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February 21, 1984

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 and 2
Core Performance Branch
Loose Parts Monitoring System
Confirmatory Issue #11

Reference: E. J. Bradley to A. Schwencer letter dated June 27, 1983.

File: GOVT 1-1 (NRC)

Dear Mr. Schwencer:

The Limerick Generating Station Safety Evaluation Report (SER), NUREG-0991, Section 4.4.6, "Loose Parts Monitoring System", Table 4.1, lists the NRC staff's findings in regards to Regulatory Guide conformance and areas for which additional information is required.

Attachment A, consists of draft FSAR page changes to Chapter 4 which will appear in the February revision of the FSAR. It addresses items C.1, C.2, C.3(b), C.4 (except C.4.i), C.5 and C.6 of SER Table 4.1. Attachment B, "Comment Regarding the LGS Loose Parts Monitoring System Compliance with Regulatory Guide 1.133 (Revision 1, May, 1981)", addresses items C.3(a) and C.4.i of SER Table 4.1. Attachment B will not be incorporated into the FSAR.

Attachments A and B provide all the additional information requested in Table 4.1. They should satisfy Confirmatory Issue #11 of the Safety Evaluation Report.

Sincerely,

John S Kemper

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cc: See Attached Service List

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cc: Judge Lawrence Brenner (w/enclosure)
Judge Peter A. Morris (w/enclosure)
Judge Richard F. Cole (w/enclosure)
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Atomic Safety & Licensing Board Panel (w/enclosure)
Docket & Service Section (w/enclosure)
Martha W. Bush, Esq. (w/enclosure)
James Wiggins (w/enclosure)

Attachment (A)

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TABLES (Cont'd)

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rate. Again, no control rods are moved to accomplish the power reduction.

Varying the recirculation flow rate (flow control) is more advantageous, relative to load following, than using control rod positioning. Flow variations perturb the reactor uniformly in the horizontal planes and ensure a flatter power distribution and reduced transient allowances. As flow is varied, the power and void distributions remain approximately constant at the steady-state end points for a wide range of flow variations. After adjusting the power distribution by positioning the control rods at a reduced power and flow, the operator can then bring the reactor to rated conditions by increasing flow, with the assurance that the power distribution will remain approximately constant. Section 7.7 describes how recirculation flow is varied.

4.4.3.6 Thermal and Hydraulic Characteristics Summary Table

The thermal-hydraulic characteristics are provided in Table 4.4-1 for the core and in tables of Sections 5.1 and 5.4 for other portions of the reactor coolant system.

4.4.4 EVALUATION

Refer to subsection A.4.4.4 of GESTAR II (Ref. 4.1-1). The results of the cycle-1 stability analysis are given in Table 4.4-13 and Figures 4.4-7 through 4.4-10.

4.4.5 TESTING AND VERIFICATION

Refer to subsection A.4.4.5 of GESTAR II (Ref. 4.1-1).

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 reactor vessel sensors are discussed in Sections 7.6 and 7.7.

4.4.6.1 Loose Parts Monitoring System (LPMS)

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4.4.6.1.1 Design Basis

Replace with insert ①

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 Revision 1 (May 1981) of Regulatory Guide 1.133.

4.4.6.1.2 System Description

The primary 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.

Replace with insert ②

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

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Insert (1)　　　　　　　　　　　　　　　　　　　　INSERT (1)

[redacted]

4.4.6.1 Loose Parts Monitoring System (LPMS)

4.4.6.1.1 Design Basis

a. The LPMS is designed in conformance with Regulatory Guide 1.133 Rev. 1, May 1981 to continuously monitor the reactor and the reactor coolant system for indication of ^metallic^ loose parts.

c. The LPMS ~~is designed to~~ provide^s^ early detection and operator warning of loose parts in the primary system to avoid or mitigate safety-related damage to or malfunctions of primary system components.

d. Additional ~~primary~~ design ~~considerations~~ ^FEATURES^ provide for the inclusion of electronic features to minimize operator interfacing requirements during normal operation and to enhance the analysis function when operator action is required to investigate potential loose parts.

e. Each unit is provided with a separate ^AND DEDICATED^ LPMS. There are two identical sets of control room equipment, ^EACH IN ITS OWN RACK^ ~~one set exclusively dedicated to each unit~~.

b. The LPMS design minimizes the effects of background noise level variations on the ability to detect loose parts.

