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SCHWENCER,A. Licensing Branch 2

SUBJECT: Forwards loose parts detection sys conformance evaluation, including action requested in NUREG-0892,SER Section 4.4.6.

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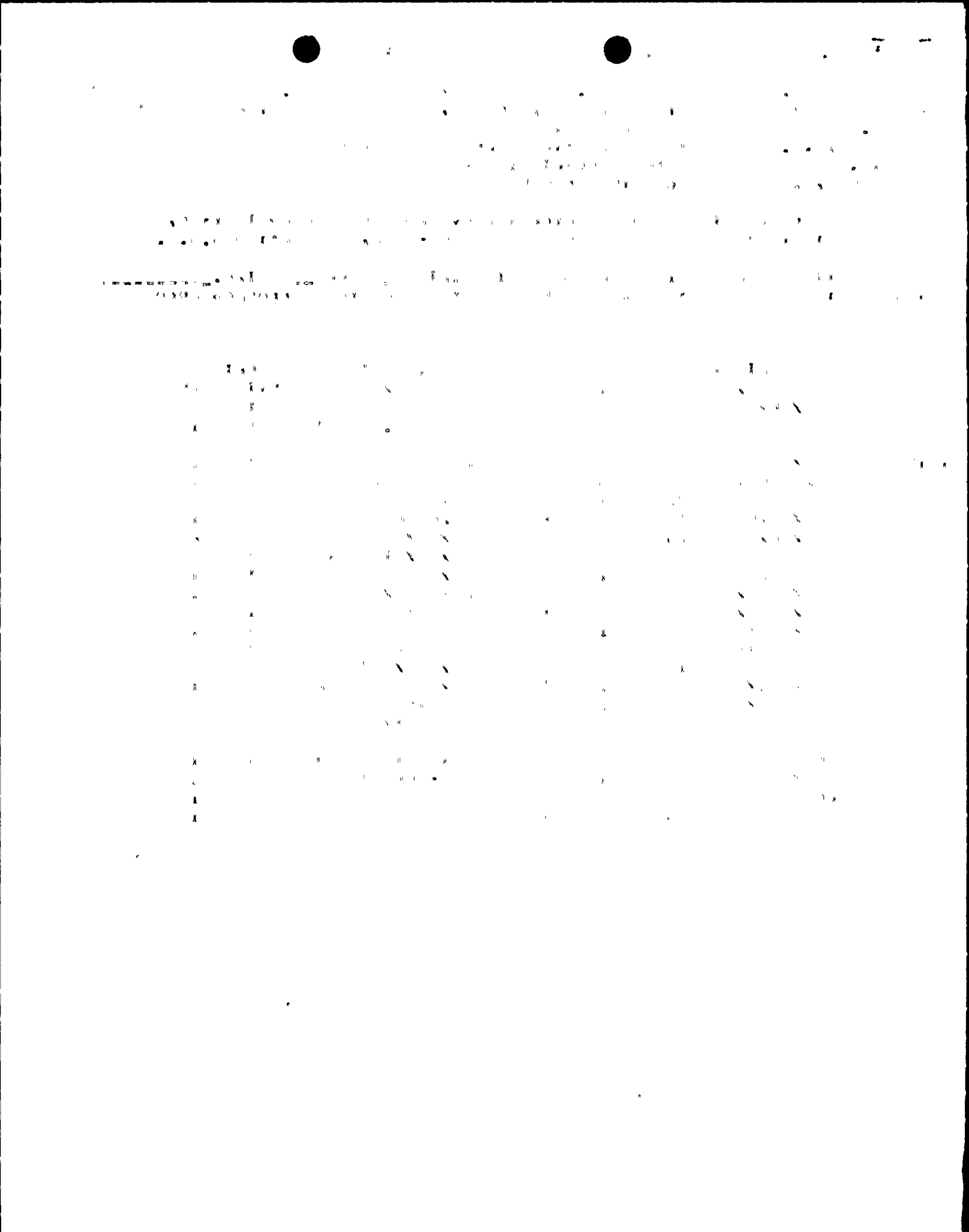

Washington Public Power Supply System
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September 29, 1983
G02-83-860

Docket No. 50-397

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

Dear Mr. Schwencer:

Subject: NUCLEAR PROJECT NO. 2
LOOSE PARTS DETECTION SYSTEM
CONFORMANCE EVALUATION, SUBMITTAL OF

Reference: Letter, G02-82-41, G. D. Bouchey (SS) to A. Schwencer (NRC), "Submittal of SER Open Issues", dated January 14, 1982

As committed to in the reference letter, the subject evaluation is submitted. Additionally, this submittal completes the action requested in NUREG-0892, WNP-2 Safety Evaluation Report, Section 4.4.6.

