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EGG-NTA-8009
May 1989
Revision 1

# INFORMAL REPORT
# TECHNICAL EVALUATION REPORT

## CONFORMANCE TO REGULATORY GUIDE 1.97: KEWAUNEE

Alan C. Udy

EG&G Idaho

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Prepared for the
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PRELIMINARY

## NOTICE

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# PRELIMINARY TECHNICAL EVALUATION REPORT

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Docket No. 50-305

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SUMMARY

This EG&G Idaho, Inc., report documents the review of the submittals for Regulatory Guide 1.97 for the Kewaunee Nuclear Power Plant and identifies areas of nonconformance to the regulatory guide. Exceptions to Regulatory Guide 1.97 are evaluated, and those areas where sufficient basis for acceptability is not provided are identified.

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## PREFACE

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 Engineering and System Technology, by EG&G Idaho, Inc., Regulatory and Technical Assistance Unit.

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# CONFORMANCE TO REGULATORY GUIDE 1.97: KEWAUNEE

## 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).

Wisconsin Public Service Corporation (WPSC), the licensee for the Kewaunee Nuclear Power Plant, provided a response to Item 6.2 of the generic letter on June 28, 1985 (Reference 4). On October 31, 1985 (Reference 5), Reference 4 was revised and resubmitted in its entirety. On May 30, 1986 (Reference 6), Reference 5 was replaced. Reference 6 reiterated that the methodology proposed in Reference 4 was being pursued and that any modifications identified would be initiated after the NRC reviewed and accepted the licensee's methodology. On April 15, 1987 (Reference 7), the licensee reaffirmed their position, i.e., that they could base their post-accident monitoring instrumentation on their emergency operating procedures rather than addressing the minimum recommendations of Regulatory Guide 1.97. A preliminary report, EGG-NTA-8009, dated March 1988, was prepared based on these submittals. It was not released by the NRC. Instead, the NRC held a meeting with the licensee on August 24, 1988. It was concluded at this meeting that the licensee would make another submittal. A submittal dated October 24, 1988 (Reference 8) addressed the information requirements of NUREG-0737, Supplement No. 1, Section 6.2, in response to the August 24, 1988 meeting, and replaces the earlier submittals.

This report revision is based on the recommendations of Regulatory Guide 1.97, Revision 3 (Reference 9), and compares the instrumentation proposed by the licensee's Reference 8 submittal with these recommendations.

## 2. REVIEW REQUIREMENTS

Item 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 any deviations taken from the regulatory guide recommendations and provide supporting justification or alternatives for the deviations identified.

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 address only 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 addresses only 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 responses to Item 6.2 of NRC Generic Letter 82-33 on June 28, 1985, October 31, 1985, May 30, 1986, April 15, 1987, and October 24, 1988. The responses describe the licensee's position on post-accident monitoring instrumentation. The October 24, 1988 submittal addresses the recommendations of Regulatory Guide 1.97. This evaluation is based on a comparison of the material in Reference 8 to the recommendations of Regulatory Guide 1.97, Revision 3.

### 3.1 Adherence to Regulatory Guide 1.97

The licensee has provided a review of their post-accident monitoring instrumentation that is based on their emergency operating procedures. A comparison to the instrumentation recommended by Regulatory Guide 1.97, Revision 3, is provided in Reference 8. The licensee states that they will continue to work with the staff to come to a mutually agreeable resolution, at which time a schedule for any resultant hardware modifications will be developed.

Exceptions to and deviations from the regulatory guide are noted in Section 3.3. We note that the licensee has identified some instrumentation as meeting the plant's original seismic design criteria instead of the more current requirements of Regulatory Guide 1.100. This is in accordance with the direction given in the NRC regional meetings.

### 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 has not identified the Type A variables in Reference 8. Regulatory Guide 1.97 requires all Type A variables to have Category 1 instrumentation. The licensee should identify the Type A variables, and verify that this instrumentation either is, or will be upgraded to, the Category 1 requirements.

## 4. EXCEPTIONS TO REGULATORY GUIDE 1.97

The approach that the licensee took in determining what instrumentation would be used to meet the post-accident monitoring instrumentation requirements of Supplement No. 1 of NUREG-0737 was unique. References 4, 5, 6, and 7 were also in a unique format that did not conform to the documentation requirements of Supplement No. 1 of NUREG-0737, Item 6.2. A preliminary report, EGG-NTA-8009, dated March 1988, was prepared based on the review of these submittals. This report had many open items, and was not issued as an interim report by the NRC.

The licensee was requested in a meeting with the NRC on August 24, 1988, to make a new submittal that discusses each Regulatory Guide 1.97 variable in a format consistent with the information requirements of Item 6.2 of Supplement No. 1 of NUREG-0737. This submittal was to be all-inclusive of the previous submittals (Reference 4 through 7). Reference 8 provides the requested information and replaces the earlier submittals. Based on the Reference 8 information, some of the instrumentation discussed in the following sections was found to be acceptable.

### 4.1 Instrumentation Found Acceptable Based on Information Submitted on October 24, 1988

Based on the information provided in Reference 8, the following instrumentation is acceptable.

#### 4.1.1 Control Rod Position

Regulatory Guide 1.97 recommends Category 3 instrumentation for this variable. It recommends full-in (inserted) or not full-in indication of the control rod position.

The licensee provided information on this instrumentation in Reference 8. The instrumentation acceptably indicates zero to 228 steps and otherwise meets the recommendations of Regulatory Guide 1.97.

4.1.2 RCS Soluble Boron Concentration

Regulatory Guide 1.97 recommends Category 3 instrumentation for this variable with a range of zero to 6000 parts per million. The licensee's instrumentation has a range of zero to 2000 parts per million.

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 has been addressed by the NRC as part of their review of NUREG-0737, Item II.B.3.

