INTERIM

CONFORMANCE TO REGULATORY GUIDE 1.97
MONTICELLO NUCLEAR GENERATING PLANT

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ABSTRACT

This EG&G Idaho, Inc. report provides a review of the submittal for the Monticello Nuclear Generating Plant, and identifies areas of full conformance to Regulatory Guide 1.97. Any exceptions to these guidelines is evaluated and those areas where sufficient basis for acceptability is not provided are identified.

FOREWORD

This report is supplied as part of the "Program for Evaluating Licensee/ Applicant Conformance to R.G. 1.97," being conducted for the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Division of Systems Integration, by EG&G Idaho, Inc., NRC Licensing Support Section.

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1. INTRODUCTION

On December 17, 1982, Generic Letter No. 82-33 (Reference 1) was issued by D. G. Eisenhut, Director of the Division of Licensing, Nuclear Reactor Regulation, to all licensees of operating reactors, applicants for operating licenses and holders of construction permits. This letter included additional clarification regarding Regulatory Guide 1.97, Revision 2 (Reference 2), relating to the requirements for emergency response capability. These requirements have been published as Supplement 1 to NUREG-0737, "TMI Action Plan Requirements" (Reference 3).

The Northern States Power Company, licensee for the Monticello Nuclear Generating Plant, provided a response to Section 6.2 of the generic letter on December 30, 1983 (Reference 4).

This report provides an evaluation of that submittal.

2. REVIEW REQUIREMENTS

Section 6.2 of NUREG-0737, Supplement 1, sets forth the documentation to be submitted in a report to NRC describing how the licensee meets the guidance of Regulatory Guide 1.97 as applied to emergency response facilities. The submittal should include documentation that provides the following information for each variable shown in the applicable table of Regulatory Guide 1.97:

1. Instrument range
2. Environmental qualification
3. Seismic qualification
4. Quality assurance
5. Redundance and sensor location
6. Power supply
7. Location of display
8. Schedule of installation or upgrade

Further, the submittal should identify deviations from the guidance in the regulatory guide and provide supporting justification or alternatives.

Subsequent to the issuance of the generic letter, the NRC held regional meetings in February and March 1983, to answer licensee and applicant questions and concerns regarding the NRC policy on this matter. At these meetings, it was noted that the NRC review would only address exceptions taken to the guidance of Regulatory Guide 1.97. Further, where licensees or applicants explicitly state that instrument systems conform to the provisions of the guide it was noted that no further staff review would be necessary.

Therefore, this report only addresses exceptions to the guidance of Regulatory Guide 1.97. The following evaluation is an audit of the licensee's submittal based on the review policy described in the NRC regional meetings.

3. EVALUATION

The licensee provided a response to Section 6 of the NRC generic letter 82-33 on December 30, 1983. This evaluation is based on that submittal.

3.1 Adherence to Regulatory Guide 1.97

The licensee has listed the Regulatory Guide 1.97 BWR variables and their status. This listing indicates conformance to the regulatory guide and justification for any nonconformance. Therefore, we conclude that the licensee has made an explicit commitment to conform to the Regulatory Guide 1.97 criteria except as noted in Section 3.3 of this report.

3.2 Type A Variables

Regulatory Guide 1.97 does not specifically identify Type A variables, i.e., those variables that provide information required to permit the control room operator to take specific manually controlled safety actions. The licensee classifies the following instrumentation as Type A variables:

1. Reactor pressure vessel water level

2. Suppression pool water temperature

These variables are included as Type B or D variables. These variables are identified by the licensee as conforming to Regulatory Guide 1.97 Category 1 requirements.

3.3 Exceptions to Regulatory Guide 1.97

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

3.3.1 Neutron Flux

Exception has been taken by the licensee to the recommendation of Regulatory Guide 1.97 for the neutron flux variable. The cables and detectors inside the primary containment are not qualified for a LOCA environment. The licensee states that except for design basis LOCA events, the neutron flux instrumentation will provide indication of neutron flux for operational and design basis accident events. The licensee considers the non-LOCA environmental qualifications acceptable based on the fact that under design basis LOCA events, the scram system is assumed to operate properly since the standby liquid control system is not designed for LOCA events. The licensee states that a scram can be verified by diverse means such as (a) indications of scram relay indication, (b) scram valve position indication, (c) control rod drive (CRD) scram accumulator low-pressure indication, (d) scram discharge volume high level alarm, and (e) indication of expected responses, i.e., makeup to the vessel, pressure decay, the torus temperature rise, etc.

