UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

CONFORMANCE TO REGULATORY GUIDE 1.97

IOWA ELECTRIC LIGHT AND POWER COMPANY

DUANE ARNOLD ENERGY CENTER

DOCKET NO. 50-331

1.0 INTRODUCTION

Iowa Electric Light and Power Company was requested by Generic Letter 82-33 to provide a report to NRC describing how the post-accident monitoring instrumentation meets the guidelines of Regulatory Guide (R.G.) 1.97 as applied to emergency response facilities. The licensee responded to Item 6.2 of the generic letter on July 3, 1985. Additional information was provided by letters dated October 16, 1985, March 31, 1987, and May 3, 1989.

A detailed review and technical evaluation of the licensee's submittals was performed by EG&G Idaho, Inc., under a contract to the NRC, with general supervision by the NRC staff. This work was reported by EG&G in Technical Evaluation Report (TER), "Conformance to Regulatory Guide 1.97: Duane Arnold," Revision 1 dated September 1989 (attached). We have reviewed this report and concur with the conclusion that the licensee either conforms to, or has adequately justified deviations from, the guidance of R.G. 1.97 for each post-accident monitoring variable except for the variable neutron flux.

2.0 EVALUATION CRITERIA

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 R.G. 1.97. At these meetings, it was established that the NRC review would only address exceptions taken to the guidance of R.G. 1.97. Further, where licensees or applicants explicitly state

that instrument systems conform to provisions of the regulatory guide, no further staff review would be necessary for those items. Therefore, the review performed and prepared by EG&G only addresses exceptions to the guidance of R.G. 1.97. This safety evaluation addresses the licensee's submittals based on the review policy described in the NRC regional meetings and the conclusions of the review as reported by EG&G.

3.0 EVALUATION

The staff has reviewed the evaluation performed by EG&G contained in the attached TER and concurs with its bases and findings. The licensee either conforms to, or has provided an acceptable justification for deviations from the guidance of R.G. 1.97 for each post-accident monitoring variable except for the variable neutron flux.

R.G. 1.97 recommends Category 1 neutron flux monitoring instrumentation to monitor reactivity control. The licensee has provided neutron flux monitoring instrumentation which conforms to the Category 1 criteria of R.G. 1.97 except for source and intermediate range monitor drive mechanism and controls, the flexible portions of the detector cabling, and the power sources. The justification provided by the licensee for not fully qualifying the neutron flux monitoring instrumentation is that the present instrumentation consists of a large number of independent channels and the operator instructions require the insertion of the neutron flux detectors immediately following a SCRAM. The licensee also stated that they will conform to the Boiling Water Reactor Owners Group (BWROG) Licensing Topical Report, "Position on NRC Regulatory Guide 1.97, Revision 3, Requirements for Post Accident Monitoring System," NEDO-31558, dated March 14, 1988.

The staff concluded that the BWROG position was unacceptable, in a letter dated January 29, 1990, to the Chairman of the BWROG. By letter dated February 21, 1990, the BWROG took exception to several items in the staff's supporting Safety Evaluation Report. The staff is currently reviewing the BWROG concerns and will transmit a final position in the near future.

It is the staff's position that the licensee should evaluate the newly developed neutron flux monitoring systems and either install neutron flux monitoring instrumentation which complies with the Category 1 criteria of R.G. 1.97 or commit to comply with the final staff position on the issue. It has been concluded by the staff that the existing neutron flux monitoring instrumentation is acceptable for operation pending satisfactory implementation of a fully qualified indication system.

4.0 CONCLUSION

Based on the staff's review of the attached TER and the licensee's submittals, the staff finds that the Duane Arnold Energy Center design is acceptable with respect to conformance to R.G. 1.97, Revision 2, except for the instrumentation associated with the variable neutron flux.

The staff finds acceptable the existing neutron flux instrumentation for interim operation. It is the staff's position that the licensee shall install neutron flux monitoring instrumentation which complies with the Category 1 criteria of R.G. 1.97, Revision 2, or commit to comply with the final staff position in response to the concerns raised by the BWROG.