4.1.3 Core Exit Temperature

Regulatory Guide 1.97 recommends Category 1 instrumentation for this variable. Category 1 recommendations include recording. Reference 8 indicates that recording is not provided, but that the instrumentation was installed in accordance with NUREG-0737, Item II.F.2. The NRC has reviewed the acceptability of this instrumentation as part of their review of NUREG-0737, Item II.F.2. We find this to be a good faith attempt [as defined in NUREG-0737, Supplement No. 1, Section 3.7 (Reference 3)] to meet NRC requirements. Therefore, this instrumentation is acceptable.

4.1.4 Coolant Level in Reactor

Regulatory Guide 1.97 recommends Category 1 instrumentation for this variable with a range from the bottom of the core to the top of the vessel. The licensee identified (Reference 8) instrumentation for this variable that covers the recommended range.

The licensee states that this instrumentation is still being evaluated for seismic qualification. The licensee also states that this instrumentation meets the requirements of NUREG-0737, Item II.F.2. The NRC has reviewed the acceptability of this variable as part of their review of NUREG-0737, Item II.F.2.

We find this to be a good faith attempt [as defined in NUREG-0737, Supplement No. 1, Section 3.7 (Reference 3)], to meet NRC requirements. Therefore, this instrumentation is acceptable.

4.1.5 Containment Sump Water Level

Regulatory Guide 1.97 recommends two sets of instrumentation for this variable. The wide-range instruments should be Category 1 with a range of 0 to 600,000 gallons. The narrow-range instruments should be Category 2 with a range that is plant specific. The licensee has provided Category 1 wide-range instrumentation with a range of zero to 22 feet, which is shown to exceed the recommended range. This instrumentation includes full-time indicators with recording provided by computer. The licensee indicates that the resolution is adequate to function for both the wide- and narrow-range recommendations. Therefore, we find the provided instrumentation acceptable.

4.1.6 Containment Pressure

Regulatory Guide 1.97 recommends Category 1 instrumentation for this variable with ranges from zero to design pressure, 10 psia to design pressure, and 10 psia to 4 times design pressure. The licensee has identified Category 1 instrumentation that covers the range of -5 psig to 200 psig (design pressure = 46 psig). The instrumentation meets the range and design recommendations of Regulatory Guide 1.97 and is acceptable.

4.1.7 Radiation Level in Circulating Primary Coolant

Regulatory Guide 1.97 recommends Category 1 instrumentation for this variable with a range from 1/2 to 100 times the technical specification limit. The licensee provides sampling and analysis that resolves the radiation level between the limits of 10 μCi/ml and 10 Ci/ml. This equipment has been reviewed by the NRC as part of their review of NUREG-0737, Item II.B.3.

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

4.1.8 Analysis of Primary Coolant (Gamma Spectrum)

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of 10 μCi/ml to 10 Ci/ml. In Reference 8, the licensee describes a gamma spectrum analysis that is performed as part of the post-accident sampling system in accordance with the recommendations of Regulatory Guide 1.97. Therefore, the instrumentation provided for this variable is acceptable.

4.1.9 Containment Area Radiation

Regulatory Guide 1.97 recommends high range Category 1 instrumentation that covers a range of 1 R/hr to $10^7$ R/hr for this variable. The licensee's instrumentation has a range of 1 R/hr to $10^8$ R/hr; however, the instrumentation does not have the redundancy recommended by the regulatory guide.

The licensee states that this instrumentation was installed to meet the requirements of NUREG-0737, Item II.F.1.4. The NRC has reviewed the acceptability of this instrumentation as part of their review of NUREG-0737, Item II.F.1. We find this to be a good faith attempt [as defined in NUREG-0737, Supplement No. 1, Section 3.7 (Reference 3)], to meet NRC requirements. Therefore, this instrumentation is acceptable.

4.1.10 Containment Hydrogen Concentration

Regulatory Guide 1.97 recommends Category 1 instrumentation for this variable. Category 1 instrumentation should be recorded. The licensee has not identified recorders for this instrumentation. The licensee states that this instrumentation was installed to the requirements of NUREG-0737.

The NRC reviewed the acceptability of this instrumentation as part of their review of NUREG-0737, Item II.F.1.6. We find this to be a good faith attempt [as defined in NUREG-0737, Supplement No. 1, Section 3.7 (Reference 3)] to meet NRC requirements. Therefore, this instrumentation is acceptable.

4.1.11 Effluent Radioactivity
Containment Effluent Radioactivity
Common Plant Vent--Noble Gas and Vent Flow Rate

Regulatory Guide 1.97 recommends Category 2 instrumentation for these variables. The licensee states that there are two identified release points--the auxiliary building vent and the shield building vent. The licensee states that this instrumentation is located in a mild environment, has Class 1E battery-backed power, and provides ranges that are location and isotope dependent. The licensee has documented, in Reference 8, the ranges supplied. Gaseous effluents are monitored with overlapping instruments. The upper limit recommended by the regulatory guide is encompassed. Before the low-limit recommended is reached, an instrument that reads counts per minute is used. Thus, the entire range recommended by the regulatory guide is monitored. Therefore, this instrumentation is acceptable.

4.1.12 Radiation Exposure Rate

Regulatory Guide 1.97 recommends Category 3 instrumentation for this variable with a range of $10^{-1}$ R/hr to $10^{4}$ R/hr. The licensee has instrumentation that has ranges that are determined by the expected radiation level at its location. All told, the 23 channels cover from 0.1 mR/hr to $10^{8}$ R/hr. Therefore, the instrumentation provided for this variable is acceptable.

4.1.13 Residual Heat Removal (RHR) Flow

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable with a range of zero to 110 percent of design flow. Reference 8

identifies Category 2 instrumentation with a range of zero to 6000 gpm, which exceeds the 4000 gpm design flow by 50 percent. Therefore, the instrumentation provided for this variable is acceptable.