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Insert (2)

THE LPMS contains the following components, FOR EACH UNIT:

1) 8 Piezoelectric Accelerometers (sensors)

2) 8 Low Noise Hardline Special Cables

3) 8 Remote Charge Preamplifiers (Line Drivers)

4) 8 Twisted-shielded pair (TPS) cables

5) 8 Noise Signal conditioners

6) 8 Automatic Gain ControlS (AGC)

7) 1 Multiplexed Analog Recording and Switching Sub-system (MARSS)

8) 1 Audio Monitor

9) 1 Digital Loose Part Locator (DLPL)

10) 8 Junction boxes

11) 1 Four channel Tape Recorder

Items 1, 2 and 3 are located in the containment, and ~~the remaining items~~ ITEMS 5 THROUGH 11 are located in the control room, CONNECTED by TPS Cables (Item #4)

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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 Khz to 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.

The LPMS ~~also~~ incorporates an automatic gain control (AGC) circuit, which normalizes the background level without operator interaction. This results in a varying threshold detection level that is a function of background noise level produced by changing operating power levels and/or configurations. This reduces false alarms by reducing sensitivity at high background levels. Conversely, at low background levels, sensitivity, and thus detection capabilities, are greatly improved.

NO SPACE

Thus, the LPMS automatically follows transient operating conditions, with decreased false alarms and increased operator confidence.

~~Each LPMS includes an array of eight piezoelectric accelerometers (sensors) strategically located on the exterior surface of the reactor coolant boundary at the following natural collection regions (Figure 4.4-20)~~.

INSERT 3

~~a. Vessel bottom: Two sensors are mounted on opposite sides of the vessel on the CRD housings as close as~~ possible to the vessel.

~~b. Recirculation pump suction pipes: Two sensors are mounted on the recirculation pump suction lines immediately outside the primary shield wall, one on each line.~~

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~~c. Feedwater inlet pipes. One sensor is mounted on each of two feedwater lines immediately outside the primary shield wall. The feedwater lines chosen are those with the maximum physical separation at the vessel.~~

~~d. Main steam lines. One sensor is mounted on each of two main steam lines immediately outside the primary shield wall. The steam lines chosen are those with the maximum physical separation at the vessel.~~

~~A functional block diagram is shown in Figure 4.4-[illegible].~~

~~Special low noise coaxial cables conduct the accelerometer signals to remote mounted preamplifiers. The preamplifiers condition the signals for transmission over the relatively long distances to the detector modules located in the control room.~~

The detector module initiates a high alarm (alert function) when a signal is received that exceeds the setpoint. There is no fixed setpoint for the detector modules in terms of an absolute energy level because they employ an automatic gain control system, which varies channel sensitivity as a function of the background noise level for that channel. Typically, the system operates at a variable sensitivity of better than 0.5 ft-lbs, and the high alarm (loose part alert) is initiated when an impact of 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~~ AUDIBLE 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

Insert (3) DRAFT

The sensors used in the LPMS are ~~very~~ sensitive to vibrations over a wide frequency band, thus ideal for detecting acoustic waves transmitted due to impact of Loose Parts (LP) to the reactor internal structure.

The sensors are mounted at strategic Locations (see section 4.4.6.1.3) immediately outside the reactor ~~wall~~ vessel and connected to the respective remote charge preamplifiers with low noise hardline special cables.

The remote charge preamplifier is an active device, powered by 30 V DC supplied from the signal conditioner via TPS cables. The remote charge preamplifier superimposes an a-c signal proportional to the accelerometer output on the d-c voltge. The signal conditioner detects the superimposed a-c signal on the d-c signal and amplifies and normalizes the a-c signal appropriately.

