CONFORMANCE TO REGULATORY GUIDE 1.97
SUSQUEHANNA STEAM ELECTRIC STATION, UNIT NOS. 1 AND 2

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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 Pennsylvania Power and Light Company, the licensee/applicant for the Susquehanna Steam Electric Station, provided a response to the generic letter on April 15, 1983 (Reference 4). The letter referred to a previous letter dated November 13, 1981 (Reference 5) for a review of the instrumentation provided for Regulatory Guide 1.97.

This interim report provides an evaluation of these submittals.

2. REVIEW REQUIREMENTS

Section 6.2 of NUREG-0737, Supplement 1, sets forth the documentation to be submitted in a report to 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 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 a response to the NRC generic letter 82-33 on April 15, 1983. This response referred to an earlier submittal of November 13, 1981, which described the licensee's position on post-accident monitoring instrumentation. This evaluation is based on these submittals.

3.1 Adherence to Regulatory Guide 1.97

The licensee stated that the Regulatory Guide shall be adhered to except where technical justification exists to deviate from the letter of the guide while maintaining adherence to its intent. 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 Subsection 3.3. The information provided by the licensee (reference 5) pre-dated Generic Letter No. 82-33 and did not include the information identified as items 1 through 8 (e.g., Instrument Range, etc.) in section 2 of this report. This information should be provided to document the licensee's commitment on conformance to Generic Letter No. 82-33.

3.2 Type A Variables

In that Regulatory Guide 1.97 does not specifically identify Type A variables, i.e., those variables that provide information required for operator controlled safety actions, the licensee classified the following instrumentation channels as Type A variables.

1. Neutron flux

2. Coolant level in reactor

3. Reactor coolant system pressure

4. Drywell pressure

5. Containment hydrogen concentration

6. Containment oxygen concentration

7. Suppression pool water temperature

8. Drywell atmosphere temperature.

The above variables are also identified as type B, C or D variables which meet Category 1 requirements with the exception of items 7 and 8. These variables, Suppression pool water temperature and Dry well atmosphere temperature are identified as satisfying the category 2 requirements. The staff considers this to be an exception taken to the Regulatory Guide, although it was not so identified by the licensee. Therefore in the absence of a commitment from the licensee to upgrade these variables to category 1 requirements or justification that the information provided by these variables is not required to satisfy the explicit definition of Type A variables, we find this to be unacceptable.

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 Neutron Flux

This instrumentation complies with Category 1 requirements. The instrument range is not as recommended by Regulatory Guide 1.97 (10^{-6} to 100% of full power). The installed instrumentation covers a range of from 10^{-4} to 100% of full power.

The licensee notes that accident scenerios resulting in an increase in reactivity could only be caused by inadvertent removal of boron that was added by the standby liquid control system or by other effects such as a change in temperature or fission product poisoning. The licensee states that these reactivity additions would likely have a slow rate of change, and concludes that power readings in the range of 10^{-2}% of full power (two decades above the minimum range provided) would give the operator sufficient time to identify the problem and investigate corrective action.

We find that the justification provided by the licensee for a deviation in the range recommendations for neutron flux unacceptable. There was no quantitative analysis provided for the increase in reactivity event (no control rods being removed). It is the staff's position that the licensee must provide the

recommended range identified in the Regulatory Guide or provide a quantitative analysis for the increase in reactivity events which address the following questions:

1. How fast is the deboration event and why?

2. When is adequate warning available to the operator via his instrumentation?

3. How much time is there between the warning and criticality?

3.3.2 Coolant Level in the Reactor

Regulatory Guide 1.97, Revision 2, requires redundant instruments with a range extending from the bottom of the core support plate to the centerline of the main steam line. To comply with this requirement, the licensee will use two fuel zone channels, two wide range channels and an upset range channel.

There is overlap between the channel ranges. The upset range instrument reference leg uses the top head vent as a penetration. In order to comply with the single failure requirement of Regulatory Guide 1.97, an additional head penetration would be needed for a redundant reference column for a second upset range channel.

The required range of indication for reactor coolant level is 440 inches. Only the upper 70 inches are not monitored by redundant instruments. The licensee notes that no manual or automatic functions are initiated in the upper 70 inches since these functions occur in the range monitored by redundant wide range channels. The licensee concludes that the proposed reactor coolant level instrumentation meets the intent of the Regulatory Guide, and that only a marginal improvement in plant safety would be achieved by installing a redundant channel. We concur that an additional upset range channel may result in only a marginal safety improvement and therefore find this justification acceptable.

3.3.3 Drywell and Drywell Drains Sump Level

The licensee has given the following reasons for not providing this variable as part of their post accident monitoring variables (Regulatory Guide 1.97) at the Susquehanna Station:

1. The sumps are shallow (6 inches deep with 316 gallon capacity) and designed for small leakage

2. The drain lines are isolated on an accident signal

3. The sumps would overflow to the suppression pool via the drywell downcomers following an accident.

4. The level in the sumps is measured by existing instrumentation to identify small leakages in accordance with Regulatory Guide 1.45.

