to the NRC describing how the licensee complies with Regulatory Guide 1.97 as applied to emergency response facilities. The submittal should include documentation that provides the following information for each variable shown in the applicable table of Regulatory Guide 1.97.

1. Instrument range

2. Environmental qualification

3. Seismic qualification

4. Quality assurance

5. Redundance and sensor location

6. Power supply

7. Location of display

8. Schedule of installation or upgrade.

The submittal should identify deviations from the regulatory guide and provide supporting justification or alternatives.

Subsequent to the issuance of the generic letter, the NRC held regional meetings in February and March 1983, to answer licensee and applicant questions and concerns regarding the NRC policy on this subject. At these meetings, it was noted that the NRC review would only address exceptions taken to Regulatory Guide 1.97. Where licensees or applicants explicitly state that instrument systems conform to the regulatory guide,

it was noted that no further staff review would be necessary. Therefore, this report only addresses exceptions to Regulatory Guide 1.97. The following evaluation is an audit of the licensee's submittals based on the review policy described in the NRC regional meetings.

3. EVALUATION

The licensee provided a response to Item 6.2 of NRC Generic Letter 82-33 on January 16, 1984, on September 27, 1984 and on August 5, 1985. The responses describe the licensee's position on post-accident monitoring instrumentation. This evaluation is based on that material.

3.1 Adherence to Regulatory Guide 1.97

The licensee has provided a review of their post-accident monitoring instrumentation that compares the instrumentation characteristics against Regulatory Guide 1.97, Revision 3 (Reference 7). The licensee states that where the design deviates from the regulatory guide, new instrumentation will be installed or additional testing and analyses performed to justify the deviation. The licensee has identified that those modifications identified to bring about compliance with the regulatory guide will be complete by the Unit 2-1988 refueling outage and by the Unit 3-1987 refueling outage. Therefore, we conclude that the licensee has provided an explicit commitment on conformance to Regulatory Guide 1.97. Exceptions to and deviations from the regulatory guide are noted in Section 3.3.

3.2 Type A Variables

Regulatory Guide 1.97 does not specifically identify Type A variables, i.e., those variables that provide the information required to permit the control room operator to take specific manually controlled safety actions. The licensee classifies the following instrumentation as Type A.

1. Reactor pressure

2. Reactor water level

3. Suppression pool water temperature

4. Suppression pool water level

5. Drywell pressure

6. Containment oxygen concentration

The above variables meet Category 1 requirements consistent with the requirements for Type A variables.

3.3 Exceptions to Regulatory Guide 1.97

The licensee identified the following deviations and exceptions from Regulatory Guide 1.97. These are discussed in the following paragraphs.

3.3.1 Neutron Flux

Regulatory Guide 1.97 recommends the use of Category 1 instrumentation for this variable. The licensee has provided instrumentation for this variable, portions of which are Category 2. The licensee indicates that the following portions of the instrumentation are not Category 1: the source and intermediate range detectors drive mechanism and controls and the neutron monitoring system power sources.

The power source is the reactor protection system power supply. We find this power source acceptable.

The licensee indicates that the only event requiring the long term surveillance of neutron flux is an anticipated transient without scram (ATWS), and any decision to upgrade depends on the resolution of the ATWS issue. The licensee states that there are 4 source range monitors, 8 intermediate range monitors and 6 average power range monitors. As there is sufficient redundancy of instrumentation and there is less importance to safety for the ATWS issue, the licensee considers the Category 2 portions of this instrumentation acceptable until the ATWS rulemaking is complete.

However, neutron flux instrumentation is needed to mitigate any inadvertant boron dilution or other reactivity addition situation after an accident has occurred.

In the process of our review of neutron flux instrumentation for boiling water reactors (BWR), we note that the mechanical drives of the detectors have not satisfied the environmental qualification requirement of Regulatory Guide 1.97. A Category 1 system that meets all the criteria of Regulatory Guide 1.97 is an industry development item. Based on our review, we conclude that the existing instrumentation is acceptable for interim operation. The licensee should follow industry development of this equipment, evaluate newly developed equipment, and install Category 1 instrumentation when it becomes available.

3.3.2 RCS Soluble Boron Concentration

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of 0 to 1000 parts per million. The licensee has instrumentation with a range of 50 to 1100 parts per million.

The licensee takes exception to Regulatory Guide 1.97 with respect to post-accident sampling capability. This exception goes beyond the scope of this review and is being addressed by the NRC as part of the review of NUREG-0737, Item II.B.3.