The output of the ~~remote~~ charge preamplifier is transmitted to the control room. ~~and instrumentation via TSP cable~~.

In the control room the signal received from the remote charge pre-amplifier is processed through the loose parts detector module.

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data or test signals, to be routed to any available output connection, which includes ~~audio~~ audible 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. The limiting conditions for the operation and surveillance requirements are discussed in Chapter 16. Insert (4)

4.4.6.1.~~4~~5 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. 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.

4.4.6.1.~~5~~6 LPMS Training and Calibration

4.4.6.1.~~5~~6.1 LPMS Training

The scope of training for the onsite LPMS ~~will~~ covers the theory and operation of the LPMS system including hands-on training. Emphasis ~~will be~~ is placed on detection and characterization of loose parts and implementation of diagnostic concepts.

Insert (4) 1/5 DRAFT

4.4.6.1.3 ~~Conformance with Regulatory Guide 1.133, Rev. 1; May, 1981~~.

~~C.1.~~ System Characteristics

a. Sensor location: Eight piezoelectric accelerometers are mounted strategically; two on each of the following four natural collection regions, to cover the whole reactor coolant boundary: ~~(See Figure 4.4-20)~~

   1) Vessel Bottom: Two sensors are mounted on two of the control rod drive housings, immediately outside of the Reactor Vessel bottom. The control rod housings choosen are at 90° and 270° to provide maximum distributed coverage of this region.

   2) Recirculation Water Pump Inlet Lines: Two sensors are mounted on the two recirculation water pump inlet lines, immediately outside the shield wall. The recirculation line are located at 0° and 180°, which provides distributed coverage of this region.

   3) Feedwater Inlet Nozzles: Two sensors are mounted on the feedwater nozzles, immediately outside the shield wall. The feedwater nozzles chosen are at 30° and 210° to provide the maximum distributed coverage of this region.

   4) Steam Outlet Lines: Two sensors are mounted on the steam outlet lines, immediately outside the ~~Reactor Vessel~~ RPV wall. The steam lines chosen are at 108° and 288° to provide the maximum distributed coverage of this region.

b. System Sensitivity: The on-line sensitivity of the system is such that, as a minimum, the system can detect a metallic loose part that weighs from 0.25 to 30 pounds and impacts with a kinetic energy of 0.5 ft-lb on the inside surface of the reactor coolant pressure boundary within 3 feet of a sensor.

   The impact signal to background ratio is optimized using the noise filtering techniques, which increases the system's sensitivity and reduces the likelihood of false alarms. The AGC maintains the background noise at a constant level, relative to threshold level.

Insert (4) 2/5 DRAFT

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c. Channel Separation: The monitoring channel for each sensor is physically separated from each other, beginning from the sensor upto and including the control room monitors, which contain the alarm circuit; and is always accessible for maintenance during full power operation.

d. Data Acquisition System: The system design for the data Acquisition includes sensors, special coaxial cable, preamplifiers, signal conditioner, AGC, DLPL, MARSS four track audio tape recorder with simultaneous audio and visual alarms on the system annunciator. The system design has capability of manual mode pre-operational testing, startup and power operation to establish alerts level.

In the event the alert level is reached or exceeded, the system overrides manual operation and activates automatically the visual and audio alarms in control room. The system has capability to record simultaneously signals from four sensors, one alarming signal and three signals selected from other sensors.