Should you have any questions, please contact Mr. P. L. Powell, Manager, WNP-2 Licensing.

Very truly yours,

GC Sorensen

G. C. Sorensen, Acting Manager,
Nuclear Safety and Regulatory Programs

PLP/tmh
Attachment

cc: R Auluck - NRC
WS Chin - BPA
A Toth - NRC Site

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LPDS CONFORMANCE REPORT

Introduction

The Loose Parts Detection System (LPDS) monitors the reactor vessel and primary coolant system for the presence of internal loose reactor parts. The system consists of accoustical sensors, signal processing electronic equipment, signal recording equipment, and an impact locator system. The LPD System has features which increase the loose part impact signal to background noise ratio. Features of the WNP-2 LPDS include: a 14 channel automatically actuated tape recording system, ten sensors located in four different reactor regions, a "First Alert" channel display system, an impact simulator, and a locator computer.

System Characteristics

Ten accoustical sensors are located in four reactor regions. The sensor locations are:

Region 1 - Mainsteam lines B & D (These lines are 180 degrees apart, one sensor per line.)

Region 2 - Feedwater Inlet lines (Two inlet lines 180 degrees apart, one sensor per line.)

Region 3 - Recirculation Suction lines (Two lines, one sensor per line.)

Region 4 - Control Rod Drive Housings (Four sensors located 90 degrees apart around the outer periphery of the Control Rod Drive Housings.)

The Loose Parts Detection System is capable of detecting an impact three feet from a sensor whose impact energy is 0.5 ft-lb. The sensitivity of the system will be verified during the LPD System Acceptance Test. The WNP-2 LPD System features a noise discrimination system based on the characteristically different frequencies of normal background noise and loose part impact noises. This background noise discrimination system will allow sensitivity to be maintained during power operations, and the noise discrimination system will be tested and verified operational during the Power Ascension Test Program.

Channel separation is maintained between two sensors in each collection region.

The LPDS will normally operate in the automatic mode. Data acquisition will automatically begin if the alarm threshold level is exceeded. The alarm level will be set such that a threshold level (impact energy) must be exceeded and a minimum number of impacts per unit time must be exceeded. If the alarm level is exceeded, an annunciator will alarm and flash in the control room, and the tape recording system will be started. The tape recorder will record all ten channels simultaneously.

The LPDS has provisions for on-line channel checks and on-line channel functional tests. Channel operational status lights and power supply status lights provide the necessary indications to perform a channel check. The system has an internal impact simulator system which allows for on-line functional checks to be performed. Channel calibrations will be performed during periods of cold shutdown or refueling.

Components of the LPDS inside containment have been qualified by testing to maintain functional operability following an OBE seismic event. The LPDS is designed to function in the normal containment environment.

Components of the LPDS inside containment have been designed for 40 years of continuous operation. The system is designed to facilitate maintenance while minimizing occupational radiation exposure.

Alert Level

The LPD System distinguishes between normal hydraulic, mechanical, and electrical signals and those associated with a loose part by incorporating the repeats per unit time feature of the alarm threshold.

Both automatic controls and administrative procedures may be utilized to momentarily override the LPDS to prevent false alarms caused by plant maneuvers. Administrative procedures will be used to place the system in bypass prior to performing plant maneuvers which could cause the system to alarm.

The alert level will be a function of the normal steady-state operating background noise, and will be set individually for each sensor dependent on the background noise at the specific transducer location.

Data Acquisition Modes

In the manual mode initial alert levels will be established during Acceptance Testing of the system. Operating alert levels will be established during startup testing and will be reported to the Commission. A channel check will be performed every 31 days and a channel calibration will be done every 18 months. In addition, a qualified system operator will listen to the audio signal from each sensor once every seven days and background levels will be verified within limits once every 92 days.

