CONFORMANCE TO REGULATORY GUIDE 1.97
WOLF CREEK PLANT, UNIT NO. 1

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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 Kansas Gas and Electric Company, the applicant for the Wolf Creek Station, has its response to the generic letter incorporated in a letter dated April 15, 1983 (Reference 4). The letter referenced the Final Safety Analysis Report (Reference 5) for a review of the instrumentation provided for Regulatory Guide 1.97.

This 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 applicant 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 applicant'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 a submittal by Standard Nuclear Unit Power Plant Systems (SNUPPS) which referred to Appendix 7A of the SNUPPS Final Safety Analysis Report (FSAR) which described the applicant's position on post-accident monitoring instrumentation. This evaluation is based on these submittals.

3.1 Adherence to Regulatory Guide 1.97

The applicant has not provided an explicit commitment on conformance to the guidance of Regulatory Guide 1.97. However, they have provided the information to show where nonconformance exists. The applicant should specifically commit to conform to Regulatory Guide 1.97 guidance except for those deviations that are justified and agreed to by the NRC.

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 applicant classified the following instrumentation channels as Type A variables.

1. Reactor coolant system (RCS) cold leg water temperature
2. RCS hot leg water temperature
3. RCS pressure
4. Containment normal sump water level
5. Containment pressure
6. Containment area radiation
7. Refueling water storage tank level
8. Pressurizer level
9. Steam generator level, narrow range
10. Steam generator pressure.

All of the previous variables are also included as Type B, C, or D variables and meet Category 1 requirements consistent with the requirements for Type A variables.

3.3 Exceptions to Regulatory Guide 1.97

The applicant identified the following exceptions to the guidelines of Regulatory Guide 1.97.

3.3.1 Neutron Flux

Regulatory Guide 1.97 specifies environmentally qualified Category 1 instrumentation for this variable. The instrumentation provided for this variable includes detectors that are not environmentally qualified for a loss-of-coolant accident or main steam line break. Environmental qualification has been clarified since Revision 2 of Regulatory Guide 1.97 was issued. The clarification is in 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.

3.3.2 RCS Hot and Cold Leg Water Temperature

Regulatory Guide 1.97, revision 2, specifies a range of 50 to 750°F. The range supplied for this variable is 0 to 700°F. The applicant indicates that the range supplied exceeds all expected design basis conditions. We concur that this deviation is acceptable based on their evaluation. Further, Revision 3 of Regulatory Guide 1.97 (Reference 7) lists the range as 50 to 700°F.

3.3.3 Radioactivity Concentration or Radiation Level in Circulating Primary Coolant

Regulatory Guide 1.97 recommends Category 1 instrumentation for this variable with a range of from 1/2 to 100 times the technical specification

limit. The purpose of this instrumentation is the detection of breach. The applicant is not providing instrumentation for this variable stating that it is unnecessary.

The applicant's in-line sampling system can provide some information to compliment this variable, however it is not a continuous measurement system.

Instrumentation that is suitable for this variable has been under research and development. We find that use of sampling system is acceptable on an interim basis, on the conditions that the applicant (a) commit to evaluate and (b) commit to installation of a satisfactory system within a reasonable time frame.

3.3.4 Radiation Exposure Rates

Revision 2 of Regulatory Guide 1.97 recommends radiation exposure rate monitors for two purposes: (1) to measure releases caused by a breach in containment and (2) to monitor the inside of buildings where access is required to service equipment important to safety. Revision 3 of the regulatory guide deletes the instrumentation for measuring releases caused by containment breach. A breach of containment could be detected by effluent monitors if the containment contained radioactive gases and the breach was to a monitored building.

The applicant takes exception to the instrument range recommended by Regulatory Guide 1.97 (10^{-1} R/hr to 10^{4} R/hr). Currently, installed area radiation monitors cover the range of 10^{-1} R/hr to 10 R/hr. The licensee's justification for this deviation is that the existing area radiation monitors provide for adequate employee protection, and these monitors can be augmented by portable monitors.