4.1.14 Accumulator Isolation Valve Position

Regulatory Guide 1.97 recommends Category 2 instrumentation to monitor the status of these valves. The licensee has provided Category 3 instrumentation for this variable.

The licensee states that these are motor-operated valves. The circuit breakers for these valves are locked open and de-energized prior to the RCS reaching 1000 psig during startup, but after the valves are verified to be open. Because these valves are open and cannot change position during or following an accident, we consider the instrumentation for this variable acceptable.

4.1.15 Boric Acid Charging Flow

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable with a range of zero to 110 percent of design flow. The licensee states that the zero to 110 gpm range exceeds the 105 gpm design flow of the positive displacement pump. Based on this design, the range is acceptable.

Environmental qualification of the instrumentation is not provided. The licensee states that this is not a safety system as in some other plants. The licensee also states that these pumps are automatically tripped on a safety injection signal (they can be restarted manually). Based on this design, we find that the instrumentation provided for this variable is acceptable.

4.1.16 Refueling Water Storage Tank Level

Regulatory Guide 1.97 recommends instrumentation for this variable that covers from the top to the bottom of the tank. The licensee's

instrumentation covers from six inches off the bottom to the top of the tank. At a six-inch level (one percent of tank volume), the tank is essentially empty. Therefore, we find this deviation from the recommendations of Regulatory Guide 1.97 acceptable.

4.1.17 Reactor Coolant Pump Status

Regulatory Guide 1.97 recommends Category 3 instrumentation that monitors the pump motor current. The licensee has chosen to monitor this variable by observing the reactor coolant system (RCS) flow. Based on the alternate instrumentation provided by the licensee, we conclude that the instrumentation provided to monitor the variable reactor coolant pump status is adequate and acceptable.

4.1.18 Primary System Safety Relief Valve Position

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable. The licensee has identified instrumentation for the pressurizer power operated relief valves (PORVs) that is in compliance with Regulatory Guide 1.97. The licensee has identified instrumentation for the code safety relief valves that is not environmentally qualified.

The licensee states that the operator cannot open, close, or isolate these valves; that they are for passive relief only; and that no automatic or manual function is initiated by the valve position. Because these valves cannot be isolated, and there are no automatic or manual operations because of the position of these valves, the Category 3 position indication for the safety relief valves is acceptable.

4.1.19 Quench Tank Level

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of from the top to the bottom of the tank. The range of the licensee's instrumentation is 3 percent to 99 percent of the pressurizer relief tank height.

We find this deviation minor and, therefore, acceptable. The range is capable of showing any expected accident or post-accident levels.

4.1.20 Steam Generator Pressure

Reference 8 identified acceptable instrumentation for this variable.

4.1.21 Main Feedwater Flow

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of zero to 110 percent of the design flow. Reference 8 shows that the instrumentation supplied by the licensee for this variable meets the requirements of Regulatory Guide 1.97. Therefore, the information provided by the licensee for this variable is acceptable.

4.1.22 Auxiliary Feedwater Flow

Reference 8 identified acceptable instrumentation for this variable.

4.1.23 Condensate Storage Tank Water Level

Regulatory Guide 1.97 recommends Category 3 instrumentation for this variable with a plant-specific range if another water source is used as the primary source of auxiliary feedwater. The licensee's instrumentation has a range of 2.4 percent to 100 percent and is satisfactory. The licensee states that the primary source of auxiliary feedwater is the service water system.

The licensee describes Category 1 indication (but no recording) that indicates the operation of the service water system: service water pump circuit breaker position, service water pump current, and valve position indication for SW-601A, SW-602B, and SW-502 (supply valves from the service water to the auxiliary feedwater pumps). These, together with auxiliary feedwater flow indication will properly indicate operation of the auxiliary feedwater system. Thus, the instrumentation supplied for the condensate storage tank water level is acceptable.

4.1.24 Containment Spray Flow

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable with a range of zero to 110 percent of design flow. The licensee states that this flow instrumentation does not exist, but describes alternate instrumentation.

The licensee has alternate Category 2 instrumentation, consisting of pump circuit breaker position, and valve position indication for valves ICS-5A, ICS-5B, ICS-6A, ICS-6B, RHR-400A, and RHR-400B. Additionally, the effectiveness of the containment spray can be shown by the trend of the containment pressure and temperature.

The alternate instrumentation provided by the licensee is adequate to monitor this variable. Therefore, this exception is acceptable.

4.1.25 Heat Removal by the Containme : Fan Heat Removal System

Regulatory Guide 1.97 recommends plant-specific Category 2 instrumentation for this variable. Reference 8 states that containment fan coil breaker position and containment fan coil service water valve position are used to verify the operation of the containment fan heat removal system to satisfy the plant specific requirements for this variable. We find this instrumentation acceptable for the variable heat removal by the containment fan heat removal system.

4.1.26 Containment Atmosphere Temperature

Regulatory Guide 1.97 recommends instrumentation with a range up to 400°F for this variable. The licensee's instrumentation is available in the technical support center and has a range up to 385°F. The licensee states that the containment design temperature is 268°F, and that the saturation temperature at 4 times the design pressure (see Section 3.3.11, Containment Pressure) is 382°F. Based on these statements, we find that the range is acceptable. While the display is not in the control room,

communication between the technical support center and the control room will exist in a post-accident situation. In addition, Category 3 containment temperature instrumentation is displayed in the control room.

We find the provided instrumentation for this variable acceptable.

4.1.27 Makeup Flow--In

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable with a range of zero to 110 percent of design flow. The licensee states that the zero to 110 gpm range exceeds the 105 gpm design flow of the positive displacement pump. Based on this design, the range is acceptable.

