CONFORMANCE TO REGULATORY GUIDE 1.97
NORTH ANNA POWER STATION, UNIT NOS. 1 AND 2

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ABSTRACT

This EG&G Idaho, Inc., report reviews the submittals for North Anna Power Station, Unit Nos. 1 and 2, and identifies areas of nonconformance to Regulatory Guide 1.97, Revision 3. Exceptions to these guidelines are evaluated and those areas where sufficient basis for acceptability is not provided are also identified.

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 Systems Integration, by EG&G Idaho, Inc., NRC Licensing Support Section.

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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 1 to NUREG-0737, "TMI Action Plan Requirements" (Reference 3).

The Virginia Electric and Power Company, the licensee for the North Anna Power Station, provided a response to Section 6.2 of Supplement 1 to NUREG-0737 on January 31, 1984 (Reference 4).

This interim report provides an evaluation of that submittal.

2. REVIEW REQUIREMENTS

Section 6.2 of NUREG-0737, Supplement 1, sets forth the documentation to be submitted in a report to the NRC describing how the licensee meets the guidance of 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.

Further, the submittal should identify deviations from the guidance in 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 matter. At these meetings, it was noted that the NRC review would only address exceptions taken to the guidance of Regulatory Guide 1.97. Further, where licensees or applicants explicitly state that instrument systems conform or will conform to the provisions of the guide it was noted that no further staff review would be

necessary. Therefore, this report only addresses exceptions to the guidance of 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 the information required by Section 6.2 of Supplement No. 1 to NUREG-0737. This evaluation is based on that submittal.

3.1 Adherence to Regulatory Guide 1.97

The licensee stated that the review of existing instrumentation at the North Anna Power Station showed which instrumentation meets the intent of Regulatory Guide 1.97, Revision 3 (Reference 5). Modifications are being implemented where the licensee feels necessary, and justification for exemptions were given where the licensee feels modifications are not nesessary. Therefore, it is concluded that the licensee has provided an explicit commitment on conformance to the guidance of Regulatory Guide 1.97, except for those exceptions that were justified as 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 information required to permit the control room operator to take specific manually controlled safety actions. The licensee classifies the following instrumentation as Type A variables.

1. Steam generator narrow range level
2. Steam generator pressure
3. Core exit temperature
4. Reactor coolant system (RCS) cold leg water temperature
5. RCS hot leg water temperature
6. RCS flow

7. RCS wide range pressure

8. High pressure safety injection flow

9. Condensate storage tank water level

10. Refueling water storage tank level

11. Power operated relief valve position indication

12. Pressurizer liquid temperature

13. Pressurizer level narrow range

14. Containment hydrogen concentration

15. Containment intermediate range pressure

All of the above variables, except RCS flow and pressurizer liquid temperature, are also included as Type B, C, or D variables. All of these variables except RCS flow, either meet Category 1 requirements, or will be upgraded to meet these requirements, consistent with the requirements for Type A variables. As RCS flow has been identified by the licensee as providing information required to permit manual controlled actions that are necessary to the functioning of safety systems in design basis events, the licensee should upgrade this instrumentation to Category 1 requirements.

3.3 Exceptions to Regulatory Guide 1.97

The licensee identified the following exceptions to the requirements of Regulatory Guide 1.97.

3.3.1 RCS Soluble Boron Concentration

Regulatory Guide 1.97 recommends continuously indicating instrumentation with a range from 0 to 6000 parts per million for this variable. The licensee

provides manual grab sampling and the post-accident sampling system. They did not indicate that they meet the range recommendations.

The licensee takes exception to the guidance of 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 their review of NUREG-0737, Item II.B.3.

3.3.2 Containment Isolation Valve Position

The licensee has identified that there is instrumentation for this variable, however, it is not the recommended closed-not closed indication. Their submittal does not indicate what the indication is, nor that the licensee will modify the indication to comply with the regulatory guide. Therefore, based on the information available to us, we find this deviation unacceptable. The licensee should identify the indication and justify any deviation.