3.3.3 Coolant Level in Reactor

Regulatory Guide 1.97 recommends Category 1 instrumentation for this variable with a range from the bottom of the core support plate to the lesser of the top of the vessel or the centerline of the main steamline. The licensee indicates that this range is equivalent to -331 to +114 inches. The licensee has two Category 1 instrument ranges that, overlapping, cover from -325 to 0 inches and -165 to +50 inches. Thus, the licensee's range deviates by 6 inches on the lower end of the recommended span and by 64 inches on the upper end.

The licensee justifies this deviation by quoting Section D of Revision 2 of Regulatory Guide 1.97, "plants currently operating should meet the provisions of this guide, except as modified by NUREG-0737." The licensee also states that the installed range is in compliance with NUREG-0737, Item II.F.2 in lieu of the regulatory guide recommendation.

This exception goes beyond the scope of this review and is being addressed by the NRC as part of their review of NUREG-0737, Item II.F.2.

3.3.4 Drywell Sump Level
Drywell Drains Sump Level

The licensee has provided Category 3 instrumentation for this variable that provides a high level alarm and flow from the sump drain. Regulatory Guide 1.97 requires Category 1 instrumentation with indication from the bottom to the top of the sump. The deviation for this variable is in the category of the supplied instrumentation and alarm and flow indication versus continuous level indication. This instrumentation does not cause any automatic or operator initiated safety-related functions. The sump systems are automatically isolated on an accident signal as part of containment isolation. This prevents the pump out of the sump contents.

The licensee indicates that the sump flow instrumentation is a primary method for determining the leakage rate resulting from identified and non-identified leakage in the primary containment. Also, an abnormal leakage rate, based on an abnormally high sump level, is alarmed in the control room.

We conclude that the alternate instrumentation supplied by the licensee will provide appropriate monitoring for the parameters of concern. This is based on (a) for small leaks, the alternate instrumentation is not expected to experience harsh environments during operation, (b) for larger leaks, the sumps fill promptly and the sump drain lines isolate due to the increase in drywell pressure, thus negating the drywell sump flow and drywell drain sumps flow instrumentation, and

(c) this instrumentation neither automatically initiates nor alerts the operator to initiate operation of a safety-related system in a post-accident situation. Therefore, we find the alternate Category 3 instrumentation provided acceptable.

3.3.5 Primary Containment Isolation Valve Position

Regulatory Guide 1.97 recommends Category 1 instrumentation for this variable. From the information provided, we find the licensee deviates from a strict interpretation of the Category 1 redundance recommendation. Only the active valves have position indication (i.e., check valves have no position indication). Since redundant isolation valves are provided, we find that redundant indication per valve is not intended by the regulatory guide. Position indication of check valves is specifically excluded by Table 2 of Regulatory Guide 1.97. The licensee states that manual valves do not need position indicators, as the valve position is controlled by written procedures. As these valves are pre-set to the appropriate position and would not be changed, we find the licensee's instrumentation acceptable in this regard.

Certain of the isolation valves associated with the transversing in-core probe system and with the control rod drive system are identified in Reference 5 as not being environmentally qualified. Reference 6 states that environmental qualification for this indication will be addressed to the requirements of the environmental qualification rule, 10 CFR 50.49. We conclude that this commitment is acceptable.

The indicating lamps are not seismically qualified. The licensee states that they could be qualified, either by analysis or by testing. The licensee states that lamps and lamp filaments in particular have an uncertain lifespan. Because of this, the operator is trained to replace these lamps if neither the open nor the closed lamp is lit. The licensee does not expect all lamps to fail following a seismic event.

In an accident situation, we find it impractical to expect the operator to have time to re-lamp those indicator bulbs damaged by a seismic event. Therefore, we find that the licensee should either qualify those existing bulbs for seismic events or replace the existing bulbs with bulbs that are seismically qualified.

3.3.6 Radiation Level in Circulating Primary Coolant

The licensee states that radiation level measurements to indicate fuel cladding failure are provided by the following instruments.

1. Condenser off-gas radiation monitors

2. Main steamline radiation monitors

3. Primary containment radiation monitors

4. Containment hydrogen concentration monitors

5. Post-accident sampling system

The post-accident sampling system is being reviewed by the NRC as part of their review of NUREG-0737, Item II.B.3.

Based on the alternate instrumentation provided by the licensee, we conclude that the instrumentation supplied for this variable is adequate and, therefore, acceptable.

3.3.7 Containment and Drywell Hydrogen Concentration

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of 0 to 30 percent. The licensee has supplied instrumentation for this variable; however, the range is limited to 20 percent.