Storage of Data for Comparison - The tape recorders will provides the necessary recording reproduction capability of baseline signature or unusual events. Significant departure from the baseline tape may indicate the presence of an unusual noise. This shall ascertain whether the departure is due to electrical noises which are found to be periodic in nature and have individual wave forms or mechanical noises which are result of the normal plant operation.

e. Alert level: Provisions shall be made to incorporate a reference signal into the LPMS that would indicate alert level due to presence of a loose part.

f. Capability for Sensor Channel Operability Test: Provisions shall be made for periodic on-line channel check and channel functional tests and for off-line channel calibration during periods of cold shutdown or refueling.

g. Operability for Seismic and Environmental Conditions: The devices mounted within each containment are designed to withstand the SSE which do not require

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Insert (4) 3/5 DRAFT

~~plant shutdown.~~ Under simulated test conditions of DBE, there was no evidence of mechanical damage, deterioration or loss of ability to operate during or after the test with exception of the recording device. The environmental design data are shown in Table 4.4-6.

h. Quality of System Components: The system components are ~~of the~~ state of the art electronics and transducers with proven performance in other similar applications. Though 40 years life cannot be assured, the components are replaceable. A replacement program shall be established for those components which have limited life expectancy.

i. System Repairs: The modular configuration allows a failed module to be replaced, the channel recalibrated, and returned to operation with ease and without deenerging the system. All module components are interchangeable and allow repairs to be made at the module, card, or component level.

~~However the system is not safety related but is used for information purposes only.~~

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Insert (4) 4/5

4.4.6.1.4 System Operation ~~and maintenance~~

Normal System Operation - The LPMS ~~will be set~~ IS DESIGNED to alarm for detected noises having the characteristics of metal-to-metal impacts.

A loose part is considered to be a metallic object that can be physically moved by fluid flow. In general, loose parts are classified into two generic categories, captive and free. Captive loose parts are the result of an unanticipated mechanical failure which causes a metallic object to impact its surrounding structures without being physically severed from its original structure. Free loose parts, on the other hand, are free to migrate from one physical location to another. This movement of the metallic object is caused by its suspension in the surrounding primary fluid. The primary concern of loose parts entrapped in a high-velocity fluid system is the potential severe mechanical damage that may result if the metallic object is allowed to impact structures.

Metal-to-metal impacts resulting from loose parts excite the preferential ringing modes of the NSSS components. The modes are typically between 1 kHz and 10 kHz and are easily detected by externally mounted accelerometers.

After installation of a strategically located accelerometer array, as identified above, the overall and individual channel characteristics of the accelerometer system will be determined before operation monitoring.

The LPMS includes provisions for analysis and diagnostic data acquisition capabilities, such as:

a. Problem verification - false or real alarm

b. Data gathering - transient or unusual plant conditions

c. Limitations and location of the problem, captive or loose part

d. Diagnostic phase which includes location, energy content, and damage assessment

The summary of supplemental data and diagnostic procedures are included in the LIMERICK operating procedures

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Once operations of the NSSS have commenced, each accelerometer channel will exhibit its own particular and unique frequency spectrum. This frequency signature, or normal background, results from such internal sources as primary flow turbulence, recirculation pump vibrations, feedwater and steam flow turbulence, structural responses of NSSS components and secondary plant equipment, and a host of other localized noise sources. In addition, external sources, such as airborne noises from fans and other equipment, contribute to the overall background.

To achieve more reliable detection of unusual noises indicative of metal-to-metal impact, a spectral comparison of the measured local metal-to-metal acoustical resonances and the normal background will be performed. Based on the spectral comparison, the broad-band signal is band-limited to the portion of the spectra that maximizes the signal-to-noise ratio. This band-limited signal, which in most cases eliminates or minimizes the contributions of normal acoustical background, is then monitored for sudden transients indicative of metal-to-metal impacts. A transient must exceed a threshold which is a function of the plant background noise level before it can activate the alarm circuitry. The background level is derived in an RMS converter circuit having a time constant long enough to be largely unaffected by rapid transients and therefore always proportional to the background level. Normal plant transients cause a shift in the background level and will not activate the alarm circuitry, thereby affecting a reduction in spurious alarms.