3.3.3 Radiation Level in Circulating Primary Coolant

The licensee states that two independent and redundant systems are available to obtain this sample. The Post Accident System is one of the systems to be used for this variable. The other system is stated to be fully environmentally and seismically qualified; however, this instrumentation is not identified.

The licensee should provide the information required by Section 6.2 of NUREG-0737, Supplement No. 1 for this variable.

3.3.4 RHR System Flow
RHR Heat Exchanger Outlet Temperature

Regulatory Guide 1.97 recommends environmentally qualified Category 2 instrumentation for these variables. The licensee takes exception to the environmental qualification recommended for these variables by Regulatory

Guide 1.97. The following justification was provided by the licensee. "The RHR system is not required to operate during post accident conditions as identified in the updated Final Safety Analysis Report Section 5.5.4.3.3. Additionally, RHR flow and temperature are backup variables for monitoring core cooling which can be determined from redundant and qualified temperature and pressure measurements."

We concur with the licensee that, with their station design, this instrumentation is not required post-accident. However, it is our understanding that the RHR system does operate during an accident and must be manually shutdown. Therefore. this instrumentation is needed to monitor the operation of the RHR system. The only identified deviation from Category 2 recommendations is environmental qualification. Environmental qualification has been subsequently clarified by the environmental qualification rule, 10 CFR 50.49. It is concluded that the guidance of Regulatory Guide 1.97 has been superseded by a regulatory requirement. Any exception to this rule is beyond the scope of this review and should be addressed in accordance with 10 CFR 50.49.

3.3.5 Accumulator Tank Level and Pressure
Accumulator Isolation Valve Position

Regulatory Guide 1.97 recommends Category 2 instrumentation for these variables. The licensee takes exception to the recommended level range (10 to 90 percent of volume) and to the environmental qualification for each of these variables.

The licensee's supplied level instrumentation indicates over a span of twelve inches. The licensee states that this "narrow range is needed to obtain the accuracy needed to meet technical specification conditions and meet the intent of RG 1.97."

We find the licensee's justification for this deviation unacceptable. The technical specifications provide the limiting conditions for operation and surveillance requirements for system variables (volumes, pressures, levels, temperatures and etc.) that are required to be operational and available for pre-accident conditions. The technical specifications do not identify

specific instrumentation ranges that must be available in post-accident conditions. The licensee should show that the accumulator level instrumentation will adequately cover the maximum expected range, or provide instrumentation with the range recommended by Regulatory Guide 1.97.

The licensee believes that these variables should be classified as Category 3, as they are considered qualified for their intended normal operating environment. This justification follows: the transmitters and position switches are located below the flood plane after an accident and "environmentally qualified only for the environment that they see during normal plant operations. During power operations the power to the accumulator isolation valve, which is open, is removed with the breaker being verified locked open by Technical Specifications during start-up procedure. Therefore, accumulator pressure, level and valve position indication serve as a means to determine accumulator status during normal operations and to ensure their capability to perform their automatic accident function which is independent of electrical signals and strictly mechanical in nature."

Environmental qualification has been subsequently clarified by the environmental qualification rule, 10 CFR 50.49. It is concluded that the guidance of Regulatory Guide 1.97 has been superseded by a regulatory requirement. Any exception to this rule is beyond the scope of this review and should be addressed in accordance With 10 CFR 50.49.

3.3.6 Boric Acid Charging Flow

Regulatory Guide 1.97 recommends environmentally qualified instrumentation for this variable. The licensee is replacing the transmitter for this variable; however, they have not stated that environmental qualification will be complied with. The licensee should state that after the modifications are complete, the instrumentation will be environmentally qualified.

3.3.7 Flow in High Pressure Injection System

The licensee has identified this variable as Type A. As such, Category 1 instrumentation should be supplied. The licensee is relocating and replacing

the transmitter to above the submergence level. They indicate that separation of channels will be provided. They have not verified that the environmental and seismic qualification and redundancy required for Category 1 instrumentation will be provided. The licensee should verify that Category 1 instrumentation will be provided for this variable.