Sump level detection is a method of determining leakage from the reactor coolant system that is specified in Regulatory Guide 1.45. Once the sump is full, no useful post-accident information would be available for instruments qualified to either Regulatory Guide 1.45 or 1.97. The sump drains are isolated on an accident signal, and the operator is able to tell that the sump is full by using the existing instrumentation.

Based on the above, the lack of instrumentation recommended by Regulatory Guide 1.97 is acceptable.

3.3.4 Primary Containment Isolation Valve Positions

The instrumentation for valve position indication does not use seismically qualified indicator lamps. The licensee indicates that seismically qualified indicator lamps are not available.

The staff requires a commitment from the licensee to a) take action in pursuit of seismically qualified lamps and, b) replace the unqualified lamps in a reasonable period of time.

3.3.5 Radiation Level in Circulating Primary Coolant

A direct measurement of this variable is not provided. The licensee indicates that radiation level measurements to indicate fuel cladding failure are provided by the following instruments:

1. Off-gas pretreatment radiation monitor

2. Main steam line radiation monitor

3. Containment area radiation monitor

4. Containment hydrogen monitor

5. Post-accident sample station (manual sample analysis)

6. Post-accident sample station sample line radiation monitor.

This instrumentation is recommended by the Regulatory Guide to indicate damage to fuel cladding regardless of whether there has been a breach of the reactor coolant system pressure boundary.

Not all of these monitors are available (due to containment isolation) in a post-accident situation. Those that are have not been shown by the licensee to have a continuous direct relationship to the radiation level in the circulating primary coolant. We cannot conclude that the present instrumentation is suitable for this variable.

Instrumentation that is suitable for this variable has been under research and development. We find that the diverse indication presently provided for this

variable is acceptable on an interim basis, on the conditions that the licensee (a) commit to asses the availability of systems for this variable and to evaluate the systems within a reasonable time frame, and (b) commit to installation of a satisfactory system within a reasonable time frame.

3.3.6 Radiation Exposure Rate

The licensee has instrumentation for this variable with individual instrument ranges that vary from the recommended range. The licensee has performed a post-accident radiation study that determined the maximum radiation field for each location. Where existing radiation monitors will drive offscale during a postulated accident, the licensee has committed to increase the range to ensure that the instrument will remain on scale. The licensee has not identified what range changes are required or provided a schedule for implementation consistent with the information requirements identified in the generic letter. We find that the licensee commitment to implement those changes required to provide an adequate instrument range is acceptable, however, the licensee should provide the ranges and locations with a schedule for implementation consistant with the Section 6.2 requirements of Generic Letter 82-33.

3.3.7 Noble Gas and Vent Flow Rates

The licensee takes exception to the guidance of Regulatory Guide 1.97 in that these instruments are not environmentally qualified to meet Regulatory Guide 1.89. Previously, the NRC found these instruments to be acceptable in the review of Item II.F.1 of NUREG-0737. This is addressed in the Susquehanna Safety Evaluation Report. However, 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 Section (g) to 10 CFR 50.49.

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. Provide the information identified in Section 2 to document the licensee's commitment on conformance to Generic Letter No. 82-33 (see Section 3.1).

2. Suppression pool water temperature--this instrumentation meets Category 2 requirements rather than Category 1 requirements. The licensee needs to commit to upgrade this variable to Category-1 requirements or justify this deviation (see Section 3.2).

3. Drywell atmosphere temperature--this instrumentation meets Category 2 requirements rather than Category 1 requirements. The licensee needs to commit to upgrade this variable to Category 1 requirements or justify this deviation (see Section 3.2).

4. Newtron Flux---this instrumentation does not cover the recommended range by the Regulatory Guide. The licensee must provide this range or provide a quantitative analysis for the increase in reactivity events (see Subsection 3.3.1).

5. Primary Containment Isolation Valve Position---the valve position indication lamps are not seismically qualified. The staff requires a commitment from the licensee to a) take action in persuit of seismically qualified lamps and b) replace the unqualified lamps in a reasonable period of time (see Subsection 3.3.4).

6. Radiation level in circulating primary coolant--the existing instrumentation is acceptable on an interim basis. The licensee needs to commit to installing newly developed instrumentation for this variable (see Subsection 3.3.5).

7. Radiation exposure rate--the licensee should identify instrument locations and ranges, and a schedule for implementation as required by Reference 1 (see Subsection 3.3.6).

8. Since instrumentation used to monitor Noble Gas and Vent Rate have not been environmentally qualified in accordance with Section (g) 10 CFR 50.49, this is a matter for which the licensee should request an exception to regulatory requirements.

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. Pennsylvania Power & Light Company (PP&L) letter, N. W. Curtis to Director of Nuclear Reactor Regulation, NRC, "Response to Generic Letter 82-33," April 15, 1983, PLA-1621.

5. PP&L letter, N. W. Curtis to A. Schwencer, NRC, "SER Issue No. 39 (R.G. 1.97)," November 13, 1981, PLA-965.

6. Clarification of TMI Action Plant Requirements, NUREG-0737, NRC, Office of Nuclear Reactor Regulation, November 1980.