This deviation is similar to most BWRs. A Category 1 system that meets all the criteria of Regulatory Guide 1.97 is an industry development item. Based on our review, we conclude that the existing instrumentation is acceptable for interim operation. The licensee should follow industry development of this equipment, evaluate newly developed equipment, and install Category 1 instrumentation when it becomes available.

3.3.2 Coolant Level in Reactor

Exception has been taken by the licensee to the recommendation of Regulatory Guide 1.97 for the coolant level in the reactor. The guide specifies that the level range should be from the bottom of the core support plate to the lesser of top of vessel or centerline of main steamlines. The licensee provides redundant indication from the bottom of the core support plate to the top of the normal operating range (-335 in. to +65 in.) with overlapping ranges. One qualified level indicator is provided by the licensee for vessel floodup (to top of vessel including steamlines).

The licensee considers the system acceptable because (a) there is only one reactor vessel tap available for use in indicating level to the top of the vessel, (b) the fuel zone and operating range level indication is sufficient to deal with design basis accidents, (c) the vessel floodup is called for as a contingency operation, and (d) modifications to the reactor level sensing line arrangement are being implemented to improve the accuracy of level instrumentation during a drywell temperature transient or reactor depressurization events, thereby reducing the probability of floodup events. The licensee concludes that the proposed reactor coolant level instrumentation meets the intent of the regulatory guide, and that only a marginal improvement in plant safety would be achieved by installing a redundant channel. Based on the above, we conclude that the single floodup range level instrument channel is acceptable.

3.3.3 Drywell Sump Level and Drywell Drain Sumps Level

The licensee has provided Category 3 drywell sump level and drywell drain sumps level instrumentation instead of Category 1. The licensee's justification is that (a) the drywell pressure and temperature along with the suppression pool water level and primary containment hydrogen can be used to provide indication of leakage in the drywell, (b) these variables are qualified to Category 1 or 2, and (c) the drywell sump systems are isolated for accident conditions.

The instrumentation does not cause any automatic or operator initiated safety related functions. The sump systems are automatically isolated on an accident signal as part of containment isolation. This prevents the pump-out of the sump contents. However, the recovery from simple small leaks which do not cause isolation of the sump drains requires the knowledge of changes in leakage rates.

For small leaks, this Category 3 instrumentation will continue to function as the drywell temperature and pressure will not have changed significantly. Therefore, the sump levels can be used as a leading indicator of reactor coolant system leakage. For larger leaks, the sumps will fill

promptly, negating this information because the sumps isolate due to the increase in drywell pressure caused by the accident. The sumps can be assumed full with Category 3 instruments once containment isolation occurs at 2 psig.

In either case, we find the Category 3 instruments provided for this variable acceptable.

3.3.4 Primary Containment Isolation Valve Position

Regulatory Guide 1.97 recommends redundant instrumentation for this variable. The licensee does not provide redundant indication of the position of a given primary containment isolation valve. The justification provided is that there are two isolation valves in series at each primary containment penetration, either of which will accomplish the required isolation. Therefore, the control room operator can verify proper isolation by observing the indication of the redundant valve should the position indication on any valve fail.

From the information provided, we find the licensee deviates from a strict interpretation of the Category 1 redundancy recommendation. Only the active valves have position indication (i.e., check valves have no position indication). Since redundant isolation valves are provided, we find that redundant indication per valve is not intended by the regulatory guide. Position indication of check valves is specifically excluded by Table 2 of Regulatory Guide 1.97. Therefore, we find that the instrumentation for this variable is acceptable.

3.3.5 Radioactivity Concentration or Radiation Level in Circulating Primary Coolant

Exception has been taken by the licensee to the recommendation of Regulatory Guide 1.97 for this variable. A Category 3 classification has been assigned to this variable instead of the recommended Category 1 classification per Regulatory Guide 1.97. The licensee states that the deviation is

justified based on the fact that the critical actions to be taken to prevent and mitigate a gross breach of fuel cladding are (a) shut down the reactor, and (b) maintain water level. Neither of these are influenced by the recommended variable. The licensee indicates that the post-accident sampling system (PASS) provides a means of obtaining samples of reactor coolant and primary containment atmosphere and that radiation monitors in the steam jet air ejector and main steamlines provide information on the status of fuel cladding when the plant is not isolated.

