Attachment to
Safety Evaluation

CONFORMANCE TO REGULATORY GUIDE 1.97
NINE MILE POINT NUCLEAR STATION, UNIT NO. 1

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ABSTRACT

This EG&G Idaho, Inc., report reviews the submittal for Regulatory Guide 1.97, Revision 2, for the Nine Mile Point Nuclear Station, Unit No. 1. Any exceptions to Regulatory Guide 1.97 are evaluated.

FOREWORD

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 PWR Licensing - A, by EG&G Idaho, Inc., NRR and I&E Support Branch.

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CONFORMANCE TO REGULATORY GUIDE 1.97
NINE MILE POINT NUCLEAR STATION, UNIT NO. 1

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).

Niagara Mohawk Power Corporation, the licensee for the Nine Mile Point Nuclear Station, provided a response to Section 6.2 of the generic letter on April 2, 1984 (Reference 4). Additional information was submitted on October 18, 1985 (Reference 5) and December 6, 1985 (Reference 6).

This report provides an evaluation of this material.

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 submittal should identify deviations from the regulatory guide and provide supporting justification or alternatives.

Subsequent to the issuance of the generic letter, the NRC held regional meetings on 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 only address 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 only addresses 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 a response to Item 6 of Generic Letter 82-33 on April 2, 1984. The response describes the licensee's position on post-accident monitoring instrumentation. Additional information was provided on October 18, 1985 and December 6, 1985. This evaluation is based on this material.

3.1 Adherence to Regulatory Guide 1.97

The licensee has 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 concludes that those Regulatory Guide 1.97 variables that are applicable to the Nine Mile Point Nuclear Station, Unit No. 1, are monitored and displayed in the control room. Those modifications identified by the licensee to bring the instrumentation into compliance with Regulatory Guide 1.97 have been completed. 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 information required to permit the control room operator to take specific manually controlled safety actions. The licensee has determined that there are no variables that are required for manual safety response; that all safety-related plant protective actions are done automatically. Therefore, there are no Type A variables at Unit No. 1 of the Nine Mile Point station.

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 environmentally qualified instrumentation. The licensee has instrumentation for this variable that has not been environmentally qualified. The licensee states that protective action is initiated prior to exposure to a harsh environment.

The licensee states that the source and intermediate range monitor (SRM and IRM respectively) detectors are driven into the core immediately as a result of the scram signal. As neutron flux decays, the recorders are re-ranged and the detectors are inserted. Exposure to the post-accident steam filled containment during this period of detector insertion would be brief. The licensee states that this equipment normally operates in the containment when elevated temperatures (not a harsh environment) are present. There are 4 SRMs and 8 IRMs in addition to the average/linear power range monitors that are said to be able to detect inadvertent reactivity insertion in the post-accident situation.

In the process of our review of neutron flux instrumentation for boiling water reactors (BWRs), we note that the mechanical drives of the detectors 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 is an industry development item. Based on our review, we conclude that the existing instrumentation is acceptable for interim operation. The licensee has committed to follow industry development of this equipment, evaluate newly developed equipment, and install Category 1 instrumentation when it becomes available.

3.3.2 Reactor Coolant System Soluble Boron Concentration

Regulatory Guide 1.97 recommends instrumentation for this variable with a range from 0 to 1000 parts per million. The licensee has supplied

instrumentation for this variable with a range of 50 to 2000 parts per million. Thus, the licensee cannot resolve between 0 and 50 parts per million.

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

3.3.3 Drywell Pressure

Regulatory Guide 1.97 recommends monitoring the pressure in the drywell. The range recommended is from 12 psia to design pressure (62 psig). Category 1 instrumentation is recommended. The instrumentation identified in Reference 5 for this variable is the Category 1 primary containment pressure that has a range of -5 to 250 psig. These pressure detectors are located in the drywell. Thus the recommendation of Regulatory Guide 1.97 for the variable drywell pressure are satisfied.

3.3.4 Drywell Sump Level
Drywell Drain Sumps Level

The licensee has supplied Category 3 instrumentation; a single channel with a span of 600 gallons for the drywell equipment drain tank and a single channel with a span of 200 gallons for the drywell floor drain tank. The licensee states that (a) the drywell pressure and temperature are more appropriate to detect a breach of the reactor coolant system and (b) the sump level equipment does not initiate any automatic protective action and (c) the sump level equipment would not be available if containment were isolated.

We conclude that the instrumentation supplied by the licensee will provide appropriate monitoring for the parameters of concern. This is based on (a) for small leaks, the 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 level and drywell drain sumps level instrumentation, (c) the drywell pressure and temperature can be used to detect leakage in the drywell, and (d) this instrumentation neither automatically initiates nor alerts the operator to initiate operation of a safety-related system in post-accident situation. Therefore, we find the Category 3 instrumentation provided acceptable.