Attachment:
Technical Evaluation Report,
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TECHNICAL EVALUATION REPORT

CONFORMANCE TO REGULATORY GUIDE 1.97:
DUANE ARNOLD

Alan C. Udy

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TECHNICAL EVALUATION REPORT

CONFORMANCE TO REGULATORY GUIDE 1.97: DUANE ARNOLD

Docket No. 50-331

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SUMMARY

This EG&G Idaho, Inc., report documents the review of the Regulatory Guide 1.97, Revision 2, submittals for the Duane Arnold Energy Center and identifies areas of nonconformance to the regulatory guide. Exceptions to Regulatory Guide 1.97 are evaluated; 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 Systems Technology, by EG&G Idaho, Inc., Regulatory and Technical Assistance Unit.

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CONFORMANCE TO REGULATORY GUIDE 1.97: DUANE ARNOLO

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).

Iowa Electric Light and Power Company, the licensee for the Duane Arnold Energy Center, provided a response to Section 6.2 of the generic letter on July 3, 1985 (Reference 4). Schedular information was provided on October 16, 1985 (Reference 5). Additional information was provided on March 31, I987 (Reference 6). A submittal dated May 3, 1989 (Reference 7), revised some of the earlier commitments.

This report is based on the recommendations of Regulatory Guide 1.97, Revision 2, and compares the instrumentation proposed in the licensee's submittals with these recommendations.

2. REVIEW REQUIREMENTS

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

1. instrument range
2. environmental qualification
3. seismic qualification
4. quality assurance
5. redundance and sensor location
6. power supply
7. location of display
8. schedule of installation or upgrade

The submittals should identify deviations taken from the recommendations of Regulatory Guide 1.97 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. It was also noted that where licensees or applicants explicitly state that instrument systems conform to the

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

3. EVALUATION

The licensee provided a response to Item 6.2 of NRC Generic Letter 82-33 on July 3, 1985. Schedular information was provided on October 16, 1985. Additional information was provided on March 31, 1987. Revised commitments were identified on May 3, 1989. The responses describe the licensee's position on post-accident menitoring instrumentation. This evaluation is based on these submittals.

3.1 Adherence to Regulatory Guide 1.97

The licensee provided a review of their post-accident monitoring instrumentation that compares the instrumentation characteristics against the recommendations of Regulatory Guide 1.97, Revision 2. The licensee identifies instrumentation that will be modified to meet the regulatory guide, and provides justification for instrumentation that will deviate from the recommendations of the regulatory guide. The licensee scheduled identified modifications for completion during the Cycle 10 refueling outage. Therefore, we conclude that the licensee has provided an explicit commitment on conformance to Regulatory Guide 1.97. Exceptions to and deviations from the regulatory guide are noted in Section 3.3.

3.2 Type A Variables

Regulatory Guide 1.97 does not specifically identify Type A variables, i.e., those variables that provide the information required to permit the control room operator to take specific, manually controlled safety actions. The licensee states that all safety systems accomplish their safety functions by automatic control. Therefore, there are no specific, manually controlled safety actions. Because of this, the licensee does not have any Type A variables.

3.3 Exceptions to Regulatory Guide 1.97

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

3.3.1 Neutron Flux

Regulatory Guide 1.97 recommends Category 1 instrumentation for this variable. The licensee states that the source range monitor and intermediate range monitor drive mechanisms and controls, the flexible portions of the detector cabling, and the power sources (reactor protection system [RPS] power supplies) are not Category 1. The licensee states that the present instrumentation is acceptable due to the large number of independent channels and the operator instructions to insert the detectors immediately following a SCRAM, before adverse environmental conditions would cause drive mechanism failure. The RPS power supplies have Class 1E protection.

During our review of neutron flux instrumentation for boiling water reactors, we noted that the mechanical drives of the detectors and their cables have not satisfied the environmental qualification requirement of Regulatory Guide 1.97. A Category 1 system that meets all the criteria of Regulatory Guide 1.97 has been an industry development item. Based on our review, we conclude that the existing instrumentation is acceptable for interim operation.

The licensee states that they will conform to the BWR Owners Group topical report on neutron flux monitoring. This topical report has been submitted, with NRC review now proceeding. The licensee should commit to conform to the outcome of the NRC review of the BWR Owners Group topical report on neutron flux monitoring.

3.3.2 Coolant Level in Reactor

Regulatory Guide 1.97 recommends Category 1 instrumentation for this variable with a range from the bottom of the core support plate to the centerline of the main steamline. The licensee relates this to -153 inches (below the top of active fuel) to 276 inches (above the top of active fuel). The licensee has Category 1 instrumentation, except from 218 to 276 inches. This portion of the range is covered by a single channel of floodup range instrumentation.