Environmental qualification of this instrumentation is not provided. The licensee states that this is not a safety system as in some other plants. The licensee also states that these pumps are automatically tripped on a safety injection signal (they can be restarted manually). Based on this design, we find that the instrumentation provided for this variable is acceptable.

4.1.28 Letdown Flow--Out

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable. The zero to 120 gpm range exceeds the zero to 110 percent of design flow recommended by the regulatory guide.

Environmental qualification of the instrumentation is not provided. The licensee states that this is not a safety system and that the letdown line is isolated by a containment isolation signal.

As this variable is not utilized in conjunction with a safety system, we find that the instrumentation provided is acceptable.

4.1.29 Volume Control Tank Level

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable with a range from the top to the bottom of the tank. The licensee has instrumentation with a range of 10.78 percent to 89.22 percent for this variable. Outside of the supplied instrument range, in the hemispherical vessel ends, the volume to level ratio is not linear (approximately 22 percent of the length of the vessel is not monitored). We find this deviation acceptable.

Environmental qualification of this instrumentation is not provided. The licensee states that the volume control tank is not a part of any safety system, and that safety systems do not take suction on this tank.

As this variable is not utilized in conjunction with a safety system, we find that the instrumentation provided is acceptable.

4.1.30 Component Cooling Water Flow to Engineered Safety Features System

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable with a range of zero to 110 percent of design flow. The licensee has provided Category 2 instrumentation with a range of zero to 8000 gpm for this variable. It is located in a mild environment. The range is slightly less than 10 percent of design flow. The 30 gpm difference is less than 4 percent of the range. We consider this deviation minor and acceptable.

4.1.31 High-Level Radioactive Liquid Tank Level

Regulatory Guide 1.97 recommends instrumentation for this variable with a range from the top to the bottom of the tank. The licensee has instrumentation with a range of 6.6 percent to 99.7 percent. Approximately 7 percent of the reactor coolant drain tank is not monitored. The display is located on the radwaste control panel, with an annunciator in the control room.

We find the control room annunciator in combination with the local level instrumentation acceptable for this variable.

4.1.32 Radioactive Gas Holdup Tank Pressure

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of zero to 150 percent of the tank design pressure. The licensee has instrumentation with a range of zero to 150 psig, whereas the recommended range would be zero to 225 psig. The licensee states that this tank has a relief valve set at 150 psig. Based on this justification, we conclude that the range provided for this variable is adequate to monitor the operation of these tanks and is, therefore, acceptable. The display is located on the radwaste control panel, with an annunciator in the control room. We find the control room annunciator, in combination with the local pressure instrumentation, acceptable for this variable.

4.1.33 Emergency Ventilation Damper Position

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable. Reference 8 describes appropriate Category 2 instrumentation for this variable. Therefore, the instrumentation provided by the licensee for this variable is acceptable.

4.1.34 Status of Standby Power

Regulatory Guide 1.97 recommends plant-specific Category 2 instrumentation to monitor parameters for those energy sources that are important to safety. In Reference 8, the licensee identifies the following as Category 2 instrumentation for this variable:

- Safeguards bus (zero to 5000-Vac) voltage
- Annunciators:
  - 125-Vdc LO volt
  - Circuit breaker trip

- Loss of AC volt

- HI-dc volt ac trip

- Loss of dc volt

- Ground detection alarm

The above instrumentation and annunciators are acceptable for monitoring the diesel generators, batteries, and battery chargers.

4.1.35 Condenser Air Removal System Exhaust--Noble Gas and Vent Flow Rate

Reference 8 identifies this variable as being discharged through the auxiliary building vent. The regulatory guide is specific that instrumentation dedicated to this variable is not needed if the discharge is through a monitored common plant vent. The auxiliary building vent release is monitored in the radiological assessment facility with Category 2 instrumentation. We find the location acceptable. The vent flow rate is estimated based on the number of fans in operation.

The licensee states that this instrumentation was approved as part of the NRC review of NUREG-0737, Item II.F.1. We find this to be a good faith attempt [as defined in NUREG-0737, Supplement No. 1, Section 3.7 (Reference 3)] to meet NRC requirements. Therefore, this instrumentation is acceptable.

4.1.36 Vent from Steam Generator Safety Relief Valves

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable with a range of $10^{-1}$ µCi/cc to $10^{3}$ µCi/cc, duration of release and mass of release per unit time. Reference 8 describes this instrumentation. It is shown to meet the recommendations of Regulatory Guide 1.97 for this variable.

4.1.37 Particulates and Halogens

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of $10^{-3}$ to $10^{2}$ µCi/cc. The licensee's instrumentation deviates slightly from these recommendations as shown below:

| | Regulatory Guide 1.97, Revision 3 | Auxiliary Building Stack | Containment Building Stack |
|---|---|---|---|
| Beta particulate | $10^{-3}$ to $10^{2}$ µCi/cm$^3$ | $9.38 \times 10^{-4}$ to 22.1 µCi/cm$^3$ | $1.02 \times 10^{-3}$ to 24 µCi/cm$^3$ |
| Iodine | $10^{-3}$ to $10^{2}$ µCi/cm$^3$ | $1.12 \times 10^{-3}$ to 26.3/µCi/cm$^3$ | $1.1 \times 10^{-3}$ to 25.8 µCi/cm$^3$ |

The licensee states that this instrumentation was approved as part of the NRC review of NUREG-0737, Item II.F.1. We find this to be a good faith attempt [as defined in NUREG-0737, Supplement No. 1, Section 3.7 (Reference 3)] to meet NRC requirements. Therefore, this instrumentation is acceptable.