Once an unusual noise characteristic of a metal-to-metal impact is detected by the loose parts monitor, it is essential to determine the source or cause of the alarm. The first and simplest form of diagnosis is audio interpretation, but this method is very subjective and can result in a number of erroneous conclusions to the uneducated listener. Background noises, such as throttled steam and flow turbulence, can be easily distinguished. Metal-to-metal impacts can also be readily recognized because of their characteristic spectral content. In addition, the metal-to-metal impacts caused by a bona fide loose part will occur with a random repetitious rate. Further insight can be gained by using a real-time spectrum analyzer, observing the transient spectra of the impact, and comparing the transient spectrum to known metallic impact and background spectra.

The procedures to minimize radiation exposure to station personnel during maintenance, calibration and diagnostic procedure, pursuant to FSAR Chapter 12, ~~"Radiation Protection" of FSAR~~ are included in the "Limerick operating procedures"

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4.4.6.1.6.2 LPMS Calibration

The LPMS calibration is in accordance with Regulatory Guide 1.133. The calibration is performed both at cold plant shutdown with no background noise sources (pumps, fans, etc) and with the plant running at maximum power levels. Calibrated impact hammers are used. Data is taken at various impact levels at various locations relative to each sensor. The data obtained provide information to determine the following system characteristics to be used as baseline for plant operations:

a. Channel sensitivity or minimum loose part impact to cause alarm (Alert Level)

b. Time and frequency responses to impact

c. Delay time matrix for LPMS sensor array with impacts at various locations.

d. Impact energy versus channel output amplitude.

4.4.6.1.6.3 Acceptance Criteria

Loose Parts Monitoring Sensitivity EVALUATION

No specific acceptance criteria is specified. Sufficient quality data is recorded to satisfy the objectives listed. The procedure provides guidelines to ensure the quality and quantity of data to achieve those objectives; however, it is the responsibility of the field engineer in charge to determine the point at which sufficient data has been acquired and when the procedure should be terminated.

The procedure is intended to be used at the beginning of plant life to establish the system sensitivity. More abbreviated tests may be performed on a periodic basis to demonstrate that the system response (and sensitivity) is unchanged.

Add TABLE 4.4-6

~~INSERT FIG. 4.4-20~~

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TABLE 4.4-6

LPMS EQUIPMENT ENVIRONMENTAL DESIGN

Equipment		Environmental Design
1. Accelerometers	Vibration:	500g peak
	Shock:	3,000g peak
	Temperature:	-65 to 700 F
	Relative Humidity:	Sealed by glass-to-metal fusion and welding
	Integrated Gamma flux:	6.2×10^{10} rad
	Integrated Neutron flux:	3.7×10^{18} n/cm^2
2. Hardline cable	Temperature:	-300 to 900 F
	Relative Humdity:	100% noncondensing
	Materials:	Stainless steel and magnesium oxide hardened against radiation
3. Preamplifier	Temperature:	0 to 160 F
	Relative Humidity:	100% noncondensing
4. Control room equipment	Temperature:	40 to 100 F operating, 75 F normal
	Relative Humidity:	20 to 80% operating; can accommodate brief periods of higher humidity, but not continuous higher humidity; 50% normal, free of salt or industrial pollutants
	Pressure:	Atmospheric

Attachment (B)

COMMENT REGARDING THE LGS LOOSE PARTS MONITORING SYSTEM COMPLIANCE WITH REGULATORY GUIDE 1.133 (REVISION 1, MAY, 1981) SECTIONS C.3.a AND C.4.i

The NRC Regulatory Guide 1.133 describes a method acceptable to the NRC staff for implementing requirements with respect to detecting a potentially loose part in a light water cooled reactor during normal operation. The purpose of this document is to outline on a point-by-point basis the content of the Regulatory Guide (dated May, 1981) Sections C.3.a and C.4.i as it relates to the Limerick Generating Station Loose Parts Monitoring System (LPMS).

