

CONFORMANCE TO REGULATORY GUIDE 1.97  
LIMERICK GENERATING STATION UNIT NOS. 1 AND 2

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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 Philadelphia Electric Company, applicant for the Limerick Generating Station Unit Nos. 1 and 2, provided a response to the generic letter on April 15, 1983 (Reference 4). This submittal refers to the Limerick Final Safety Analysis Report (FSAR) (Reference 5) for the review of the instrumentation provided in conformance to Regulatory Guide 1.97.

This report provides an evaluation of the submittal and the referenced FSAR.

2. REVIEW REQUIREMENTS

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

1. Instrument range

2. Environmental qualification

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

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

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

### 3. EVALUATION

In the applicant's response to NRC generic letter 82-33, Section 7.5 of the Limerick FSAR is identified as containing (a) the description of the Post-Accident Monitoring System (PAMS), (b) tables which identify the monitored parameters, and (c) compliance to, or deviations from, the guidance of Regulatory Guide 1.97 along with the supporting justification or alternatives. This evaluation is based on the information provided in Section 7.5 of the Limerick FSAR.

### 3.1 Adherence to Regulatory Guide 1.97

The applicant has stated in Section 1.8 of the FSAR that Limerick is in conformance to Regulatory Guide 1.97 to the extent discussed in Section 7.5 of the FSAR. Within Table 7.5.3 of the Limerick FSAR, the applicant has identified the post-accident monitoring instrumentation that provides indication of Regulatory Guide 1.97 variables. The applicant has made an explicit commitment to conform to the guidelines of Regulatory Guide 1.97 with the exception of the identified deviations 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 for operator controlled safety actions. The applicant has classified the following instrumentation channels as Type A variables:

1. Primary containment oxygen and hydrogen concentration
2. Reactor pressure vessel pressure
3. Reactor pressure vessel water level
4. Suppression pool water temperature
5. Suppression pool water level
6. Drywell pressure.

The above variables are included as Type B, C, D or E variables. All of the above variables are identified by the applicant as conforming to Regulatory Guide 1.97.

### 3.3 Exceptions to Regulatory Guide 1.97

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

#### 3.3.1 Neutron Flux

Exception has been taken by the applicant to Regulatory Guide 1.97 for the Neutron Flux measurement. A Category 2 classification has been assigned to this variable instead of the recommended Category 1 classification per Regulatory Guide 1.97. The applicant has provided, as justification for this deviation, an analysis of the neutron flux monitoring systems using a postulated performance scenario (refer to Section 7.5.2.5.1.1.2.4.1 of the FSAR). Based on the results of the analysis, the applicant identifies the Neutron Flux as a key variable but concludes that the degree to which the variable is important to safety does not justify a Category 1 classification.

The applicant has proposed some upgrading of the current neutron monitoring systems but has not identified the qualification requirements which will be applicable. The licensee should identify the specific deviations for the proposed upgraded instrumentation. The applicant should also justify why conformance to a Category 1 cannot be accomplished by the upgraded instrumentation.

#### 3.3.2 Reactor Water Level

Exception has been taken by the applicant to Regulatory Guide 1.97 for the Reactor Water Level measurement. The guide specifies that the range should be from the bottom of the core support plate to lesser of top of vessel or centerline of main steamline. The instrumentation for measuring the Reactor Water Level consists of two wide range and two narrow range differential pressure transmitters. The range of the wide range transmitters is from the top of the feedwater control range to a point near the top of the active fuel. The narrow range transmitters measure the fuel zone which is the level just over the top of the active fuel to near the

bottom of the active fuel. The fuel zone level and the wide range level overlap; however, the overall range does not comply with R. G. 1.97. The exception is that the upper level is 5 ft less than the recommended by Regulatory Guide 1.97. The applicants justification is that this eliminates long runs of exposed sensing line tubing that contribute to erratic indication.

The applicant should provide clarification of his position. An additional 5 feet of elevation in the transmitter sensing leg (line) when properly installed should not cause erratic indication. The applicant should provide more specific information showing why compliance cannot be accomplished and why this deviation is acceptable.

### 3.3.3 Drywell Sump Level and Drywell Drain Sumps Level

Exception has been taken by the applicant to Regulatory Guide 1.97 for the Drywell Sumps Level and the Drywell Drain Sumps Level measurements. The applicant position is that the Drywell Sump Level and Drywell Drain Sumps Level instrumentation should be qualified to Category 3 instead of Category 1 requirements. The supporting justification is that (a) the drywell pressure and temperature along with the primary containment area radiation 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 applicant has not provided acceptable justification for the use of Category 3 instrumentation for this variable. The sump level instrumentation is the primary means to determine identified and non-identified leakage rates. Although the drywell sump systems are isolated at the primary containment penetration on receipt of an accident signal, the systems are not automatically isolated for certain accidents. Post-accident monitoring following such an accident could provide useful information. Operator action is based on the source and extent of the leakage. Table 7.5-3 of the FSAR specifies that the type of indication, quantity, and range for the instrumentation for this variable be provided



at a later date. The applicant should confirm that the instrumentation meets the recommendations of Regulatory Guide 1.97, or identify and provide justification for any deviation.