The licensee states that no operator actions are required above 218 inches, nor is confirmation of automatic or operator action required. The licensee indicates that the instrument taps are located at 218 inches. Any extension of the range covered by Category 1 instrumentation would require additional instrument taps in the reactor vessel. Additionally, the floodup range (used for refueling) is calibrated for ambient conditions not operating conditions, but it will establish any trend in water level on that range. Overlap with the wide range instruments is provided.

As previously stated, all manual and automatic safety functions are initiated in the range covered by the safety-related wide range level instrumentation. The licensee has concluded that the existing 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 floodup range channel.

We find that a second floodup range channel, with both channels upgraded to Category 1, would not result in a significant increase in plant safety. We conclude that the single non-Class 1E floodup range channel is acceptable.

3.3.3 Drywell Sump Level
Drywell Drain Sumps Level

Regulatory Guide 1.97 recommends Category 1 instrumentation for these variables. The licensee has supplied Category 3 instrumentation for the sump leakage flow rate instead of sump level. In Reference 7, the licensee states that the cables of these two instrument systems will not be rerouted to separate the two systems. The leakage rate is determined by the sump pump running time and time between pump starts. The pump is started by fixed position level switches. The drywell sump systems are automatically isolated at the primary containment penetration should an accident signal occur. The licensee states that drywell pressure, drywell temperature and primary containment area radiation also indicate reactor coolant system leakage.

We conclude that the alternate instrumentation supplied by the licensee will provide appropriate monitoring for the parameters of concern. This conclusion is based on the following.

a. For small leaks, the alternate instrumentation is not expected to experience harsh environments during operation.

b. For larger leaks, the sumps fill promptly and the sump drain lines isolate due to the increase in drywell pressure; thus, negating the drywell sump flow and drywell drain sump flow instrumentation.

c. The drywell pressure and temperature, as well as the primary containment area radiation instrumentation, can be used to detect leakage in the drywell.

d. This instrumentation neither automatically initiates nor alerts the operator to initiate operation of a safety-related system in a post-accident situation.

Therefore, we find that the alternate Category 3 instrumentation provided is acceptable.

3.3.4 Radiation Level in Circulating Primary Coolant

The licensee indicates that the critical actions to be taken in the event of an accident are to (a) shut down the reactor and (b) maintain the water level in the reactor vessel. This variable does not initiate any automatic or operator action and does not influence either critical action. The licensee indicates that radiation level measurements to indicate fuel cladding failure are provided by the following:

a. Main steamline radiation monitors

b. Drywell high range radiation monitors

c. Primary containment area radiation monitors

d. Post-accident sampling system

The post-accident sampling system has been reviewed by the NRC as part of their review of NUREG-0737, Item II.8.3. Additionally, containment and drywell hydrogen concentration indicates the extent of fuel failure.

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

3.3.5 Containment and Drywell Hydrogen Concentration

Regulatory Guide 1.97 recommends instrumentation for this variable with a range from zero to 30 percent. The licensee's instrumentation has a range of zero to 20 percent.

The licensee states that the containment is inerted. Therefore, monitoring for the potential breach of containment includes monitoring the oxygen concentration with instrumentation that meets the recommendations of Regulatory Guide 1.97. The licensee states that both the lower flammability limit of hydrogen (4 percent) and the lower explosive limit of hydrogen (18 percent) are included in the range of the hydrogen concentration instrumentation supplied. The licensee states that the detection of the potential for a breach of containment is also monitored by the drywell pressure and the reactor coolant system pressure. The licensee states that the range of the hydrogen concentration instrumentation includes the range recommended by NUREG-0737, Item II.F.1.6.

The NRC has reviewed the acceptability of this variable as part of the staff's review of NUREG-0737, Item II.F.1.6.

3.3.6 Radiation Exposure Rate

Revision 2 of Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable with a range of 10^{-I} to 10^{4} R/h. The licensee indicates that there are Category 3 instruments with ranges that are typically 3 decades lower than the recommended range. These instruments alarm on increasing radiation. The licensee acknowledges that these instruments could saturate offscale following an accident. As Revision 3 of Regulatory Guide 1.97 (Reference 8) recommends Category 3 instrumentation, we find the use of Category 3 instrumentation acceptable.