The licensee states that the Peach Bottom containment is inerted and that post-accident combustible gas control is maintained by oxygen deficiency, and that the control of combustible gas concentrations in

containment is relatively insensitive to the rate or extent of hydrogen generation due to metal water reaction. Maintenance of containment gas concentrations below combustible limits is accomplished by the addition of nitrogen to limit oxygen concentrations to less than 5 percent. Indication of hydrogen concentration is used only to determine if a level of hydrogen exists within containment such that control of oxygen concentration is needed. The licensee concludes that this reduced range will not affect the ability of the hydrogen monitoring instrumentation to perform its intended function.

The licensee deviates from Regulatory Guide 1.97 with respect to hydrogen concentration instrumentation. This deviation goes beyond the scope of this review and has been addressed by the NRC as part of the review of NUREG-0737, Item II.F.1.6.

3.3.8 Containment Effluent Radioactivity--Noble Gases From Identified Release Points

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of 10^{-6} to 10^{-2} µCi/cc. The licensee has supplied instrumentation for this variable with overlapping ranges that cover from 10^{-5} to 1.4×10^{4} µCi/cc. The deviation identified by the licensee is that the range does not cover from 10^{-6} to 10^{-5} µCi/cc.

The licensee justifies this deviation, saying that the station background radiation is approximately 10^{-5} µCi/cc, and is greater than the low range recommended by the regulatory guide. Based on the licensee's justification, we find that the range supplied is adequate.

3.3.9 Effluent Radioactivity--Noble Gases from Buildings or Areas Which are in Direct Contact with Primary Containment Where Penetrations and Hatches are Located

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable. The licensee has supplied Category 3 instrumentation.

The licensee has identified the reactor building unit vent stacks as the only effluent under this heading. These vents are not used during an accident, as the effluent is routed via the standby gas treatment system to the off-gas stack. Based on this, we find that Category 3 instrumentation is acceptable.

3.3.10 Suppression Chamber Spray Flow
Drywell Spray Flow

Regulatory Guide 1.97 specifies Category 2 instrumentation for these variables with a range from 0 to 110 percent of design flow. These two sprays are not provided with dedicated flow measurement channels. Instead, a flow element common to these two sprays and the suppression pool cooling water line is used. Valve lineup, observable in the control room, for the suppression chamber spray, drywell spray and the suppression pool cooling water lines show which spray has the indicated flow. The licensee indicates that the effectiveness of these flows is indicated by pressure and temperature changes in the drywell and suppression chamber. We find that this instrumentation is acceptable for this variable.

3.3.11 Drywell Atmosphere Temperature

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of 40 to 440°F. Reference 4 identifies instrumentation for this variable with a range of -150 to 300°F stating that the range will be modified. Reference 6 states that the range will be as specified in Regulatory Guide 1.97. We find this commitment acceptable.

3.3.12 Standby Liquid Control System (SLCS) Flow

The licensee has elected not to implement this variable as recommended in Regulatory Guide 1.97. The justification given by the licensee is (a) the SLCS pump-discharge header pressure indication provides indication that the SLCS pump is operating, (b) the level indication in the sodium pentaborate solution storage tank gives indication that flow is occurring,

(c) the reactivity change in the reactor as measured by neutron flux is an indication of flow (d) the motor indicating lights and pump discharge pressure show system operation, and (e) the squib valve continuity indicating lights are an indication of flow. The above instrumentation and indicators are Category 2.

We find that the above indications are valid for an alternative SLCS flow indication.

3.3.13 Cooling Water Temperature to ESF System Components

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of 40 to 200°F. The licensee states that the emergency service water system is not a recirculating system, and that the cooling water is the river water. Therefore, the temperature indication is not needed. Furthermore, the equipment rooms and the diesel generator cooling jacket are monitored for temperature, and alarmed in the control room for high temperature. Additionally, the pump output pressure of the emergency service water system is monitored.

We find that the river water temperature is essentially constant. The temperature will be within the design limits of the emergency service water system. Using it for coolant, the diverse indication adequately monitors the operation of the emergency service water system.

3.3.14 Cooling Water Flow to ESF System Components

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of 0 to 110 percent of design flow. The licensee does not provide instrumentation that is a direct indication for this variable, relying instead on temperature indication and alarms for the rooms or equipment cooled. The output pressure of the emergency service water pumps is also available in the control room on Category 2 instrumentation.

We find that the provided diverse indication appropriately monitors the operation of the emergency service water system.

3.3.15 Reactor Building or Secondary Containment Area Radiation

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable with a range of 10^{-1} to 10^{4} R/hr for the Mark I containment. The licensee has one instrument with a range of 1 to 10^{6} mR/hr (10^{-3} to 10^{3} R/hr), and 22 instruments with a range of 0.01 to 10^{4} mR/hr (10^{-5} to 10 R/hr). All these instruments are Category 3 rather than the recommended Category 2.