#### 3.3.4 Radioactivity Concentration or Radiation Level in Circulating Primary Coolant

Exception has been taken by the applicant to Regulatory Guide 1.97 for this measurement. A Category 3 classification has been assigned to this variable instead of the recommended Category 1 classification per Regulatory Guide 1.97. The applicant 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.

The purpose as stated in Regulatory Guide 1.97 of this instrumentation is to detect the breach of fuel cladding, a direct measure for monitoring the accomplishment of a safety function. Thus, it is a key variable as defined in Regulatory Guide 1.97 and therefore this variable should be Category 1, not Category 3 as proposed by the applicant.

Instrumentation that is suitable for this variable has been under research and development. We find that the diverse indication presently provided for this variable is acceptable on an interim basis, on the condition that the applicant commits to evaluate systems for this variable as they become available.

#### 3.3.5 Radiation Exposure Rate

The applicant has elected not to implement this type C variable as recommended by Revision 2 of Regulatory Guide 1.97, the justification being that the applicant feels other means such as noble gas monitoring are better suited for breach detection. The applicant states that exposure

rate monitors are being provided for indication of habitability only. Revision 3 of Regulatory Guide 1.97 (Reference 6) deletes this Type C variable from the recommended instrumentation. Therefore, lack of the instrumentation for this variable is acceptable.

### 3.3.6 Suppression Spray Flow and Drywell Spray Flow

The applicant has chosen to provide an alternate indirect means for monitoring the suppression spray flow and drywell spray flow measurements. The applicant has proposed that these variables are accurately and reliably measured by the Residual Heat Removal System flow indication. The applicant states that the effectiveness of spray flow can be verified by pressure and temperature changes of the drywell and suppression chamber. The applicant has not shown that the suppression pool pressure is a direct, unambiguous indication of the suppression chamber spray flow. Also, in an accident situation, there may be a considerable time lag between changes in spray flow and the resultant change in suppression chamber pressure. The applicant has not addressed this. The applicant has not shown the spray valve position instrumentation to be Category 2. The applicant should show that the operation of the suppression chamber spray can be identified unambiguously and in a timely manner by the proposed alternative instrumentation systems.

### 3.3.7 Standby Liquid Control System (SLCS) Flow

Exception has been taken by the applicant to Regulatory Guide 1.97 for the SLCS Flow measurement. The applicant states that the SLCS Flow can be adequately monitored by (a) the decrease in the level of the boric acid storage tank, (b) the reactivity change in the reactor as measured by neutron flux and concentration of boron, (c) the SLC pump motor contractor indicating lights (or motor current) or (d) the squib valve continuity indicating lights.

Based on the above justification, we find that the applicant's position meets the requirements of Regulatory Guide 1.97 for this variable.



### 3.3.8 Standby Liquid Control System (SLCS) Storage Tank Level

Exception has been taken by the applicant to Regulatory Guide 1.97 for the SLCS storage tank level measurement. A Category 3 classification has been assigned to this variable instead of the recommended Category 2. The applicant provides the justification that the SLCS instrumentation will be operating in a mild environment and that its importance to safety is considerably less than the reactor protection and engineered safeguards system.

If the applicant conforms to all the criteria (power supply, range, etc.) identified under Category 2 instrumentation, except for equipment qualification, and the SLCS tank level instrumentation is in a mild environment, then this justification is acceptable. The applicant should provide a commitment of conformance to Category 2 criteria, except for equipment qualification, and provide a statement that the instrumentation for this variable is located in a mild environment.

### 3.3.9 Reactor Building or Secondary Containment Area Radiation

Exception has been taken by the applicant to Regulatory Guide 1.97 for the Reactor Building or Secondary Containment Radiation measurement. Regulatory Guide 1.97 recommends that this variable be monitored, whereas, the applicant's position is that the secondary containment area radiation is not an appropriate parameter to use to detect or assess primary containment leakage. Therefore, the applicant deems that reactor enclosure area radiation monitors are not required for the Limerick secondary containment.

The purpose of this variable, as stated in the regulatory guide, is detection of significant releases, release assessment, long term surveillance and emergency plan actuation. The applicant has not shown how the purpose of this variable will be fulfilled by alternate instrumentation. The applicant has not supplied sufficient justification for not implementing this variable.

### 3.3.10 Radiation Exposure Rate

Exception has been taken by the applicant to Regulatory Guide 1.97 for the radiation exposure rate Type E measurement. Regulatory Guide 1.97 recommends that this variable be monitored, whereas, the applicant's position is (a) the Limerick design does not require access to harsh environment area to service safety-related equipment during an accident and (b) portable radiation monitors will be provided to establish accessibility.

The applicant has not supplied sufficient justification for this deviation. The purpose of this variable, as stated in the regulatory guide, is detection of significant releases, release assessment and long term surveillance. The applicant should identify the ranges of the portable radiation monitors and their alternate instrumentation for long term surveillance and release assessment.