The licensee states that access is not required to service safety-related equipment, and that should access be required, it is established by a combination of portable radiation survey instruments and post-accident sampling of the secondary containment atmosphere. The licensee also states that extended range airborne effluent radiation monitors are suitable for the detection of a containment breach, for the detection of significant releases, and for release assessment and long-term surveillance.

Should the instrument range be exceeded, alternate instrumentation, including portable survey instruments, atmosphere sampling and effluent radiation monitors will be used to detect a breach of containment, to detect significant releases, and to assess and provide long-term surveillance for any releases. Based on the use of alternate instrumentation, we find the range of the licensee's instrumentation for this variable acceptable.

3.3.7 Effluent Radioactivity--Noble Gases

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable. The licensee's instrumentation is Category 3. The licensee states that Category 3 instrumentation is sufficient for this variable, because it does not serve a primary safety function, it is not a key variable, and it does not indicate the need for contingency actions.

As this instrumentation is used as a backup variable, we find the use of Category 3 instrumentation for this variable acceptable.

3.3.8 Suppression Chamber Spray Flow
Drywell Spray Flow

The instrumentation for the variable low pressure coolant injection (LPCI) flow is used for these variables. This is a subsystem of the residual heat removal (RHR) system, with a valve proportioning the flow between the two sprays. The position of the proportioning valves is controlled from and indicated in the control room. Pressure and temperature changes in the drywell and in the suppression pool determine the effectiveness of the spray. The licensee concludes that the LPCI flow, the RHR proportioning valve position, and suppression chamber and drywell temperature and pressure accurately and reliably measure the effectiveness of the suppression chamber and the drywell sprays.

We find that this instrumentation will provide appropriate indication of flow for these variables. Therefore, we find this instrumentation acceptable.

3.3.9 Suppression Pool Water Temperature

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable with a range of 30°F to 230°F. The licensee's instrumentation has a range of 20°F to 220°F. This deviation is supported by the licensee's statement that the maximum calculated bulk temperature in the suppression pool is 197°F. Based on this, the instrument range, 20°F to 220°F, is acceptable. In Reference 7, the licensee states that they have provided Class 1E power to this instrumentation and have determined that it is not practical to provide divisional separation of the instrumentation cables involved. Since Category 2 requirements do not include divisional separation, we find this instrumentation acceptable.

3.3.10 Drywell Atmosphere Temperature

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable with a range of 40°F to 440°F. The licensee's instrumentation has a range of zero to 350°F. This deviation is supported by the licensee's statement that the maximum post-accident drywell temperature is 340°F. Based on this, the instrument range of zero to 350°F is acceptable.

Reference 7 reiterates that this instrumentation has been upgraded. Class 1E power has been provided. Because of the uniqueness of the thermocouple extension cables, the individual channels share a common containment electrical penetration. Thus, there is no divisional separation. Divisional separation is not a Category 2 requirement. The temperature elements and connecting cables are environmentally qualified. With this clarification, we find that this instrumentation is acceptable for Category 2 instrumentation.

3.3.11 Main Steamline Isolation Valves' Leakage Control System

Regulatory Guide 1.97 recommends instrumentation for this variable with ranges of zero to 15 inches water and zero to 5 psid. The licensee's instrumentation has a range of -1 psig to +5 psig.

The licensee states that the main steamline isolation valve leakage control system is uniquely designed to operate between the limits of -1 psig to +5 psig. Exhaust blowers will maintain the slight negative pressure if no leakage is present. The maximum pressure is stated to be limited to 5 psig. Based on this design, the range of -1 psig to +5 psig is satisfactory for this variable.

3.3.12 Standby Liquid Control System (SLCS) Flow

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

Reference 7, the licensee describes the addition of Category 2 flow instrumentation with a range of zero to 60 gallons per minute (115 percent of design flow) for this variable. Thus, the regulatory guide recommendations for this variable are satisfactorily met.

3.3.13 SLCS Storage Tank Level

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable. The licensee states (Reference 6) that this instrumentation is located in a mild environment and meets the Category 2 recommendations. Therefore, the instrumentation supplied for this variable is acceptable.

3.3.14 Residual Heat Removal (RHR) Heat Exchanger Outlet Temperature

Revision 2 of Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable with a range of 32°F to 350°F. The licensee states (Reference 4) that the instrumentation meets the Category 2 recommendations except in the area of environmental qualification. The range supplied is 40°F to 500°F. As Revision 3 of the regulatory guide recommends a range of 40°F to 350°F, we find the provided range acceptable. The licensee states (Reference 6) that the detector and cables associated with this variable are environmentally qualified. Other portions of these instrument loops are located in a mild environment. With this clarification, we find the instrumentation provided for this variable acceptable.