REGULATORY GUIDE 1.133 LOOSE PART DETECTION FOR THE PRIMARY SYSTEM OF LIGHT-WATER-COOLED REACTORS

C. REGULATORY POSITIONS

3. USING THE DATA ACQUISITION MODES

THE LOOSE-PART DETECTION PROGRAM SHOULD INCLUDE DATA ACQUISITION IN AUTOMATIC AND MANUAL MODES. THE AUTOMATIC MODE IS FOR CONTINUOUS, ONLINE DETECTION OF LOOSE APRTS. THE MANUAL MODE IS TO BE USED PERIODICALLY FOR DETECTING LOOSE PARTS, DETERMINING SYSTEM OPERABILITY (INCLUDING CALIBRATION), ESTABLISHING THE ALERT LEVEL, AND DETECTING SIGNIFICANT SAFETY-RELATED TRENDS IN THE SENSOR SIGNALS AND FOR DIAGNOSTIC PURPOSES.

a. MANUAL MODE

In this mode, the analyst may select any combinations of sensors for data recording and evaluation.

THIS MODE OF DATA ACQUISITION SHOULD BE USED AT THE FOLLOWING TIMES FOR THE INDICATED PURPOSE.

(1) PREOPERATIONAL TESTING: ESTABLISH ALERT LEVEL FOR THIS TEST PHASE.

The LPMS manufacturer (Babcock & Wilcox) will provide interim setpoints for use prior to startup. These setpoints will be used to help establish an alert level for this test phase.

(2) STARTUP AND POWER OPERATION

(a) ESTABLISH ALERT LEVELS FOR STARTUP AND POWER OPERATION. THE ALERT LEVEL FOR POWER OPERATION SHOULD BE SUBMITTED TO THE COMMISSION (IN THE STARTUP REPORT WHEN ONE IS PROVIDED) WITHIN 90 DAYS FOLLOWING COMPLETION OF THE STARTUP TEST PROGRAM IF THE ALERT LEVEL IS FOR POWER OPERATION FOLLOWING INITIAL STARTUP OR THERE IS A CHANGE TO THE PREEXISTING ALERT LEVEL FOR POWER OPERATION. TEMPORARY CHANGES TO THE ALERT LEVEL NEED NOT BE REPORTED.

The alert level for power operation will be established during power ascention testing and will be submitted to the Commission within 90 days following completion of the startup test program.

(b) AT LEAST ONCE PER 24 HOURS: PERFORM CHANNEL CHECK.

A channel check will be performed at least once per 24 hours as part of ST-6-107-590-1.

The basic system function may be evaluated from the front panel by an operator in four ways; (1) bias level, (2) high alarm status and setpoint, (3) low alarm status (may be checked by pressing the appropriate front panel buttons and verifying the reading on each module) and (4) the dual channel audio monitor. ~~permits~~ An audio check for "normal" system noise of. If there is doubt regarding what "normal" noise for that channel is, a

reference tape may be replayed for comparison.

Low Alarm function can be verified from the rear of each detector module by removing the signal input.

(c) AT LEAST ONCE PER 7 DAYS: LISTEN TO AUDIO PORTION OF SIGNALS FROM ALL RECOMMENDED SENSORS FOR THE PURPOSE OF DETECTING THE PRESENCE OF LOOSE PARTS. IF SIGNALS INDICATE THE PRESENCE OR POSSIBILITY OF A LOOSE PART, STATION PERSONNEL SHOULD ACTUATE THE DATA ACQUISITION SYSTEM TO OBTAIN DATA FOR FURTHER EVALUATION.

The dual channel audio monitor permits an audio check for "normal" system. If there is doubt regarding what "normal" noise for that channel is, a reference tape may be replayed for comparison.

(d) AT LEAST ONCE PER 31 DAYS: PERFORM CHANNEL FUNCTIONAL TESTS.

The channel functional test will be performed at least once per 31 days as per ST-6-036-300-1.

The basic system function can be evaluated just as listed for "b" above. In addition, the control room amplifier gains and alarm functions may be tested by injecting a signal into the calibration port on the back of the amplifier modules. The calibration signal can be from a function generator or from a specially prepared calibration tape.