3.3.5 Primary Containment Pressure

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of from 10 psia to four times the design pressure of 62 psig (248 psig). The licensee, in Reference 4, identified instrumentation located in the drywell with a range of 0 to 250 psig. Instrumentation in the torus has a range of 0 to 4 psig.

For the torus instrumentation, the licensee states that instrumentation with a higher range is not necessary, even though the torus design pressure is 35 psig. This is because of vacuum breakers between the torus and the drywell that keep the torus within 3 psi of the drywell. Thus, the drywell pressure instrumentation is applicable to the torus pressure. In Reference 5, the licensee states that the drywell pressure instrumentation has been re-ranged to -5 to 250 psig. This satisfies the recommendations of Regulatory Guide 1.97, and is acceptable.

3.3.6 Primary Containment Isolation Valve Position

Regulatory Guide 1.97 recommends Category 1 instrumentation for this variable. Thus, environmental qualification, seismic qualification and redundancy are recommended for this instrumentation. The licensee provides instrumentation for these variables, however, deviations are identified, in Reference 4, in the above criteria.

In Reference 5, the licensee states that environmental and seismic qualification of these valves has been addressed as part of their environmental qualification program in response to the Environmental Qualification Rule, 10 CFR 50.49. Seismic qualification for those position indication switches that were not upgraded as a result of this program do meet the original plant seismic design criteria. We find this acceptable for Regulatory Guide 1.97 instrumentation.

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 1 of Regulatory Guide 1.97. Therefore, we find that the redundancy for this variable is acceptable.

There are three vacuum relief valves from the reactor building to the torus. These valves have position switches that are not stated to be seismically qualified. They function as check valves. As such, we find that position indication for these valves is not required by Regulatory Guide 1.97.

3.3.7 Radiation Level in Circulating Primary Coolant

The licensee indicates that radiation level measurements to indicate fuel cladding failure are provided by monitoring containment radiation and by utilizing the post-accident sampling system, which is being reviewed by the NRC as part of their review of NUREG-0737, Item II.B.3.

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

3.3.8 Suppression Pool Water Level

Regulatory Guide 1.97 recommends instrumentation for this variable with a range from the bottom of the ECCS suction line to five feet above the normal water level. The licensee's instrumentation has a range from 3 ft. 3 in. below the ECCS suction to 3 ft 8.5 in. above the normal water level. The licensee states that even in the most extreme degraded conditions, the level of the suppression pool is not expected to increase by more than 1-1/2 feet. All remedial operator actions to control a rise in torus level will have been taken before this level is reached. Therefore, we find the range to 3 ft. 8.5 in. above the normal water level acceptable.

3.3.9 Containment and Drywell Hydrogen Concentration

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of 0 to 30 percent. The licensee's instrumentation for this variable has a range of 0 to 20 percent.

The licensee states that for an inerted containment, the primary concern is oxygen concentration. This is because combustion could not occur if sufficient oxygen is not present. Therefore, the licensee states that a maximum range of 20 percent is acceptable.

The licensee deviates from Regulatory Guide 1.97 with respect to hydrogen concentration instrumentation. This deviation goes beyond the scope of this review and has been addressed by the NRC as part of the review of NUREG-0737, Item II.F.1.6, and found acceptable.

3.3.10 Radiation Exposure Rate

Regulatory Guide 1.97, Revision 2, specifies Category 2 instrumentation for this variable with a range of 10^{-1} to 10^{4} R/hr. The licensee has provided instrumentation for this variable with ranges that vary, dependent on location, from the recommended range. The ranges are 0.01 to 100 mR/hr, 0.1 to 1000 mR/hr and a dual range of 0.1 to 1000 mR/hr and 0.01 to

10,000 mR/h. The licensee has stated that containment breach is detected by the noble gas effluent monitors, and that release assessment is better performed with portable radiation instruments and secondary containment sample analysis. The licensee concludes that Category 3 instrumentation is adequate for the radiation exposure rate instrumentation.

Regulatory Guide 1.97, Revision 3 (Reference 7), changes this variable to Category 3. Therefore the only deviation of the Nine Mile Point station for this variable is the range supplied for a given location. The licensee states that twenty-one of the thirty-three instruments have ranges that encompass the expected radiation levels in their locations. The remaining instrumentation would be used after an accident after they were shown to be operable. Should the instrumentation be offscale, entry into the area is prohibited. Portable survey instruments, atmosphere sampling and radiation monitors in the plant stack will be used by the licensee for release detection and assessment and for long term release surveillance. Based on this, we find the licensee's instrumentation for this variable acceptable.