3.3.8 Pressurizer Level

Regulatory Guide 1.97 recommends redundant Category 1 instrumentation for this variable with a range from top to bottom. The licensee does not have redundant instrumentation. They are adding "density compensation to reduce the error and expand the range of the transmitter to the full range allowed by taps." The "present instrumentation covers 390 in. of the 500 in. height of the pressurizer with only the curvature portions of the vessel not being covered." The licensee has not provided justification for the lack of redundance for this instrumentation.

The instrumentation provided for this variable does not indicate the volume in the hemispherical ends of the vessel. The level indication is provided for the cylindrical portion of the pressurizer. We find that this deviation is acceptable.

The licensee should provide a redundant channel of instrumentation.

3.3.9 Pressurizer Heater Status

Regulatory Guide 1.97 recommends monitoring the pressurizer heater electric current with Category 2 instrumentation. The licensee monitors the heater circuit breaker position. The licensee states that this instrumentation is adequate.

Section II.E.3.1 of NUREG-0737 requires a number of the pressurizer heaters to have the capability of being powered by the emergency power sources. Instrumentation is to be provided to prevent overloading a diesel-generator. Also, technical specifications are to be changed accordingly. The Standard Technical Specifications, Section 4.4.3.2, requires

that the emergency pressurizer heater current be measured quarterly. These heaters, as required by NUREG-0737, should have the current instrumentation recommended by Regulatory Guide 1.97.

3.3.10 Quench Tank Temperature

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of 50 to 750°F. The licensee has provided instrumentation with a range of 0 to 350°F. The licensee has justified this range. "The quench tank design pressure is 100 psig. Prior to attaining this pressure, the tank rupture disk will provide a relief path to the containment atmosphere. Therefore, any relief from the pressurizer safety valves will be maintained below 100 psig and a corresponding saturation temperature of less than 350°F."

We find the licensee's justification for this deviation acceptable.

3.3.11 Steam Generator Level, Wide Range

Regulatory Guide 1.97 recommends instrumentation for this variable with a range from the tube sheet to the separators. The licensee deviates from this range, covering from fourteen inches above the tube sheet to the separators. This is 97.6 percent of the recommended range.

At fourteen inches above the tube sheet, the steam generator is essentially dry. Therefore, this deviation is acceptable.

3.3.12 Containment Spray Flow

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of 0 to 110 percent of design flow. The licensee has alternate instrumentation which they consider adequate. "A flow switch is installed on the discharge side of each quench spray pump to monitor low flow with annunciator alarm available in the control room. Additionally, the effectiveness of the quench spray flow can be determined by the use of containment temperature and pressure indication."

Based on the licensee's justification, we find this deviation acceptable.

3.3.13 Containment Sump Water Temperature

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable. The licensee has Category 3 instrumentation for this variable that, except for environmental qualification, is Category 2. The licensee states that "the containment sump temperature indication is not required based on the regulatory position delineated in Safety Guide 1 Net Positive Suction Head for Emergency Core Cooling and Containment Heat Removal System Pumps." Vepco's Emergency Core Cooling and Containment Heat Removal System pumps which take suction from the containment sump when the refueling water storage tank is empty were designed assuming saturated water conditions in meeting the NPSH requirements and in meeting the criteria of Safety Guide 1.

Environmental qualification is the only deviation from Category 2 requirements identified. Environmental qualification has been subsequently clarified by the environmental qualification rule, 10 CFR 50.49. It is concluded that the guidance of Regulatory Guide 1.97 has been superseded by a regulatory requirement. Any exception to this rule is beyond the scope of this review and should be addressed in accordance with 10 CFR 50.49.