The licensee reports that the use of local radiation exposure rate monitors to detect breach or leakage through primary containment penetrations results in ambiguous indications. This is due to the radioactivity in the primary containment, the radioactivity in the fluids flowing in emergency core coolant system piping and the amount and location of fluid and electrical penetrations. The licensee concludes that the use of the plant noble gas effluent monitors is the proper way to accomplish the purpose of this variable. Therefore, the licensee concludes that the existing Category 3 instrumentation for this variable is adequate.

The licensee has shown that the range requirement (10^{-1} to 10^{4} R/hr) is correlated to and satisfied by the plant noble gas effluent monitors. We conclude that the instrumentation provided by the licensee is acceptable.

3.3.16 Noble Gas and Vent Flow Rate--Common Plant Vent

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable with a range of 10^{-6} to 10^{+3} μCi/cc. The Peach Bottom units have two common plant vents, the unit vent stack and the off-gas stack. The unit vent stack, which is isolated from the reactor building on a high radiation signal, discharges the turbine building, recombiner building and

the radwaste buildings during and following an accident. The reactor building atmosphere is treated by the standby gas treatment system prior to discharge through the off-gas stack.

The licensee has Category 3 instrumentation for the unit vent stack. The justification is that post-accident releases from this stack are all from accessible areas that can be sampled to quantify any releases. Based on the above, we find that the deviation from Category 2 to Category 3 instrumentation for the unit vent stack is acceptable.

The licensee deviates for the off-gas stack in that the lower limit of the range is 10^{-5} µCi/cc instead of the recommended 10^{-6} µCi/cc. The licensee justifies this deviation by stating that the normal station radiation level is approximately 10^{-5} µCi/cc and is greater than the specified low range. Based on this, we find that the lower limit of the instrumentation range is acceptable.

3.3.17 Accident Sampling (Primary Coolant, Containment Air and Sump)

The licensee's post-accident sampling system provides the sampling and analysis of the recommended parameters but deviates in two areas. First, the range of the parameter boron content deviates from that recommended. Second, the sump is not sampled, but a representative sample from the suppression pool (the containment sumps overflow to the suppression pool) is used.

The licensee deviates from Regulatory Guide 1.97 with respect to post-accident sampling capability. This deviation goes beyond the scope of this review and is being addressed by the NRC as part of the review of NUREG-0737, Item II.B.3.

4. CONCLUSIONS

Based on our review, we find that the licensee either conforms to or is justified in deviating from Regulatory Guide 1.97, with the following exceptions:

1. Neutron flux--the licensee's present instrumentation is acceptable on an interim basis until Category 1 instrumentation is developed and installed. The licensee should commit to install Category 1 instrumentation for this variable when it becomes available (Section 3.3.1).

2. Primary containment isolation valve position--the licensee should provide seismic qualification for the indicating lamps used for this variable (Section 3.3.5).

5. REFERENCES

1. NRC letter, D. G. Eisenhut to All Licensees of Operating Reactors, Applicants for Operating Licenses, and Holders of Construction Permits, "Supplement No. 1 to NUREG-0737--Requirements for Emergency Response Capability (Generic Letter No. 82-33)," December 17, 1982.

2. Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident, Regulatory Guide 1.97, Revision 2, NRC, Office of Standards Development, December 1980.

3. Clarification of TMI Action Plan Requirements, Requirements for Emergency Response Capability, NUREG-0737, Supplement No. 1, NRC, Office of Nuclear Reactor Regulation, January 1983.

4. Philadelphia Electric Company letter, S. L. Daltroff to D. G. Eisenhut, NRC, "Implementation of NUREG-0737, Supplement 1, Regulatory Guide 1.97, Application to Emergency Response Facilities," January 16, 1984.

5. Philadelphia Electric Company letter, S. L. Daltroff to D. G. Eisenhut, NRC, "Implementation of NUREG-0737, Supplement 1, Regulatory Guide 1.97--Application to Emergency Response Facilities," September 27, 1984.

6. Philadelphia Electric Company letter, S. L. Daltroff to J. F. Stolz, NRC, "Emergency Response Capability, Conformance to Regulatory Guide 1.97, Rev. 3," August 5, 1985.

7. Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident, Regulatory Guide 1.97, Revision 3, NRC, Office of Nuclear Regulatory Research, May 1983.

8. NRC letter, J. F. Stolz to E. G. Bauer, Philadelphia Electric Company, "Post Accident Sampling," October 6, 1983.