3.3.11 Suppression Chamber Spray Flow
Drywell Spray Flow

Regulatory Guide 1.97 specifies Category 2 instrumentation for these variables with a range from 0 to 110 percent of design flow. These two sprays are not provided with dedicated flow measurement channels. Instead, a flow element common to these two sprays is used in their common header. This measures the total system flow that is going to both of these sprays. The licensee indicates that a predetermined portion of the total flow is delivered to each spray via a throttling valve. The licensee concludes that indication of total flow and valve position is sufficient to monitor the operation of these sprays. We find this deviation acceptable.

3.3.12 Drywell Atmosphere Temperature

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of 40 to 440°F. The licensee has instrumentation for this variable

with a range of 50 to 300°F, and states that the range is sufficient to provide the operator with information relative to the potential for flashing in the level sensing instrument lines.

We agree that the given range is sufficient to monitor the potential for flashing in the instrumentation lines for the reactor vessel level instrumentation.

Our examination of the Final Safety Analysis Report (FSAR, Reference 8) shows that the maximum internal drywell design temperature is 310°F. The actual peak temperature would be less than this and of short duration. Based on this, the licensee's upper limit of 300°F for the post-accident period is sufficient.

The licensee states that in the 16 years since reactor startup, the drywell atmosphere temperature has remained above 50°F. During post-accident conditions, the licensee states that the heat sources are sufficient to insure that this instrumentation will remain onscale. Therefore, we find the range of 50 to 300°F acceptable for this variable.

3.3.13 Standby Liquid Control System Flow

Exception has been taken by the licensee to Regulatory Guide 1.97 for the variable standby liquid control system flow. The licensee states that proper functioning of the system can be verified by monitoring the pump discharge header pressure, tank level, neutron flux change and system valve position.

We find the above instrumentation valid as an alternative indication of standby liquid control system flow.

3.3.14 Standby Liquid Control System Storage Tank Level

Regulatory Guide 1.97 recommends instrumentation for this variable with a range from the bottom to the top. The instrumentation supplied by the licensee for this variable has a range from 350 to 4150 gallons.

The licensee states that the range of the liquid poison level indicator covers the minimum (2000 gallons) to maximum (4080 gallons) volume of liquid poison maintained in the tank, as required by Technical Specifications. The licensee concludes that the range is sufficient for the operator to determine that the liquid poison system is operating properly.

The range supplied corresponds to the height of the pump suction inlet and the tank overflow. Based on the licensee's justification, the deviation from the recommended range is acceptable.

3.3.15 Residual Heat Removal System Flow
Residual Heat Removal Heat Exchanger Outlet Temperature

Regulatory Guide 1.97 recommends monitoring the residual heat removal system for flow (0 to 110 percent of design flow) and heat exchanger outlet temperature (32 to 350°F) with environmentally qualified instrumentation. Unit No. 1 at Nine Mile Point has no direct indication of flow rate for this variable. The licensee states that the shutdown cooling system flow is manually adjusted to maintain the cooldown rate below 100°F/hr. Thus, flow is controlled by the shutdown cooling system temperature.

The licensee monitors the operation of the shutdown cooling system (SCS) with the following instrumentation

Reactor vessel water level

SCS pump running indication

SCS heat exchanger tube side outlet temperature

SCS heat exchanger shell side inlet and outlet temperature.

The licensee states that there is no flow disturbance that cannot be observed with the existing instrumentation. Additionally, the SCS is not expected to be operated during accident or immediate post-accident conditions. It would only be operated in the long term after the unit is in a normal stable shutdown cooling condition. The licensee states, in Reference 5, that the instrumentation for the shutdown cooling system has been addressed in accordance with 10 CFR 50.49, and environmental qualification found not applicable.

Based on the alternate instrumentation and the design function of the shutdown cooling system, we find the instrumentation supplied for these variables acceptable.

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

Unit No. 1 at Nine Mile Point does not use a separate cooling water system to cool these components, which according to the licensee consist of the core spray and the containment spray pumps. These pumps are cooled by recirculation of the discharge flow. Pump suction is from the torus. Thus, the cooling water temperature is essentially the torus water temperature, and flow is coincident with pump operation. We find that these deviations are acceptable.

3.3.17 High Radioactivity Liquid Tank Level

Regulatory Guide 1.97 recommends instrumentation for this tank with a range from top to bottom. The indicated range for this variable is 0 to 100 percent (corresponding to 0 to 166 in. height, whereas the tank is 180 in. high). The existing range is adequate to indicate storage volume. Therefore, this is an acceptable deviation from Regulatory Guide 1.97.

3.3.18 Emergency Ventilation Damper Position

Regulatory Guide 1.97 recommends Category 2 instrumentation to monitor the operation of the emergency ventilation dampers. The licensee has provided two types of instrumentation for this variable. First, there are damper position indicator lights which are not Category 2. Second, system flow is monitored by Category 2 instrumentation.