4.1.38 Airborne Radiohalogens and Particulates

Regulatory Guide 1.97 recommends portable sampling for this variable with onsite analysis capability over the range of $10^{-9}$ µCi/cc to $10^{-3}$ µCi/cc. In Reference 8, the licensee describes the use of portable sampling and analysis that is in accordance with the regulatory guide. Therefore, we find the instrumentation provided for this variable acceptable.

4.1.39 Plant and Environs Radiation

Regulatory Guide 1.97 recommends portable instrumentation for this variable. It recommends a range of $10^{-3}$ R/hr to $10^{4}$ R/hr for photons and $10^{-3}$ rads/hr to $10^{4}$ rads/hr for beta and low energy photons. In Reference 8, the licensee identifies portable instrumentation with ranges that exceed those recommended. Therefore, we find the instrumentation provided for this variable acceptable.

4.1.40 Plant and Environs Radioactivity

Regulatory Guide 1.97 recommends a portable gamma ray spectrometer for this variable. In Reference 8, the licensee describes the capability of sampling and performing an onsite isotopic analysis.

The laboratory equipment at this station can provide isotopic analysis and a timely assessment of radioactive releases. Therefore, this instrumentation is acceptable for meeting the recommendations of Regulatory Guide 1.97.

4.1.41 Wind Direction

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of zero to 360°. In Reference 8, the licensee states that their wind direction instrumentation meets this range and has been approved by the NRC in the NRC review of NUREG-0737, Item III.A.2. Therefore, we find the provided instrumentation acceptable for this variable.

4.1.42 Wind Speed

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of zero to 50 miles per hour. In Reference 8, the licensee states that their wind-speed instrumentation meets this range and has been approved by the NRC in the NRC review of NUREG-0737, Item III.A.2. Therefore, we find the provided instrumentation acceptable for this variable.

4.1.43 Estimation of Atmospheric Stability

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of -9°F to +18°F or an analogous range for alternative stability analysis. The licensee's instrumentation has a range of -5°F to +10°F. The licensee justifies this in Reference 8, stating that this range

adequately defines the seven stability classifications contained in the Kewaunee E-Plan, and that this instrumentation has been approved by the NRC in the NRC review of NUREG-0737, Item III.A.2.

Table 1 of Regulatory Guide 1.23 (Reference 10) provides seven atmospheric stability classifications based on the difference in temperature per 100-meter elevation change. These classifications cover from extremely unstable to extremely stable. A temperature difference greater than +4°C or less than -2°C has no impact in the stability classification. The licensee's instrumentation includes this range. Therefore, we find that this instrumentation is acceptable for determining atmospheric stability.

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

Regulatory Guide 1.97 recommends sampling and on-site analysis capability for the reactor coolant system, containment sump, emergency core cooling system pump room sumps, other auxiliary building sump liquids, and containment air. The licensee states that their post-accident sampling system was installed to the requirements of NUREG-0737. The licensee's analysis capability provides for the limits recommended, except as follows:

- Boron content: 0.2 ppm instead of 0.0 ppm
- Chloride content: 0.05 ppm instead of 0.0 ppm
- Dissolved hydrogen: 6 to 1800 $cm^3/kg$ instead of zero to 2000 $cm^3/kg$
- Dissolved oxygen: 0.1 ppm instead of 0.0 ppm.

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 has been addressed by the NRC as part of their review of NUREG-0737, Item II.B.3.

## 4.2 Deviations Not Accepted Based on the October 24, 1988 Submittal

The licensee identified deviations from the recommendations of Regulatory Guide 1.97. Reference 8 identified these deviations; however, for the reasons outlined below, these deviations were found to be not acceptable. In some cases there are significant technical deviations or exceptions that should be discussed in detail.

### 4.2.1 Neutron Flux

Regulatory Guide 1.97 recommends Category 1 instrumentation with a range of $10^{-6}$ percent to 100 percent of full power for this variable. The licensee's instrumentation consists of three sets of redundant instrumentation with overlapping ranges. The source range instruments have a range of $10^{-9}$ percent to $10^{-3}$ percent of full power. The intermediate range instruments have a range of $10^{-6}$ percent to 100 percent of full power. The power range instruments have a range of 0.1 percent to 100 percent of full power. None of these instruments is environmentally or seismically qualified.

The licensee states (Reference 8) that they will install an instrument that will eliminate any noncompliance with Regulatory Guide 1.97 when the total accident monitoring instrumentation review is resolved. We find the licensee's commitment to upgrade this instrumentation acceptable. However, since the licensee agrees that this instrumentation should be upgraded, the licensee should schedule the modifications and not wait for the complete resolution of the other post-accident monitoring issues. In addition, the licensee should verify that the commitment made includes installation of at least two redundant channels of instrumentation that cover the recommended range.

### 4.2.2 RCS Cold Leg Water Temperature

Regulatory Guide 1.97 recommends Category 1 instrumentation with a range of 50°F to 700°F for this variable. The licensee identifies

instrumentation, portions of which do not meet the redundancy recommendations of the regulatory guide, with a range of 50°F to 650°F. The licensee states that since the normal operating temperature is 530°F, and because core exit thermocouples provide more accuracy at any temperature in excess of 650°F, the range is acceptable. The range is not acceptable because, if the temperature were in excess of 650°F, the operator would have to contend with instrumentation that is off scale and could be considered inoperative.

The licensee states that the nonredundant portions of this instrumentation will be corrected. A schedule to resolve this discrepancy will be submitted following resolution of the remaining questions surrounding WPSC's Regulatory Guide 1.97 methodology. We find the licensee's commitment to upgrade the instrumentation acceptable. However, since the licensee agrees that this instrumentation should be upgraded, the licensee should schedule the modifications and not wait for the complete resolution of the other post-accident monitoring instrumentation issues. The licensee should also commit to rescale the instruments so that they will remain on scale during any post-accident situation.