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

3.3.6 Containment and Drywell Hydrogen Concentration

Regulatory Guide 1.97 recommends a range of 0 to 30 percent for this variable. The hydrogen monitors provided have a range of 0 to 20 percent. The licensee states that although the hydrogen analyzers do not have the recommended range, they do detect the potential for a breach of the containment by measuring hydrogen concentration well into the explosive range, thus satisfying the intent of the Regulatory Guide 1.97 recommendation.

The Monticello containment is inerted. Post-accident combustible gas control is maintained by nitrogen inerting. Oxygen concentration is limited by this method to less than combustible limits. The indication of hydrogen is used to determine if the oxygen concentration needs further depletion. Therefore, we conclude that the range of 0 to 20 percent is adequate and acceptable.

3.3.7 Radiation Exposure Rate

Exception has been taken by the licensee to the recommendation of Regulatory Guide 1.97 for this Type C variable. The licensee has implemented this variable as a Category 3 variable, the reason being that the stack and reactor building vent radiation monitors provide positive evidence of a break or leakage.

Revision 3 of Regulatory Guide 1.97 (Reference 5) deletes this Type C variable from the recommended instrumentation. Therefore, this is acceptable.

3.3.8 Drywell Atmosphere Temperature

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable. The licensee has Category 3 instrumentation. The licensee states that for normal operation, operational transients, and design basis accidents which do not result in a harsh environment, the drywell atmosphere temperature will provide the proper indication. For the harsh environment design basis accident (LOCA) the drywell pressure (a Category 1 variable) will be used to determine the temperature.

The licensee has not shown that the drywell pressure is a direct, unambiguous indication of drywell temperature. Under certain accident conditions the temperature can decrease while the pressure remains the same. Therefore, this deviation is unacceptable.

The licensee should upgrade the drywell atmosphere temperature instrumentation to Category 2 criteria.

3.3.9 RCIC Flow

Regulatory Guide 1.97 recommends that this instrumentation be environmentally qualified. The licensee has not qualified the RCIC flow instrumentation for a harsh environment, the justification being that the instrumentation was designed, installed, and licensed prior to the regulatory guide program and was not initially designed for LOCA events.

Environmental qualification has been clarified since Revision 2 of Regulatory Guide 1.97 was issued. The clarification is in the environmental qualification rule, 10 CFR 50.49. It is concluded that the guidance of Regulatory Guide 1.97 has been superseded by a regulatory requirement. Any exception to this rule is beyond the scope of this review and should be addressed in accordance with 10 CFR 50.49.

3.3.10 Standby Liquid Control System (SLCS) Flow

The licensee has not implemented this variable as recommended in Regulatory Guide 1.97. The justification given by the licensee is (a) the SLCS pump-discharge header pressure indication provides indication that the SLCS pump is operating, (b) the level indication in the boron solution storage tank gives indication that flow is occurring, (c) the reactivity change in the reactor as measured by neutron flux is an indication of flow, (d) the motor indicating lights and pump discharge pressure shows system operation, and (e) the squib valve continuity indicating lights are an indication of flow.

We find that the above indications are valid as an alternative indication of SLCS flow.

3.3.11 Standby Liquid Control System (SLCS) Storage Tank Level

Regulatory Guide 1.97 recommends that this variable be environmentally qualified. The licensee does not have environmentally qualified instrumentation. The justification is that the instrumentation was designed, installed, and licensed prior to the regulatory guide program and was not initially designed for LOCA or High Energy Line Break (HELB) events.

Environmental qualification has been clarified since Revision 2 of Regulatory Guide 1.97 was issued. The clarification is in the environmental qualification rule, 10 CFR 50.49. It is concluded that the guidance of Regulatory Guide 1.97 has been superseded by a regulatory requirement. Any exception to this rule is beyond the scope of this review and should be addressed in accordance with 10 CFR 50.49.

3.3.12 RHR Heat Exchanger Outlet Temperature

Exception has been taken by the licensee to the recommendation of Regulatory Guide 1.97 for the RHR heat exchanger outlet temperature variable. The guide recommends Category 2 instrumentation. The licensee has Category 3 instrumentation. The licensee states that for non-harsh environments, the instrumentation will provide reliable temperature indication. For harsh

environment conditions (LOCA and HELB), the suppression pool temperature monitoring system (a Category 1 variable) will provide the proper indication of the cooling trend.