In the automatic mode, the LPDS is activated automatically whenever the alert threshold level is exceeded. Actuation of the system causes a control room annunciator to alarm and initiation of the system data recording equipment.

All alerts will be documented and diagnostic steps initiated within 72 hours if a loose part is detected.

Training and Procedures

Training for Operations personnel falls into two categories. In the first category are the licensed plant operators, the second category consists of plant personnel trained to operate the LPD System.

The licensed operators will receive training in the purpose and function of the LPDS, and they will receive specific training for the LPDS annunciator response. Additional training will be provided for administrative procedures concerning the LPDS as the need for these procedures is identified.

The WNP-2 Shift Technical Advisors will be trained to operate the LPD System. Special training for the Shift Technical Advisors by the LPDS Supplier has been arranged. This training will cover the purpose and function of the LPDS, operation of of LPDS equipment, response to LPDS alarms, and engineering analysis of LPDS data. See Attachment 2 for a detailed outline of the training to be provided.

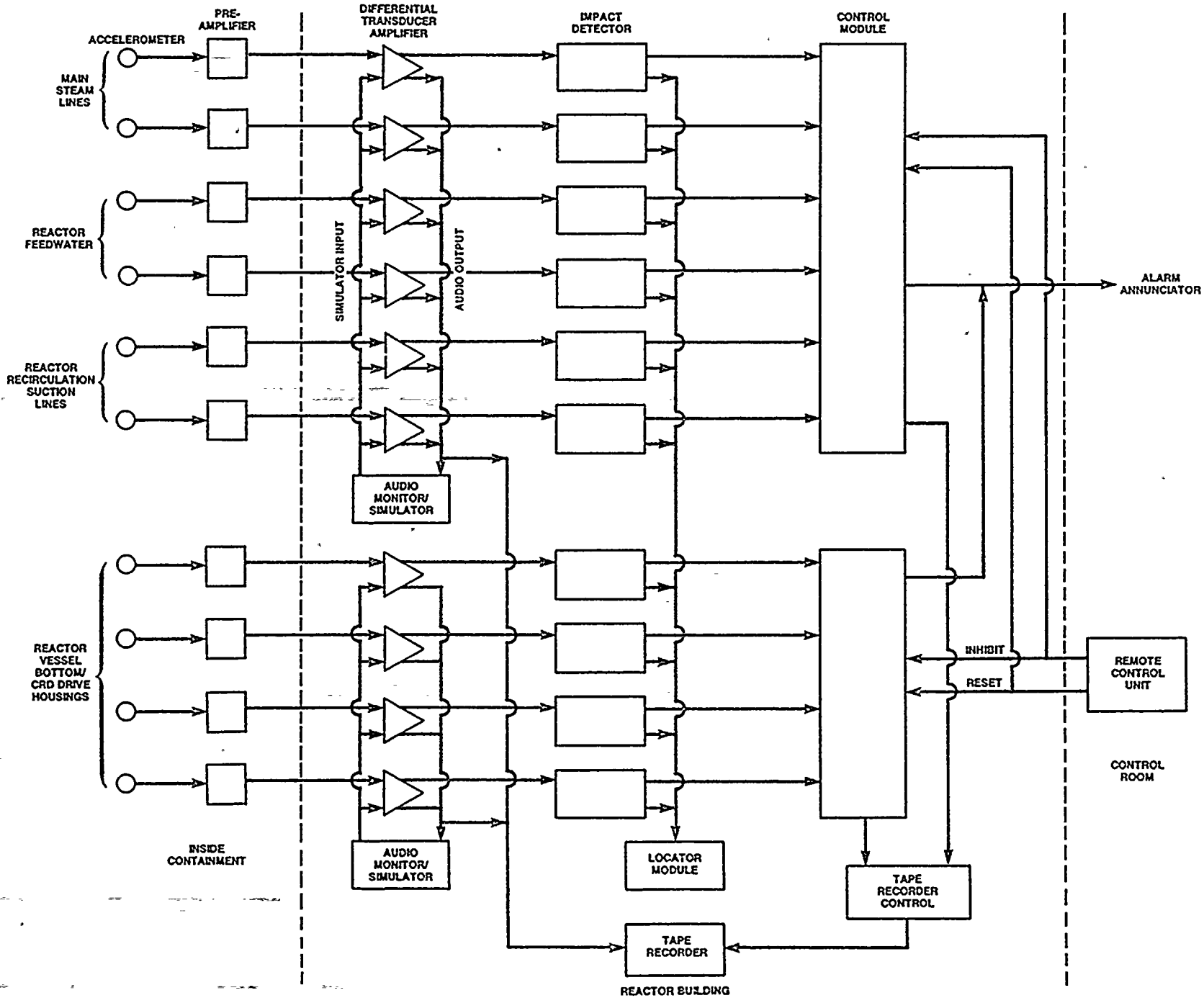
Operation in the manual mode consists of periodically listening to each LPDS channel. Periodic listening provides an extra dimension because it is possible to detect, by listening, a loose part whose energy is not great enough to trigger the automatic system. If a loose part is detected while manually listening to the system, the operator will manually start the tape recorder and listen to the remaining LPDS channels. The audio signals and the tape recorded impacts will be analyzed to try and determine the approximate location of the loose part and the component generating the impact noise. The approximate location will be determined by analyzing the signal strength at each sensor and the location of the detectors sensing the impacts. The component generating the signal may be recognized based on its characteristic signal which may be determined during power ascension testing.