### 3.3.11 Plant and Environs Radiation

Regulatory Guide 1.97 specifies that plant and environs radiation should be monitored over the range of  $10^{-3}$  R/hr to  $10^4$  R/hr, photons and  $10^{-3}$  Rads/hr to  $10^4$  Rads/hr, beta radiation and low energy photons. The classification is Category 3.

The applicant has identified within Section 12.5.2.2.3 of the FSAR the instrumentation that will be used to monitor the Plant and Environs Radiation along with additional equipment to enhance post-accident monitoring. The post-accident instrumentation will be comprised of low, medium, and high range portable ion chambers (1 mR/hr to 20,000 R/hr gamma and 20,000 Rad/hr beta), open window alpha scintillation probes, Geiger Mueller (GM) probes, energy compensated beta/gamma GM probes (for low energy photons), and portable beta/gamma geiger counters. Audio speakers, alarming count rate meters, and extension arms will be provided for attachments to the survey instruments. Airborne radioactivity levels will be determined from laboratory analysis of particulate filters and iodine cartridge samples obtained with high and low volume samplers. Portable instruments and equipment reserved for emergency use will be located at an assembly area remote from the main plant.

It is concluded that the applicant meets the intention and purpose of the Regulatory Guide recommendations and the alternate instrumentation is acceptable.

### 3.3.12 Primary Coolant and Sump Grab Sampling

Exception has been taken by the applicant to Regulatory Guide 1.97 for the Primary Coolant and Sump Grab Sampling variables. Regulatory Guide 1.97 recommends that the primary coolant and sump be sampled, whereas, the applicant's position is that sampling of the suppression pool is representative of the variables. 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 justification presented by the applicant is acceptable for the requirements of NUREG-0737, II.B.3; however, the applicant has not shown that a sample of the suppression pool is representative of the primary containment sump, nor addressed the dilution of the sump overflow in the suppression pool or time delay in response to the accident. Therefore, the applicant's position on sampling the primary containment sump does not meet the requirements of Regulatory Guide 1.97. The applicant should commit to installation of a satisfactory system or provide further justification.

## 4. CONCLUSIONS

With the exceptions identified by the applicant in Section 7.5.2.5 of the FSAR, the applicant has committed conformance to Regulatory Guide 1.97. Review of the identified exceptions to the regulatory guide has resulted in the following conclusions.

1. Neutron Flux--The applicant should address which proposed option for modifications will be followed, which specific deviations will result, if any, and any justifications where deviations are taken. (Section 3.3.1).
2. Reactor Water Level--The applicant should address specifically why the recommendations of Regulatory Guide 1.97 cannot be accomplished for this variable. (Section 3.3.2).
3. Drywell Sump Level and Drywell Drain Sumps Level--The applicant should provide justification for the use of Category 3 instrumentation for this variable. The applicant should also provide the information to complete Table 7.5-3 for this variable. (Section 3.3.3).
4. Radioactivity Concentration or Radiation Level in Circulating Primary Coolant--The applicant has not provided acceptable justification for the use of Category 3 instrumentation for this variable. The diverse indication presently provided for this variable is acceptable on an interim basis on the condition that the applicant commits to evaluate systems for this variable as they become available. (Section 3.3.4).
5. Suppression Spray Flow and Drywell Spray Flow--The applicant has not provided acceptable justification for not monitoring these parameters directly. The applicant should provide additional information for these variables. (Section 3.3.6).
6. Standby Liquid Control System Storage Tank Level--The applicant should confirm conformance to the Category 2 Criteria except for equipment qualification and provide a statement that the instrumentation for this variable is located in a mild environment. (Section 3.3.8).

7. Reactor Building or Secondary Containment Area Radiation--The applicant has not shown how the proposed alternate method for monitoring this variable satisfies the recommendations of Regulatory Guide 1.97 nor has the applicant provided sufficient justification for not implementing this variable. The applicant should provide additional justification for this deviation. (Section 3.3.9).
8. Radiation Exposure Rate--The applicant has not shown how the proposed alternate method for monitoring satisfies the recommendations of Regulatory Guide 1.97 for long term surveillance and release assessment. Nor has the applicant provided sufficient justification for not implementing this variable. The applicant should provide additional justification for this variable. (Section 3.3.10).
9. Primary Coolant and Sump Grab Sampling--The applicant has not shown how the proposed alternate method for monitoring satisfies the recommendations of Regulatory Guide 1.97. The applicant should commit to installation of a satisfactory system for this variable or provide further justification. (Section 3.3.12).

## 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. Philadelphia Electric Company Letter to NRC, V. S. Boyer to Darrell B. Eisenhut, Director, Division of Licensing, "Limerick Generating Station, Units 1 and 2 Docket Nos. 50-352 and 50-353," April 15, 1983.
5. Final Safety Analysis Report (FSAR) for Limerick Generating Station Unit 1 and Unit 2, Revision 25 May 1983.
6. Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident, Regulatory Guide 1.97, Revision 3, U.S. Nuclear Regulatory Commission (NRC), Office of Standards Development, May 1983.