From a radiological standpoint, if the radiation levels reach or exceed the upper limit of the range (10 R/hr), personnel would not be permitted to the areas except for life saving. We therefore find the proposed range (10 R/hr) for the radiation exposure rate monitors acceptable.

3.3.5 Residual Heat Removal Heat Exchanger Outlet Temperature

The applicant has supplied instrumentation for this variable with a minimum range of 50°F. The minimum recommended by the regulatory guide is 32°F. The applicant did not provide justification for this deviation. The applicant should either provide a new instrument span so that the recommended range is covered, or provide satisfactory justification for not providing the recommended range.

3.3.6 Accumulator Tank Level and Pressure

The applicant has provided instrumentation for this variable that is not qualified as Category 2 instrumentation as recommended by the regulatory guide. The applicant states that this variable will not be necessary following an event. We do not find this justification acceptable, as the accumulators may or may not discharge dependent on the size of the break. The ranges supplied (13+ inches, level; 0-700 psig, pressure) are not as recommended (10 to 90 percent volume, level; 0 to 750 psig, pressure). The applicant has not justified this deviation. We conclude that the instrumentation supplied for this variable is not acceptable. The applicant should provide instrumentation that meets the recommendations of the regulatory guide or provide satisfactory justification for not doing so.

3.3.7 Pressurizer Level

Regulatory Guide 1.97 recommends Category 1 instrumentation for this variable with a range from the bottom to the top of the vessel to ensure proper operation of the pressurizer.

The applicant has provided instrumentation for this variable that does not include the hemispherical heads. Only when the level is within the limits of the cylindrical portion of the pressurizer is the level on scale. Outside of the supplied instrumentation range in the hemispherical vessel heads, the volume to level ratio is not linear (approximately 15 percent of

the total volume). We feel that this deviation is minor, and therefore acceptable.

3.3.8 Quench Tank Temperature

Regulatory Guide 1.97 recommends a range for this variable of up to 750°F. The applicant has provided instrumentation for this variable with a range up to 350°F. The applicant has stated that an analysis shows the temperature will not exceed 328°F under any condition. We find the applicant's justification for this deviation in the upper limit of the range acceptable.

3.3.9 Steam Generator Level

Regulatory Guide 1.97 recommends redundant Category 1 instrumentation for this variable with a range from the tube sheet to the separators. This instrumentation is to be supplied for each steam generator to monitor its operation.

The applicant has supplied wide range instrumentation for this variable with the low limit of the range 22 inches above the tube sheet rather than at the tube sheet as recommended by the regulatory guide. The applicant provided no justification for this deviation.

Regulatory Guide 1.97 recommends redundant range instrumentation. The applicant has redundant narrow range instruments that provide redundancy over a portion of the wide range instrument span. The applicant states that this would indicate a failure of a wide range instrument. We find the justification for deviations in range and redundancy for this variable unacceptable.

The applicant should provide redundancy for the wide range steam generator level channels over the entire recommended range or provide satisfactory justification for not doing so.

3.3.10 Steam Generator Pressure

The applicant has supplied instrumentation for this variable that covers up to 1300 psig (110 percent of the lowest safety valve setpoint) rather than the recommended 20 percent above the lowest safety valve setpoint. The applicant considers the supplied range to be adequate.

Relief valve setpoints, while typically specified as ±1 percent of nominal, routinely exhibit a repeatability scatter on the order of ±3 percent. Such a variation in relief valve setpoint in combination with reasonable instrumentation sensor-to-readout inaccuracy and drift (in the order of ±5 percent) could eliminate the instrumentation margin. Given that there is insufficient instrumentation margin, and that the instrumentation could be respanned to give a range of up to 120 percent of the lowest safety valve setpoint, we do not consider the applicant's justification for the deviation to be adequate.

However, there are redundant, independent instruments that measure to 1500 psig (126% of the lowest safety valve setpoint). These are not identified with Regulatory Guide 1.97, but the transmitters and indicators are safety grade. We do not know if they satisfy the Category 2 requirements. We concur with the applicant that the instrumentation supplied for this variable is acceptable, if the redundant 1500 psig instruments can be shown to meet the recommendations for Category 2 instrumentation.

