PHILADELPHIA ELECTRIC COMPANY

2301 MARKET STREET

P.O. BOX 8699

PHILADELPHIA, PA. 19101

(215) 841-4000

EDWARD G. BAUER, JR.
VICE PRESIDENT
AND GENERAL COUNSEL

EUGENE J. BRADLEY
ASSOCIATE GENERAL COUNSEL

DONALD BLANKEN
RUDOLPH A. CHILLEMI
E. C. KIRK HALL
T. H. MAHER CORNELL
PAUL AUERBACH
ASSISTANT GENERAL COUNSEL
EDWARD J. CULLEN, JR.
THOMAS H. MILLER, JR.
IRENE A. McKENNA
ASSISTANT COUNSEL

June 27, 1983

Mr. A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Limerick Generating Station, Units 1&2
Loose Parts Monitoring System (LPMS)
50-352 50-353

Reference: PECO and NRC Conference Call dated 6/21/83

File: GOVT 1-1 (NRC)

Dear Mr. Schwencer:

As a result of the discussions in the referenced conference call, the attached draft FSAR page changes concerning the Loose Parts Monitoring System will be incorporated into the FSAR, exactly as it appears on the attachments, in the revision scheduled for July, 1983.

As requested by the NRC reviewer, a more detailed system description will be provided to show compliance with Regulatory Guide 1.133. A schedule will be developed for submittal of this information upon our receipt of the Safety Evaluation Report.

A001
1/1

Sincerely,

Eugene J. Bradley

RJS/gra/54

Copy to: See Attached Service List

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Limerick qualification tests of electric cables, field splices, and connections are discussed in Section 3.11.

(Category 1)

REGULATORY GUIDE 1.132 Site Investigations for Foundations of Nuclear Power Plants
Rev 1, March 1979

This guide is applicable to Limerick only for new investigations conducted after March 30, 1979. No new investigations have been conducted since that time.

Site investigations are discussed in Sections 2.4 and 2.5.

(Category 1)

REGULATORY GUIDE 1.133 Loose-Part Detection Program for the Primary System of Light-Water-Cooled Reactors
Rev ~~0, September 1977~~ 1, MAY 1981

Limerick is in conformance with ~~Draft 2 of Revision 1~~ 9 this guide as discussed in Section 4.4.6.1, ~~where a comparison with Revision 0 of the guide is also~~ provided.

(Category 1)

REGULATORY GUIDE 1.134 Medical Certification and Monitoring of Personnel Requiring Operator Licenses
Rev 1, March 1979

Limerick will be in conformance with this guide, which endorses/modifies ANSI N546-1976, as discussed in Section 13.1.

(Category 1)

REGULATORY GUIDE 1.135 Normal Water Level and Discharge at Nuclear Power Plants
Rev 0, November 1977

throughout core lifetime are discussed in Chapter 14. A summary of preoperation and initial startup testing is as follows:

a. Preoperational testing: Tests are performed during the preoperational test program to confirm that construction is complete and that all process and safety equipment is operational. Baseline data are taken to assist in the evaluation of subsequent tests. Heat-balance instrumentation and jet pump flow and core temperature instrumentation are calibrated and setpoints verified.

b. Initial startup: Hot functional tests are conducted with the reactor between 5% and 10% power. Core performance is monitored continuously to ensure that the reactor is operating within allowable limits (e.g., peaking factors, LHGR, etc) and is evaluated periodically to verify the expected and actual core performance margins.

4.4.6 INSTRUMENTATION REQUIREMENTS

The reactor vessel instrumentation monitors the key reactor vessel operating parameters during planned operations. This ensures sufficient control of the parameters. The following reactor vessel sensors are discussed in Sections 7.6 and 7.7:

a. Reactor vessel temperature

b. Reactor vessel water level

c. Reactor vessel coolant flow rates and differential pressures

d. Reactor vessel internal pressure

e. Neutron monitoring system

4.4.6.1 Loose Parts Monitoring System (LPMS)

4.4.6.1.1 Design Basis

a. The LPMS is designed to detect loose parts in the reactor coolant systems.

b. The LPMS is designed to reduce the effects of variations in background noise on system capabilities for the detection of loose parts.

c. The LPMS is designed in conformance ~~with Draft 2 to~~ with Revision 1 (May 1978) of Regulatory Guide 1.133. ~~Exceptions to Revision 1 (May 1981) of the guide are as noted below:~~

a. The Limerick LPMS does not follow Regulatory Position C.1.d in that the system does not simultaneously record all sensor channels for future playback and analysis. The system's magnetic tape recorder system records event-related parameters simultaneously on four channels only. Recorder operation is initiated by the first sensor detecting a loose part impact exceeding the preset alert level. This channel, and three others selected by the programmable alarm matrix, are automatically recorded. Data thus recorded can then be diagnosed to determine mass and location of the loose part. This meets the intent of this regulatory position.

b. The Limerick LPMS does not follow Regulatory Position C.1.g in that the total system is not tested to the complete requirements of Regulatory Guides 1.89 and 1.100. Equipment located in the control room is successfully tested to seismic levels exceeding operating basis earthquake (OBE) criteria at that location. This equipment is also protected from damage from other devices in the same or adjacent cabinets, and the enclosure in which it is located has been constructed and analyzed to structurally survive excitation exceeding the OBE levels. Equipment external to the control room has been similarly tested to OBE criteria.