Based on this diversity, we find that the deviation from Category 2 to Category 3 instrumentation for damper position indication is acceptable. System operation can be observed by the Category 2 flow instrumentation.

3.3.19 Reactor Building or Secondary Containment Radiation

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable with a range of 10^{-1} to 10^{4} R/hr for the Nine Mile Point Mark I containment. The licensee has 34 instruments for this variable, some with a range of 10^{-5} to 10^{-1} R/hr, some with a range of 10^{-4} to 1 R/hr and one with a range of 10^{-2} to 10^{3} R/hr. These instruments are Category 3 rather than Category 2. The ranges were chosen on a plant analysis of expected radiation levels. The licensee's position is that secondary containment area radiation is not an appropriate parameter to use for assessing primary containment leakage or detecting significant releases. The licensee also states that the reactor building ventilation system is automatically isolated and the emergency ventilation system initiated at an exposure rate of 20 mR/hr (2×10^{-2} R/hr). The licensee concludes that the existing Category 3 instrumentation for this variable is adequate.

Based on the above, we find that the existing Category 3 instrumentation and ranges are acceptable.

3.3.20 Noble Gas and Vent Flow Rate--Common Plant Vent

Regulatory Guide 1.97 recommends instrumentation for this variable with a range from 10^{-6} to 10^{+4} µCi/cc and 0 to 110 percent design flow.

The licensee's instrumentation for this variable was not completely identified by Reference 4. This was due to the installation of new equipment for this variable. Reference 5 identifies the range as 2×10^{-8} to 10^{5} µCi/cc which meets the recommended range and 15 to 110 percent for the vent flow. Below the 15% limit of this instrumentation the flow is no longer isokinetic, but samples can still be analyzed. Additionally, flow would be above 15 percent with any one fan operating. We find this instrumentation acceptable for this variable.

3.3.21 Particulates and Halogens--All Identified Plant Release Points

Regulatory Guide 1.97 recommends instrumentation for this variable with a range from 10^{-3} to 10^{+2} µCi/cc.

The licensee's instrumentation for this variable was not completely identified by Reference 4. This was due to the installation of new equipment for this variable. Reference 5 identifies the range as 10^{-13} to 10 µCi/cc for undiluted samples. With dilution, the recommended range is satisfied. Additionally, lab samples can be analyzed in this range. We find this instrumentation acceptable for this variable.

3.3.22 Plant and Environs Radioactivity

Revision 2 of Regulatory Guide 1.97 recommends a multichannel gamma-ray spectrometer for this variable for isotopic analysis in release assessment and analysis.

The licensee, in Reference 5, identifies the instrumentation for this variable and shows that it satisfies the recommendations of Regulatory Guide 1.97.

3.3.23 Estimation of Atmospheric Stability

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of -9 to +18°F or an analogous range for alternative stability analysis. The licensee has supplied instrumentation with a range of -8 to +20°F. The licensee has not provided justification for the deviation from -9 to -8°F.

Table 1 of Regulatory Guide 1.23 (Reference 9) provides seven atmospheric stability classifications based on the difference in temperature per 100 meters evaluation change. These classifications cover from extremely unstable to extremely stable. Any temperature difference greater than +4°C or less than -2°C does nothing to the stability classification. The licensee's instrumentation includes this range. Therefore, we find that this instrumentation is acceptable to determine atmospheric stability.

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

The licensee's post-accident sampling system provides sampling and analysis as recommended by the regulatory guide except for the following deviations.

1. Boron content--the minimum observable concentration is 50 ppm.

2. Chloride content--the minimum observable concentration is 0.1 ppm.

3. Dissolved hydrogen--the minimum observable concentration is 25 cc/kg.

4. Dissolved oxygen--the minimum observable concentration is 0.1 ppm.

5. Air hydrogen content--the minimum observable concentration is 0.1 percent.

6. Air oxygen content--the minimum observable concentration is 0.5 percent.

7. Coolant pH--the range is 2 to 12 rather than the recommended 1 to 13.

8. A grab sample from the primary containment sump cannot be obtained.

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

4. CONCLUSIONS

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

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).

NRC FORM 335 (2-84) NRCM 1102 3201, 3202

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13 ABSTRACT (200 words or less)

This EG&G Idaho, Inc., report reviews the submittals for the Nine Mile Point Nuclear Station, Unit No. 1, and identifies areas of nonconformance to Regulatory Guide 1.97. Any exceptions to these guidelines are evaluated.

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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.

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4. Niagara Mohawk Power Corporation letter, C. V. Mangan to Director of Nuclear Reactor Regulation, NRC, "Nine Mile Point Unit 1, Docket No. 50-220, DPR-63," April 2, 1984.

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