The AUTO activated system provides "First Alert" data, channel trip status, tape recorded data, and impact location data. If the alert threshold level is exceeded the system automatically causes an annunciator to alarm in the control room and the tape recording system to start. The system displays the number of the first channel to exceed the alert threshold, and a status LED indicates any other channels which tripped. A special locator computer determines the time from the trip of the first alert channel to the time each succeeding channel trips, and it also determines the peak rms voltage level for each channel. The diagnostics associated with an automatic alert include calculation of the approximate location of the impacts and the approximate energy of the impact. The tape recorded information can be compared with baseline information to help determine the component involved.

The WNP-2 Technical Specifications comply with Regulatory Guide 1.133. See Attachment 3 for a copy of the draft WNP-2 Technical Specification applicable to this system.

If a loose part is confirmed, the Commission will be notified in accordance with the guidelines for reportable occurrences that call for prompt notification with written followup.

LOOSE PARTS DETECTION SYSTEM



ATTACHMENT 2

LOOSE PARTS MONITORING SYSTEM TRAINING PROGRAM

For

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

1. History of LPM in U.S. Reactors
   - 1.1 Opinions of NRC and ACRS
   - 1.2 Present Status of the Technology
   - 1.3 ORNL Recommendations for Achieving Improved Performance
   - 1.4 Introduction to Regulatory Guide 1.133
2. Methods of Impact Detection
   - 2.1 Definition of Impact Energy
   - 2.2 Wave Propagation and Attenuation
   - 2.3 Detection of Impact Signal by Mounted Accelerometers
   - 2.4 Typical Plant Noise
   - 2.5 Methods of Detecting Impact Signals in the Presence of Varying Background Noise
3. Formulation of a Loose Part Detection Program
   - 3.1 Compliance with NRC Regulatory Guide 1.133
   - 3.2 Optimizing Benefits to Plant
     - 3.2.1 LPM as a Surveillance and Diagnostic Tool
     - 3.2.2 Relationship to Plant Availability
4. The TEC LPM System
   - 4.1 General Description
     - 4.1.1 Sensors, Cables and Charge Converters

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INSTRUMENTATION

LOOSE-PART DETECTION SYSTEM

LIMITING CONDITION FOR OPERATION

3.3.7.10 The loose-part detection system shall be OPERABLE.

APPLICABILITY: OPERATIONAL CONDITIONS 1 and 2.

ACTION:

a. With one or more loose-part detection system channels inoperable for more than 30 days, in lieu of any other report required by Specification 6.9.1, prepare and submit a Special Report to the Commission pursuant to Specification 6.9.2 within the next 10 days outlining the cause of the malfunction and the plans for restoring the channel(s) to OPERABLE status.

b. The provisions of Specifications 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.3.7.10 Each channel of the loose-part detection system shall be demonstrated OPERABLE by performance of a:

a. CHANNEL CHECK at least once per 24 hours,

b. CHANNEL FUNCTIONAL TEST at least once per 31 days, and

c. CHANNEL CALIBRATION at least once per 18 months.