3.3.15 Cooling Water Temperature to Engineered Safety Feature (ESF) System Components

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable with a range of 32°F to 200°F. The licensee's instrumentation meets the Category 2 recommendations except in the area of environmental qualification. The range supplied is zero to 100°F.

The licensee states that the maximum expected temperature of the cooling water system is less than the design temperature of 95°F, as the source of cooling water for the ESF system components is the Cedar River. Based on this, the range of zero to 100°F is acceptable.

The licensee states that Category 3 instrumentation is sufficient for this variable because it does not serve a primary safety function, it is not a key variable, it is not needed to ensure design basis behavior, and it does not indicate the need for contingency actions. Additionally, it will be the temperature of the Cedar River, which will remain relatively constant during the course of an accident. This temperature can be determined by alternate methods without regard to an accident condition. Based on the above, we find the use of Category 3 instrumentation for this variable acceptable.

3.3.16 Cooling Water Flow to ESF System Components

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable. The licensee states (Reference 6) that this instrumentation is located in a mild environment. With this information, along with the information provided in Reference 4, we conclude that this instrumentation meets the Category 2 recommendations.

3.3.17 High Radioactivity Liquid Tank Level

The licensee's recorders for this variable are located in the radwaste control room rather than in the main control room. The licensee presented the following as justification for this deviation.

1. The radwaste system does not operate during a design basis accident at Duane Arnold.

2. The lines that could add liquid waste to this tank are automatically isolated with an accident signal.

3. There are no emergency operating procedures requiring operation of the radwaste system.

4. Monitoring this variable is not necessary to maintain offsite release rates below the technical specification limits.

Based on the licensee's justification, we find that monitoring this variable in the control room of the Duane Arnold station is not necessary.

3.3.18 Reactor Building Area Radiation

The licensee states (References 4 and 6) that the instrumentation for this variable does not meet the range or the category recommendations of Regulatory Guide 1.97. The licensee supplements this instrumentation with the airborne effluent monitors (which are Category 2 instrumentation). The licensee states that this instrumentation is more useful and practical in detecting or assessing primary containment leakage. The licensee reports that use of local radiation monitors to detect breach or leakage through primary containment penetrations results in ambiguous indications. This is due to the radioactivity in the primary containment, the radioactivity in the fluids flowing in the emergency core cooling system piping, and the amount and location of piping and electrical penetrations and hatches between the primary containment and the reactor building. The licensee concludes that the use of the extended range airborne effluent monitors is the proper way to accomplish the purpose of this variable.

We find that the Category 3 instrumentation and ranges, in concert with the airborne effluent monitors, are acceptable.

3.3.19 Noble Gas and Vent Flow Rate--Secondary Containment, Turbine Building and Common Plant Vent

Regulatory Guide 1.97 recommends Category 2 instrumentation for these variables. The licensee's instrumentation is Category 3. The licensee states that this instrumentation is acceptable for these variables for

detection and assessment of releases and long-term surveillance. They state that this instrumentation does not serve a primary safety function, that it is not a key variable, that it is not required to ensure design basis behavior, and that it does not indicate the need for contingency actions. Based on the licensee's justification, we find the deviation from Category 2 to Category 3 instrumentation acceptable.

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

The licensee's sample system can obtain samples and provide the analyses within the ranges recommended for this variable from the reactor coolant and the containment air. The licensee has not shown that samples can be taken from the containment, auxiliary building, and emergency core coolant system (ECCS) sumps. The licensee states that the drywell sump systems are isolated automatically by a Group 2 isolation signal to establish containment integrity. The suppression pool and the reactor coolant are sampled. The drywell sump systems overflow to the suppression pool.

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 the staff's review of NUREG-0737, Item II.B.3.

3.4 Exceptions Identified in the Licensee's May 3, 1989, Submittal

In a submittal dated May 3, 1989, the licensee identified deviations where satisfactory instrumentation had previously been identified or the instrumentation had previously been scheduled for modifications to bring about compliance with Regulatory Guide 1.97. These variables were not discussed in this report earlier because of the commitment to compliance with Regulatory Guide 1.97. This section is added in Revision 1 of this report to address these changes in commitments.