4.2.3 RCS Hot Leg Water Temperature

Regulatory Guide 1.97 recommends Category 1 instrumentation with a range of 50°F to 700°F for this variable. The licensee identifies instrumentation, portions of which do not meet the redundancy recommendations of the regulatory guide, with a range of 50°F to 650°F. The licensee states that since the normal operating temperature is 590°F, and because core exit thermocouples provide more accuracy at any temperature in excess of 650°F, the range is acceptable. The range is not acceptable because, if the temperature were in excess of 650°F, the operator would have to contend with instrumentation that is off scale and could be considered inoperative.

The licensee states that the nonredundant portions of this instrumentation will be corrected. A schedule to resolve this discrepancy

will be submitted following resolution of the remaining questions surrounding WPSC's Regulatory Guide 1.97 methodology. We find the licensee's commitment to upgrade the instrumentation acceptable. However, since the licensee agrees that this instrumentation should be upgraded, the licensee should schedule the modifications and not wait for the complete resolution of the other post-accident monitoring instrumentation issues. The licensee should also commit to rescale the instruments so that they will remain on scale during any post-accident situation.

4.2.4 RCS Pressure

Regulatory Guide 1.97 recommends Category 1 instrumentation for this variable. The licensee's instrumentation has not been shown to meet the seismic qualification recommendations for Category 1 instruments.

The licensee states that this instrumentation is still being evaluated for seismic qualification (Reference 8). The licensee further states that this instrumentation will be upgraded to include seismic qualification if seismic qualification cannot be verified. This commitment is acceptable; however, the licensee should inform the NRC of the final disposition of this evaluation, commitment, and schedule.

4.2.5 Degrees of Subcooling

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable with a range of 200°F subcooling to 35°F superheat. The licensee identified (Reference 8) instrumentation for this variable; however, the range was not identified as required by Section 6.2 of Supplement No. 1 of NUREG-0737. The licensee states that this instrumentation meets the requirements of NUREG-0737, Item II.F.2. The NRC has reviewed the acceptability of this variable as part of their review of NUREG-0737, Item II.F.2.

We find this to be a good faith attempt [as defined in NUREG-0737, Supplement No. 1, Section 3.7 (Reference 3)] to meet NRC requirements.

Therefore, this instrumentation is acceptable. However, the licensee should document the range as required by Supplement No. 1 of NUREG-0737.

4.2.6 Containment Isolation Valve Position

Regulatory Guide 1.97 recommends Category 1 instrumentation for this variable. The licensee indicates that position recording (a Category 1 recommendation) is not provided for any valves. Some containment isolation valves are otherwise acceptable as is; some have been upgraded to Category 1 (except for recording) in accordance with Design Change Request (DCR) 1522. For the remaining containment isolation valves (Valves ICS-201, ICS-202, NG-302, BT-32A, BT-32B, and NG-107) limit switches, the licensee states that they will schedule the upgrade of this indication (but apparently with no recording) when the other post-accident monitoring issues are resolved.

We find the licensee's commitment to upgrade this instrumentation acceptable. However, since the licensee agrees that this instrumentation should be upgraded, the licensee should schedule the modifications and not wait for the complete resolution of the other post-accident monitoring issues. The licensee did not justify the lack of recording. The licensee should identify the means of recording the position of the containment isolation valves.

4.2.7 Residual Heat Removal (RHR) Heat Exchanger Outlet Temperature

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable with a range of 40°F to 350°F. The licensee's instrumentation has a range of 100°F to 400°F and is not environmentally qualified. The licensee states that the plant is in refueling shutdown mode if the RCS temperature is less than 140°F. Based on this safe shutdown condition, the range of 100°F to 400°F is acceptable.

The licensee states that environmental qualification is not needed for this instrumentation because there are no procedural or guideline requirements to use this instrumentation.

This instrumentation is not only to monitor the operation of the RHR system, it is also to be provided for analysis. For example, in conjunction with RHR flow and the containment sump-water temperature, a quantitative analysis of the heat removed from inside containment can be performed. The licensee has not addressed the analytical aspects of this instrumentation. Therefore, we find that environmentally qualified instrumentation should be provided for this instrumentation in accordance with 10 CFR 50.49 and Regulatory Guide 1.97.

4.2.8 Accumulator Tank Level and Pressure

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable with a range of 10 percent to 90 percent of the tank volume (level) and zero to 750 psig pressure. Environmentally qualified instrumentation is necessary to monitor the status of these tanks. The licensee has instrumentation with ranges of 59 percent to 68 percent level and zero to 800 psig pressure. No environmental qualification is provided for this instrumentation. The licensee states that this is not needed because operators are not procedurally required to use this instrumentation.

Regardless of procedural requirements, environmentally qualified instrumentation should be available to the operator to monitor the status of the accumulators through the course of an accident.

The licensee should designate either level or pressure as the key variable to directly indicate accumulator discharge and provide instrumentation for that variable that meets the requirements of Regulatory Guide 1.97 and 10 CFR 50.49. Should level be the key variable, the range of the level instruments should be expanded to meet the recommendations of Regulatory Guide 1.97.

4.2.9 Flow in High-Pressure Injection System

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable with a range of zero to 110 percent of design flow. Category 2

instrumentation should be environmentally qualified for the post-accident environment that the instrumentation would be exposed to. Environmental qualification is not provided. The licensee's instrumentation has a range of zero to 1500 gpm (107 percent of design flow). We find this range adequate and acceptable..

The licensee states that operators are not required to determine the flow rate, and that system operation can be verified by pump circuit breaker position, pump current, and valve position. All this instrumentation is either in a mild environment, or the valves are locked open, or the valves will be positioned prior to the occurrence of harsh environment.

Regardless of procedural requirements, environmentally qualified instrumentation should be available to the operator to monitor the flow through this safety system. The licensee should therefore provide instrumentation that is environmentally qualified in accordance with the provisions of 10 CFR 50.49 and Regulatory Guide 1.97.