The licensee has not shown that the suppression pool temperature is a direct, unambiguous indication of the RHR heat exchanger outlet temperature. The licensee should commit to upgrade the instrumentation for this variable to the Category 2 criteria.

3.3.13 Cooling Water Temperature ESF System Components
Cooling Water Flow to ESF System Components

Exception has been taken by the licensee to the recommendation of Regulatory Guide 1.97 for these variables. The guide recommends Category 2 instrumentation. The licensee has implemented these variables with Category 3 instrumentation. The licensee states that with the capability for manual verification of operation at the intake structure, Category 3 implementation is acceptable.

The cooling of ESF system components is done by two systems at Monticello. The normal service water system is raw water taken from the ultimate heat sink via the intake structure. There is no temperature control over this water. Therefore, Category 3 instrumentation for temperature indication of this system is acceptable. The emergency service water system water is cooled in heat exchangers by the normal service water system. In an accident condition Category 3 instruments are not responsive enough for this service. For both the normal and the emergency service water systems, the licensee interprets flow by Category 3 pump outlet pressure alarms. These are not acceptable to monitor flow in these cooling water systems. Flow blockage could occur, rendering a pressure alarm useless.

Therefore, with the exception of the normal service water temperature, the licensee should supply the recommended Category 2 temperature and flow instrumentation.

3.3.14 Status of Standby Power

Regulatory Guide 1.97 recommends voltage indication for the standby power supplies. The licensee has not provided control room voltmeters but has provided undervoltage alarms in the control room for the 250 Vdc, 125 Vdc, and the 24 Vdc battery systems. The licensee states that this is acceptable because the battery systems are redundant and the battery rooms are accessible during design basis accident events so that an operator can investigate alarm conditions.

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

3.3.15 Accident Sampling Capability (Primary Coolant, Containment Air and Sump)

Regulatory Guide 1.97 recommends that the primary coolant and sump be sampled, whereas the licensee's position is that sampling of the suppression pool is representative of the sump variables and primary coolant sampling is provided. The justification for sampling the suppression pool is that the primary containment sump is isolated for all accidents and the radioactive material which would be in the primary containment sump would overflow into the suppression pool. Once overflow has occurred the primary containment sump and the suppression pool would be sufficiently similar in composition that a suppression pool sample is representative of the primary containment sump contents.

The licensee takes exception to the guidance of Regulatory Guide 1.97 with respect to post-accident sampling capability. This exception goes beyond the scope of this review and is being addressed by the NRC as part of the review of NUREG-0737, Item II.B.3.

4.0 CONCLUSIONS

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

1. Neutron flux--the licensee's present instrumentation is acceptable on an interim basis, until Category 1 instrumentation is developed and installed (Section 3.3.1).

2. Drywell atmosphere temperature--the licensee should upgrade the drywell atmosphere temperature instrumentation to Category 2 (Section 3.3.8).

3. RCIC flow--environmental qualification needs to be addressed in accordance with 10 CFR 50.49 (Section 3.3.9).

4. Standby liquid control system (SLCS) storage tank level--environmental qualification should be addressed in accordance with 10 CFR 50.49 (Section 3.3.11).

5. RHR heat exchanger outlet temperature--the licensee should upgrade this instrumentation to Category 2 criteria (Section 3.3.12).

6. Cooling water temperature to ESF system components--the licensee should supply Category 2 instrumentation for the emergency service water system (Section 3.3.13).

7. Cooling water to ESF system components--the licensee should supply Category 2 flow instrumentation for this variable (Section 3.3.13).

5. REFERENCES

1. NRC letter, D. G. Eisenhut to all licensees of operating reactors, applicants for operating licenses, and holders of construction permits, "Supplement No. 1 to NUREG-0737--Requirements for Emergency Response Capability (Generic Letter No. 82-33)," December 17, 1982.

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

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

4. Northern States Power Company letter to NRC, D. Musolf to Director, Office of Nuclear Reactor Regulation, "NUREG-0737 Supplement 1--Generic Letter 82-33, Regulatory Guide 1.97--Application to Emergency Response Facilities," December 30, 1983.

5. Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident, Regulatory Guide 1.97, Revision 3, U.S. Nuclear Regulatory Commission (NRC), Office of Standards Development, May 1983.