   Sensors, equipment and special cabling for use inside the primary containment is rated at 10^{18}nV and 50 rem/hour, gamma, and is suitable for continuous operation from 40°F to 630°F at 100 percent relative humidity. Equipment located outside the primary containment is constructed of high quality solid-state electronic modules. The environmental suitability of all component parts of the system has been demonstrated by over 20 system years of operation under normal plant operating conditions.

c. The Limerick LPMS does not follow Regulatory Position C.3.b in that the magnetic tape recording system only records four sensor channels simultaneously, as discussed in a. above. However, a dedicated microprocessor-based paper tape recording system does document all channel events with respect to

time. Plant operating conditions, extracted from other data sources, can then be related to these events.

4.4.6.1.2 System Description

The function of this system is to detect and alarm for loose parts in the reactor coolant system. Loose parts are those metallic objects that can be physically moved by the reactor flow. A secondary function of the system for the Limerick units is to assist the operators in locating the detected loose parts as accurately and quickly as possible.

The devices mounted within each containment are designed to withstand the SSE and are redundant (eight sensors located on opposite sides of each reactor at four elevations). There are two identical sets of control room equipment, one set dedicated to Unit 1 and one set dedicated to Unit 2. Isolation is maintained between the monitoring channels up to and including the control room monitors (which contain the alarm circuits). While these precautions have been taken, the system is not considered safety-related.

A primary consideration in the design of the LPMS is the power spectrum density (PSD) plot shown in Figure 4.4-19, which illustrates the normal background energy content over a specific band of frequencies of an operating power reactor, as detected by a piezoelectric transducer. The overall energy content and shape of the plot varies with plant conditions and between different sensor locations. Salient features demonstrated by the PSD are:

a. Low-frequency energy is related to the NSSS structure and machinery vibration

b. High-frequency energy is related to flow associated noises

c. Relatively rapid attenuation of the higher-frequency noises occurs because of the filtering effect of the acoustic path through the NSSS components. The LPMS incorporates tuned bandpass filters to concentrate on the portion of the noise spectrum that has a low background level, generally in the 1 Khz to 10 Khz frequency range. Because metal-to-metal impacts result in a relatively flat frequency response in the 1-10Khz range and because certain portions of the background noise in that portion of the frequency spectrum are of relatively low level, the signal-to-noise ratio is improved, thereby enhancing detection capability while reducing the occurrence of false alarms.

120 to 200% of the background energy level is detected. The detector module also features a low alarm, which is associated with the continuous channel check function. The low alarm output from the detector modules is routed to the master alarm module only. The high alarm output of the detector modules is routed to four places: the master alarm module, the loose parts locator, the matrix switch, and the MARSS (Multiplex Analog Recording and Switching System.).

The master alarm module accepts the high and low alarm outputs of the detectors, illuminates an indicator for the appropriate alarm, and initiates an audio alarm.

The loose parts locator is a digital processor that calculates and displays the time of arrival of each loose part impact at the sensors, thereby assisting the operator in determining the location of the loose part.

The matrix switch improves operational flexibility by allowing all sensor signals, as well as auxiliary inputs of additional data or test signals, to be routed to any available output connection, which includes audio monitors for the sensor signals, a spectrum analyzer or other auxiliary outputs that may be connected to portable diagnostic or analysis equipment.

The MARSS provides for the recording of signals as manually selected by the operator during routing system operability checkout. However, when an alarm (alert) condition is detected, MARSS automatically overrides the manually selected inputs and records the alarm channel and three others selected by the alarm matrix.

The tape recorder is a four-track audio tape recorder that records the loose part signals and an encoded channel identification.

The system is designed to operate continuously without operator supervision, except for routine system testing.

4.4.6.1.3 Safety Evaluation

The LPMS is intended to be used for information purposes only and is not a safety-related system. The system conforms with Regulatory Guide 1.133~~, except as stated in 4.4.6.1.~~ The plant operators use the LPMS to assist in the detection of anomalous loose parts. They also use it to assist in determining the location of any anomalous loose parts. The operators do not rely solely on this system or information provided by this system for the performance of any safety-related action. Any evaluations or actions taken to confirm the presence of a loose part will be handled on a case-by-case basis.