3.4.1 Drywell Pressure

Regulatory Guide 1.97 recommends Category 1 instrumentation for this variable, with a range of zero to design pressure (62 psig) and Category 2 instrumentation with ranges of 12 psia to 3 psig and zero to 110 percent of design pressure.

In Reference 7, the licensee reports that instrument loops PI-4396C and PI-4396D have been installed, which have zero to 100 psig ranges, satisfying both the Category 1 and the zero to 110 percent of design pressure. Instrument loops PT-4398A and PT-4398B have been upgraded to include Class 1E power sources. Their range covers from -5 psig to +5 psig as recommended for Category 2 instruments. The originally proposed upgrades to PT-4365A and PT-4365B, having their cables rerouted to achieve divisional separation, will not be done as the earlier mentioned instrumentation is used in meeting the recommendations of the regulatory guide.

Based on the licensee's description in Reference 7, we conclude that the licensee has provided acceptable instrumentation for this variable.

3.4.2 Primary Containment Isolation Valve Position

Regulatory Guide 1.97 recommends Category 1 instrumentation for this variable. From the information provided in Reference 7, we find that the licensee deviates from a strict interpretation of the Category 1 redundancy recommendation. The licensee addresses valves CV-5718A, CV-5718B, CV-5704A, and CV-5704B as being part of the closed loop drywell cooling system, with no redundant valves. Since redundant isolation valves or features such as closed systems are provided in accordance with the General Design Criteria, we find that redundant indication per valve is not intended by the regulatory guide. Position indication of check valves is specifically excluded by Table 1 of Regulatory Guide 1.97. Therefore, we find that the instrumentation for this variable is acceptable in this regard.

3.4.3 Containment and Drywell Oxygen Concentration

The licensee originally proposed to use the existing range of zero to 25 percent for this variable. In Reference 7, the licensee reports of plans to rerange this instrumentation to a range of zero to 10 percent. This revised range agrees with the recommendations of Regulatory Guide 1.97 and is acceptable.

3.4.4 Low Pressure Coolant Injection Flow

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable. In Reference 7, the licensee states that the instrumentation installed for this variable meets or exceeds the Category 2 requirements. Thus, the regulatory guide recommendations for this variable are satisfactorily met.

3.4.5 Emergency Ventilation Damper Position

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable. In Reference 4, the licensee proposed to upgrade the instrumentation for this variable to Category 1 requirements. In Reference 7, the licensee reported that their review determined that no upgrades were found necessary, that the instrumentation already met the Category 1 requirements. Thus, the regulatory guide recommendations for this variable are satisfactorily met.

4. CONCLUSIONS

Based on our review, we find that the licensee either conforms to or is justified in deviating from Regulatory Guide 1.97, with the exception of the variable neutron flux. The licensee's present neutron flux instrumentation is acceptable on an interim basis pending NRC review of the BWR Owners Group topical report or until Category 1 instrumentation is installed by the licensee. The licensee should commit to conform to the outcome of the NRC review of the BWR Owners Group topical report on neutron flux monitoring. (Section 3.3.1)

5. REFERENCES

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

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

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

4. Letter, Iowa Electric Light and Power Company (R. W. McGaughy) to NRC (H. R. Denton), "Regulatory Guide 1.97," July 3, 1985, NG-85-2423, File: A-370.

5. Letter, Iowa Electric Light and Power Company (R. W. McGaughy) to NRC (H. R. Denton), "Plans and Schedules for Implementation of Plant Instrumentation Upgrades for Regulatory Guide 1.97 and Generic Letter 84-23," October 16, 1985, NG-85-4481, File A-107d, A-370.

6. Letter, Iowa Electric Light and Power Company (R. W. McGaughy) to NRC (H. R. Denton), "Emergency Response Capability, Conformance to R.G 1.97, Rev. 2: Response to Request for Additional Information," March 31, 1987, NG-87-1032.

7. Letter, Iowa Electric Light and Power Company (D. L. Mineck) to NRC (T. E. Murley), "Update of Conformance to R. G. 1.97, Revision 2," May 3, 1989, NG-89-0057.

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

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11. ABSTRACT *(200 words or less)*

This EG&G Idaho, Inc., report documents the review of the Regulatory Guide 1.97, Revision 2, submittals for the Duane Arnold Energy Center, 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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