3.3.11 Containment Spray Flow

The applicant has supplied instrumentation for this variable that satisfies the range recommendation except when in the recirculation mode. The range in this mode is up to 106 percent of design flow rather than the regulatory guide recommended 110 percent of design flow. This deviation is minor and therefore acceptable. The instrumentation is not environmentally qualified. Environmental qualification has been clarified since Revision 2 of Regulatory Guide 1.97 was issued. The clarification is in 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.

3.3.12 Heat Removal by the Containment Fan Heat Removal System

Regulatory Guide 1.97 recommends plant specific instrumentation for this variable to monitor the operation of the containment fan heat removal system. This system is operated in conjunction with the containment spray system.

The applicant is not supplying instrumentation for this variable, indicating that this variable is unnecessary because the accomplishment of post-accident cooling is verified by monitoring the containment pressure and air temperature.

As the containment pressure and air temperature are affected by the containment fan heat removal system and the containment spray system, and is a function of break size and location, we do not concur with the applicant's position. The containment pressure and air temperature do not show conclusively that the containment fan heat removal system is operating.

The applicant should provide instrumentation for this variable or provide an analysis that shows the instrumentation (containment pressure and temperature) is sufficient to monitor the expected range of operation.

3.3.13 Containment Sump Water Temperature

Regulatory Guide 1.97 recommends this instrumentation to monitor the operation of the containment cooling system.

The applicant indicates that this variable is unnecessary, because containment cooling is monitored by the containment air temperature instrumentation. Also, the applicant states that the sump temperature does not affect

residual heat removal system operation, nor is it needed to assure net positive suction head. The containment air temperature is a function of break size and location. Therefore, we cannot concur that the air temperature is indicative of the operation of any one containment cooling system. The applicant should either provide instrumentation for this variable or provide further justification showing why compliance cannot be accomplished.

3.3.14 Volume Control Tank Level

Regulatory Guide 1.97 recommends instrumentation for this variable that covers a range from the top to the bottom of the tank. The applicant has provided instrumentation for this variable that does not include the hemispherical heads (where the volume to level ratio is non-linear). Only when the level is within the 75-inch length of the cylindrical portion of the volume control tank is the level measurement on scale. We find that this deviation is minor, and therefore acceptable.

3.3.15 High-Level Radioactive Liquid Tank Level

Regulatory Guide 1.97 recommends monitoring this variable with Category 3 instrumentation for the full height of the vessel to indicate storage volume.

The applicant indicates that this variable is unnecessary as the liquid radwaste system is not required following an accident as additions to the tank are prevented by the containment isolation system. The liquid radwaste system is controlled from a separate control room in the radwaste building and the level is monitored there. This control room is accessible following an accident. Inadvertent contamination is not postulated. The applicant has not identified either the range or the category of the instrumentation supplied for this variable. Based on the justification provided by the applicant, we concur that this variable can be adequately monitored from outside the main control room at the Callaway Plant. However, the applicant should provide the instrument range and category necessary to make a final determination.

Not all accidents result in automatic containment isolation. Even with an isolated containment, operating engineering safety feature equipment can develop leaks of radioactive liquids. The applicant should discuss the handling of such radioactive liquids in relation to the high-level radioactive liquid tank level.

3.3.16 Radioactive Gas Holdup Tank Pressure

Regulatory Guide 1.97 recommends monitoring this variable with Category 3 instrumentation from 0 to 150 percent of design pressure to indicate storage capacity.

The applicant indicates that this variable is unnecessary as it is not controlled from the main control room, but rather from a separate control room in the radwaste building. The pressure is monitored in the radwaste building control room, which is accessible following an accident, rather than the main control room. However, the range is 0 to design pressure rather than the recommended 0 to 150 percent of design pressure. The applicant should provide justification showing that the existing range is adequate for post-accident conditions.

3.3.17 Vent From Steam Generator Safety Relief Valves or Atmospheric Dump Valves

Regulatory Guide 1.97 recommends monitoring this variable with Category 2 instrumentation with ranges of 10^{-1} to 10^{3} μCi/cc and duration of release in seconds and mass of steam per unit time. The purpose of this instrumentation is the detection of significant releases and release assessment.