3.3.14 Volume Control Tank Level.

Regulatory Guide 1.97 recommends a range for this variable that reads from the top to the bottom of the tank. The instrumentation provided for this variable does not indicate the volume in the hemispherical ends of the vessel. The level indication is provided for the cylindrical portion of the volume control tank. We find this deviation acceptable.

3.3.15 Component Cooling Water Temperature to ESF System
Component Cooling Water Flow to ESF System

Regulatory Guide 1.97 recommends Category 2 instrumentation for these variables. The licensee's submittal states that the range, power source and

environmental qualification recommendations are not met. The licensee indicates that a temperature channel and a flow channel will be installed to monitor the charging pump cooling system.

The licensee should install Category 2 instrumentation for these variables with the recommended ranges.

3.3.16 Emergency Ventilation Damper Position

The licensee has indicated that limit switches will be installed. However, we are unable to determine from the licensee's submittal that the range and environmental qualification recommendations will be met.

Therefore, the licensee should verify that the upgraded instrumentation will meet the Category 2 requirements for this control room display of open-closed status.

3.3.17 Plant and Environs Radioactivity

Regulatory Guide 1.97 recommends portable instrumentation for this variable for isotopic analysis. The licensee does not have this instrumentation on site. The licensee states that "initially, the dose rate is calculated utilizing the radiation monitoring readings at the station. A spectrometer is available at the Surry Power Station and can be used for release assessment analysis for North Anna samples."

We find this acceptable for long-term post-accident surveillance.

4. CONCLUSIONS

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

1. RCS flow--the licensee should upgrade this instrumentation to Category 1 requirements (Section 3.2).

2. Containment isolation valve position--the licensee should identify the specific deviation from the recommended closed-not closed indication and justify this deviation (Section 3.3.2).

3. Radiation level in circulating primary coolant--the licensee should provide the information required by Section 6.2 of NUREG-0737, Supplement No. 1 for this variable (Section 3.3.3).

4. RHR system flow--environmental qualification should be addressed in accordance with 10 CFR 50.49 (Section 3.3.4).

5. RHR heat exchanger outlet temperature--environmental qualification should be addressed in accordance with 10 CFR 50.49 (Section 3.3.4).

6. Accumulator level--the licensee should show, by analysis, that the existing range will adequately cover the expected post-accident levels or provide instrumentation with a range as recommended by the regulatory guide; environmental qualification should be addressed in accordance with 10 CFR 50.49 (Section 3.3.5).

7. Accumulator pressure--environmental qualification should be addressed in accordance with 10 CFR 50.49 (Section 3.3.5).

8. Accumulator isolation valve position--environmental qualification should be addressed in accordance with 10 CFR 50.49 (Section 3.3.5).

9. Boric acid charging flow--the licensee should verify that the instrumentation, as modified, will be environmentally qualified in accordance with 10 CFR 50.49 (Section 3.3.6).

10. Flow in high pressure injection system--the licensee should verify that the instrumentation, as modified, meets the requirements of Category 1 instrumentation (Section 3.3.7).

11. Pressurizer level--the licensee should provide a redundant channel of instrumentation (Section 3.3.8).

12. Pressurizer heater status--the licensee should provide the recommended instrumentation for this variable (Section 3.3.9).

13. Containment sump water temperature--environmental qualification should be addressed in accordance with 10 CFR 50.49 (Section 3.3.13).

14. Component cooling water temperature to ESF system--the licensee should install Category 2 instrumentation for this variable (Section 3.3.15).

15. Component cooling water flow to ESF system--the licensee should verify that Category 2 instrumentation is being used for this variable (Section 3.3.15).

16. Emergency ventilation damper position--the licensee should verify that Category 2 instrumentation is being installed for the control room display of this variable (Section 3.3.16).

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, U.S. Nuclear Regulatory Commission (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. Virginia Electric and Power Company letter, W. L. Stewart to H. R. Denton, NRC, "Compliance with Regulatory Guide 1.97," January 31, 1984, Serial No: 054.

5. 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.

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