(e) AT LEAST ONCE PER 92 DAYS: VERIFY THAT THE BACKGROUND NOISE MEASURED DURING NORMAL PLANT OPERATION IS SUFFICIENTLY SMALL THAT THE SIGNAL ASSOCIATED WITH THE SPECIFIED DETECTABLE LOOSE-PART IMPACT WOULD BE CLEARLY DISCERNIBLE IN THE PRESENCE OF THIS BACKGROUND NOISE. VERIFY THAT THE SIGNAL FROM EACH

RECOMMENDED SENSOR DOES NOT FALSELY INDICATE THE PRESENCE OF A LOOSE PART. THIS SHOULD INCLUDE COMPARISON WITH DATA, INCLUDING AUDIO DATA, OBTAINED AT THE TIME OF THE LAST TWO QUARTERLY MEASUREMENTS TO VERIFY THAT THERE DOES NOT EXIST A SIGNIFICANT TREND OR ANOMALY THAT MAY FALSELY INDICATE THE PRESENCE OF A LOOSE PART. THE ALERT LEVEL AND ALERT LOGIC MAY BE REVISED TO PROVIDE FOR THE BACKGROUND NOISE OF THESE LATER MEASUREMENTS. IF THE REVISION IS NOT TEMPORARY, ITS DETAILS SHOULD BE SUBMITTED WITHIN 60 DAYS TO THE COMMISSION AS AN AMENDMENT TO THE PROGRAM DESCRIPTION.

The RMS background noise level is available on the front panel of each module for comparison with previous data. In addition, time and frequency domain data evaluation using an oscilloscope and frequency analyzer may be made to more completely document and identify any change in the system performance.

Note:

Per Reg. Guide 1.133, in the event this test results in a permanent system sensitivity adjustment, details of the change should be submitted to NRC.

(3) COLD SHUTDOWN OR REFUELING: AT LEAST ONCE PER 18 MONTHS, VERIFY CHANNEL CALIBRATION USING A CONTROLLED MECHANICAL INPUT (E.G., WEIGHT FALLING THROUGH A KNOWN DISTANCE THAT IMPACTS THE EXTERNAL SURFACE OF THE REACTOR COOLANT PRESSURE BOUNDARY). CHANNELS SHOULD, AS NECESSARY, BE RECALIBRATED AT THIS TIME. IF RECALIBRATION IS NECESSARY, CONSIDERATION SHOULD BE GIVEN TO REPLACEMENT OF UNSTABLE COMPONENTS.

As per ST-2-036-408-1, channel calibration will be verified at least once per 18 months by use of a controlled mechanical input.

4. CONTENT OF SAFETY ANALYSIS REPORT

A DESCRIPTION OF THE LOOSE-PART DETECTION PROGRAM SHOULD BE SUBMITTED TO THE COMMISSION IN RESPONSE TO THE NRC STAFF REQUEST FOR INFORMATION ON LOOSE-PART DETECTION SYSTEM IN SECTION 4.4.6, "INSTRUMENTATION REQUIREMENTS," OF REGULATORY GUIDE 1.70, "STANDARD FORMAT AND CONTENT OF SAFETY ANALYSIS REPORTS FOR NUCLEAR POWER PLANTS."

THE PROGRAM DESCRIPTION SHOULD INCLUDE THOSE ITEMS COVERED IN REGULATORY POSITIONS 1, 2, AND 3. SPECIAL ATTENTION SHOULD BE GIVEN TO THE FOLLOWING ITEMS:

i) PROCEDURES FOR MINIMIZING RADIATION EXPOSURE TO STATION PERSONNEL DURING MAINTENANCE, CALIBRATION, AND DIAGNOSTIC PROCEDURES. (REFERENCE IN CHAPTER 12, "RADIATION-PROTECTION" OF THE SAFETY ANALYSIS REPORT

It is the policy of Philadelphia Electric Company to maintain occupational radiation exposure ALARA at the Limerick Generating Station. The company's commitment to this policy is manifested in established procedures, the provisions for review of procedures and provisions for subsequent procedure revisions. This includes procedures for maintenance, calibration and diagnostic procedures for the LPMS.