The applicant has not provided the ranges to be supplied for this instrumentation nor shown it to be in conformance with the range recommendation of Regulatory Guide 1.97. The applicant should provide this information, showing that the range recommendations are satisfied or provide justification for any deviation.

3.3.18 Noble Cases and Vent Flow Rate--All Other Identified Release Points

Regulatory Guide 1.97 recommends monitoring this variable with Category 2 instrumentation with ranges of 10^{-6} to 10^{2} μCi/cc and 0 to 110 degrees of design flow. The purpose of this instrumentation is the detection of significant releases, release assessment and long-term surveillance.

The applicant has not provided the range to be supplied for the auxiliary feedwater pump turbine exhaust monitor nor shown it to be in conformance with the range recommendation of Regulatory Guide 1.97. The applicant should provide this information, showing that the range recommendations are satisfied.

3.3.19 Sump Accident Sampling Capability With Analysis Capability On-site

The applicant 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 will be addressed by the chemical engineering branch as part of their review of NUREG-0737, Item II.B.3.

3.3.20 Containment Air Sampling Capability with Analysis Capability On-site

The applicant 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 will be addressed by the chemical engineering branch as part of their 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 the guidance of Regulatory Guide 1.97 with the following exceptions:

1. Neutron flux--environmental qualification is yet to be addressed in accordance with 10 CFR 50.49 (Section 3.3.1).

2. Radioactivity concentration or radiation levels in circulating primary coolant--the applicant should commit to evaluate newly developed systems for this variable and to install a satisfactory system within a reasonable time frame (Section 3.3.3).

3. Residual heat removal heat exchanger outlet temperature--the applicant should re-span his instrumentation to provide a minimum range of 32°F rather than 50°F or provide satisfactory justification for not providing the recommended range (Section 3.3.5).

4. Accumulator tank level and pressure--the applicant should provide Category 2 instrumentation or provide satisfactory justification for not supplying it for this variable; the applicant should provide satisfactory justification for not providing the recommended ranges or should provide instrumentation with ranges that meet the regulatory guide recommendations (Section 3.3.6).

5. Steam generator level--The applicant should provide total range redundancy for the wide range instruments to conform to the recommended range or provide satisfactory justification for not doing so (Section 3.3.9).

6. Steam generator pressure--the applicant should show that the redundant 1500 psig instrumentation meets the Category 2 recommendations (Section 3.3.10).

7. Containment spray flow--environmental qualification is yet to be addressed in accordance with 20 CFR 50.49 (Section 3.3.11).

8. Heat removal by the containment fan heat removal system--the applicant should provide analysis that shows the instrumentation (containment pressure and temperature) is sufficient to monitor the expected range of operation.

9. Containment sump water temperature--the applicant should either provide instrumentation for this variable or provide further justification showing why compliance cannot be accomplished (Section 3.3.13).

10. High-level radioactive liquid tank level--the applicant should show that the category and range of the provided instrumentation is adequate; the applicant should discuss the handling of radioactive liquids that are not contained by containment isolation (Section 3.3.15).

11. Radioactive gas holdup tank pressure--the applicant should provide justification showing that the existing range is adequate for post-accident conditions (Section 3.3.16).

12. Vent from steam generator safety relief valves or atmospheric dump valves--the applicant should provide information showing that the range recommendations are satisfied, or provide justification for any deviation.

13. Noble gases and vent flow rate--auxiliary feedwater pump turbine exhaust in the applicant should supply the ranges of this instrumentation (Section 3.3.18).

14. The applicant should specifically commit to conform to the guidance of Regulatory Guide 1.97, Rev. 2 except for those deviations that are justified and accepted by NRC.

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. Standard Nuclear Unit Power Plant System (SNUPPS) letter, N. A. Petrick to H. R. Denton, NRC, "Generic Letter 82-33," April 15, 1983, SLNRC 83-0019.

5. SNUPPS Final Safety Analysis Report Appendix 7A, "Comparison to Regulatory Guide 1.97," Revision 10, September 1982.

6. 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.