4.2.10 Flow in Low-Pressure Injection System

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable. Category 2 instrumentation should be environmentally qualified for the post-accident environment that the instrumentation would be exposed to. The licensee's instrumentation is not environmentally qualified. The licensee states that operators are not required to determine the flow rate, and that system operation can be verified by pump (residual heat removal) circuit breaker position, pump current, and valve position. All this instrumentation is either in a mild environment, the valves are locked open, or will be positioned prior to the occurrence of a harsh environment.

Regardless of procedural requirements, environmentally qualified instrumentation should be available to the operator to monitor the flow through this safety system. The licensee should, therefore, provide

instrumentation that is environmentally qualified in accordance with the provisions of 10 CFR 50.49 and Regulatory Guide 1.97.

4.2.11 Pressurizer Level

Regulatory Guide 1.97 recommends Category 1 instrumentation for this variable with a range from the bottom to the top of the pressurizer. The licensee has identified Category 1 instrumentation for the pressurizer level; however, the range only covers 269.5-inch out of the 356.83-inch length of the vessel (75.5%) (Reference 6). Reference 8 indicates the display of this range is zero to 100 percent, but does not identify the location of the instrumentation taps.

The licensee provided no justification for this deviation, such as the location of the heaters and PORVs in relation to the supplied range or an analysis of the expected post-accident levels. Therefore, we cannot find the range acceptable.

The licensee should provide adequate justification for the range provided.

4.2.12 Pressurizer Heater Status

Regulatory Guide 1.97 recommends Category 2 current meters to monitor the current drawn by the pressurizer heaters. This instrumentation is an aid to preclude the overloading of emergency power sources and to determine that the heaters are actually functioning. The licensee has circuit breaker position available to the operator. The licensee states that since the heaters are either on or off, circuit breaker position indication is sufficient.

The circuit breaker position will not show that the heater is actually functioning, producing heat. Breaker position will only show that the circuit breaker is closed. The licensee should identify Category 2 instrumentation that conclusively shows that the pressurizer heaters are operating and functioning.

4.2.13 Quench Tank Temperature

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of 50°F to 750°F. The range of the licensee's instrumentation is zero to 300°F. The licensee states that discharges into this tank are throttled by the PORVs or safety valves. This throttling action is said to limit the temperature of the pressurizer relief tank contents.

The pressurizer relief tank has a design pressure of (and, we assume, a rupture disk set at) 100 psig. The range of the temperature instrumentation should be increased to read the saturation temperature corresponding to the rupture disk relief pressure.

4.2.14 Quench Tank Pressure

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of zero to design pressure (100 psig). The range of the licensee's instrumentation (zero to 50 psig) is said to be sufficient for normal operation, and that the instrument is not required for post-accident situations.

The licensee has not stated that flow into this tank can be limited to prevent the pressure from exceeding the range of this instrumentation. We assume this design includes a rupture disk at the design pressure of the tank (100 psig). Based on this, the range should be extended to cover the design pressure of the tank.

4.2.15 Steam Generator Level

Regulatory Guide 1.97 recommends wide-range Category 1 instrumentation for this variable with a range from the tube sheet to the separators. The licensee has identified Category 1 narrow range channels (from U-tube to separators). The licensee has not identified any wide-range level instrumentation.

The licensee has narrow range steam generator level instrumentation that meets the Category 1 recommendations of Regulatory Guide 1.97; however, they do not meet the range that is recommended. The licensee should identify Category 1 wide-range level steam generator instrumentation to monitor the steam generator level over the limits needed for any postulated post-accident or transient situation as recommended by Regulatory Guide 1.97.

4.2.16 Containment Sump Water Temperature

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable with a range from 50°F to 250°F. The licensee indicates that there is no procedural requirement that would use this variable in a post-accident situation. Therefore, there is no instrumentation for containment sump water temperature. However, the licensee states that the RHR heat exchanger inlet temperature instrumentation (range: 50°F to 450°F) will indicate the temperature of the sump contents when the RHR is in the recirculation mode. The instrumentation meets the Category 2 recommendations except for environmental qualification. Thus, it is not acceptable for use as post-accident instrumentation. We find that this instrumentation would be acceptable as an alternate indication for this variable if it were environmentally qualified. The licensee should environmentally qualify this instrumentation in accordance with 10 CFR 50.49 and Regulatory Guide 1.97.

4.2.17 Component Cooling Water (CCW) Temperature to Engineered Safety Features (ESF) System

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable with a range from 40°F to 200°F. The licensee has provided instrumentation with a range of 50°F to 200°F for this variable. The instrumentation measures the pump discharge temperature of this closed loop system. The deviation of 10°F out of the maximum span of 200°F is 5 percent. We consider this deviation minor and acceptable.

Environmental qualification of the instrumentation is not provided. The licensee states that there are no automatic or manual actions based on this instrumentation and that there are no procedural requirements for the operators to consult this instrumentation. The licensee has not indicated any design analysis of the temperature limits of the CCW system nor the potential consequences of exceeding the design limits of the ESF system components. The licensee should therefore provide instrumentation that is environmentally qualified in accordance with the provisions of 10 CFR 50.49 and Regulatory Guide 1.97.

## 4.3 Interfaces, Redundancy, and Separation

Regulatory Guide 1.97 recommends that qualified isolation devices be used wherever Category 1 instrumentation interfaces with non-Category 1 instrumentation or control circuits and wherever Category 2 instrumentation interfaces with non-Category 2 instrumentation or control circuits. Regulatory Guide 1.97 also recommends that Category 1 instrument channels be protected against potential single failures by applying the redundancy and separation criteria of Regulatory Guide 1.75 up to and including any isolation devices. The licensee needs to address, in detail, these Regulatory Guide 1.97 requirements.

### 4.3.1 Interfaces

Isolation devices are required between Category 1 instrumentation and any equipment that does not meet the same design criteria per Section 9 of Table 1 of Regulatory Guide 1.97, Revision 3. We are unable to establish the acceptablility of interfaces provided for non-Category 1 applications. For example, the Category 1 wide-range containment sump water level instrumentation is monitoried on a computer point as well as by Category 1 indicators. The licensee did not identify the computer as meeting Category 1 design criteria or address any isolation devices between the instrumentation and the computer. The licensee should address the isolation devices provided for each Category 1 variable.

4.3.2 Redundancy and Separation

The licensee states that the redundancy and separation of Category 1 instrumentation meets the definition established in Section 8.2.2 of the Updated Safety Analysis Report (USAR). It is stated that these requirements are different from those of Regulatory Guide 1.75, which is imposed by Regulatory Guide 1.97, Revision 3, because the Kewaunee plant design precedes Regulatory Guide 1.75, and the endorsed IEEE Standard 384-1974.

We have examined Section 8.2.2 of the USAR, and find that it discusses, in general terms, the elements of separation that were used in the design of the Kewaunee plant. This design was reviewed and approved by the NRC for the then existing instrumentation. We find this to be a good faith attempt [as defined in NUREG-0737, Supplement No. 1, Section 3.7 (Reference 3)] to meet NRC requirements. Therefore, the redundancy and separation is acceptable for those Category 1 variables where modifications are not otherwise being made. In no case is the approval of this deviation meant to preclude the use of redundant (i.e., two or more) channels of instrumentation for Category 1 or Type A variables.

However, for those variables where the licensee is scheduling modifications to bring the instrumentation into compliance with aspects of Regulatory Guide 1.97, the licensee should provide the redundancy and separation recommended by the regulatory guide.

## 5. 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. Type A variables -- The licensee should identify plant specific Type A variables and verify that the instrumentation provided for these variables meets the Category 1 criteria. (Section 3.2)

2. Neutron flux -- The licensee should schedule the modifications necessary to bring this instrumentation into conformance with the Category 1 requirements and verify that the modifications proposed will bring this instrumentation into full compliance with Regulatory Guide 1.97. (Section 4.2.1)

3. RCS cold leg water temperature - The licensee should schedule the modifications necessary to make this instrumentation fully redundant. The licensee should rescale the instrumentation so that it will remain on scale during any postulated accident. (Section 4.2.2)

4. RCS hot leg water temperature -- The licensee should schedule the modifications necessary to make this instrumentation fully redundant. The licensee should rescale the instrumentation so that it will remain on scale during any postulated accident. (Section 4.2.3)

5. RCS pressure -- The licensee should inform the NRC of the final disposition of the seismic evaluation and commitment for this instrumentation. (Section 4.2.4)

6. Degrees of subcooling -- The licensee should document the range of this instrumentation. (Section 4.2.5)

7. Containment isolation valve position -- The licensee should schedule the modifications necessary to bring this instrumentation into conformance with the Category 1 requirements. The licensee should identify the means of recording the position of the containment isolation valves. (Section 4.2.6)

8. RHR heat exchanger outlet temperature -- The licensee should provide environmentally qualified (in accordance with 10 CFR 50.49 and Regulatory Guide 1.97) instrumentation for this variable. (Section 4.2.7)

9. Accumulator tank level and pressure -- The licensee should designate either level or pressure as the key variable and upgrade that instrumentation to Category 2. Should level be defined as the key variable, then the range should be expanded to meet the requirements of Regulatory Guide 1.97. (Section 4.2.8)

10. Flow in high-pressure injection system -- The licensee should provide environmentally qualified (in accordance with 10 CFR 50.49 and Regulatory Guide 1.97) instrumentation for this variable. (Section 4.2.9)

11. Flow in low-pressure injection system -- The licensee should provide environmentally qualified (in accordance with 10 CFR 50.49 and Regulatory Guide 1.97) instrumentation for this variable. (Section 4.2.10)

12. Pressurizer level -- The licensee should justify the provided range. (Section 4.2.11)

13. Pressurizer heater status -- The licensee should provide Category 2 instrumentation that conclusively shows that the pressurizer heaters are operating and functioning. (Section 4.2.12)

14. Quench tank temperature -- The range of the instrumentation should be increased to include the saturation temperature at 100 psig. (Section 4.2.13)

15. Quench tank pressure -- The range of the instrumentation should be increased to the design pressure of the tank. (Section 4.2.14)

16. Steam generator level -- The licensee should identify Category 1 wide-range instrumentation for this variable. (Section 4.2.15)

17. Containment sump water temperature -- The licensee should provide environmental qualification (in accordance with 10 CFR 50.49 and Regulatory Guide 1.97) for the RHR heat exchanger inlet temperature instrumentation. (Section 4.2.16)

18. CCW temperature to ESF system component -- The licensee should provide environmentally qualified (in accordance with 10 CFR 50.49 and Regulatory Guide 1.97) instrumentation for this variable. (Section 4.2.17)

19. Interfaces -- The licensee should address the design qualifications of the isolation devices provided for Category 1 and Category 2 variables. (Section 4.3.1)

20. Redundancy and separation -- Any modifications to bring Category 1 or Type A instrumentation into compliance with Regulatory Guide 1.97 should include the redundancy and separation recommended by the regulatory guide. (Section 4.3.2)

## 6. REFERENCES


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13. ABSTRACT (200 words or less)

This EG&G Idaho, Inc., report reviews the submittals for the Kewaunee Nuclear Power Plant, and identifies areas of nonconformance to Regulatory Guide 1.97. Exceptions to these guidelines are evaluated and those areas where sufficient basis for acceptability is not provided are identified.

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