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Docket No. 50-461

RG 1.133
10CFR50.36

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Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Special Report: Loose Parts Monitoring System Out of Service

Dear Sir:

Clinton Power Station (CPS) Technical Specification 3.3.7.10 Action "a" requires inoperabilities of the Loose Parts Monitoring System (LPMS) (with one or more loose part detection system channels inoperable for more than 30 days) to be reported to the Nuclear Regulatory Commission (NRC) within (the next) 10 days pursuant to Technical Specification 6.9.2. On September 6, 1994, at 1300 hours CPS declared the LPMS inoperable because of intermittent alarms received for channel three and channel six of the LPMS, without corresponding evidence of any loose part. With channel three and channel six alarming intermittently at a high incidence rate, the annunciator in the Main Control Room (MCR) remained on for long periods and this MCR annunciation interferes with capability to receive subsequent alarms from any channel. Further, the high incidence rate of false alarms presented a nuisance alarm for the operators. This condition caused the LPMS to be declared inoperable and remain inoperable for more than 30 days.

Due to the extended inoperability of the LPMS channels, the attached Special Report is being submitted in accordance with the CPS Technical Specifications and in accordance with Regulatory Position C.5.A.b of Regulatory Guide 1.133 to provide information regarding the cause of the inoperability of the LPMS and plans for restoring the system to operable status.

Sincerely yours,

Richard F. Phares
Director, Licensing

AJP/csm

cc: NRC Clinton Licensing Project Manager
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Equipment Description

The CPS LPMS is a multi-channel instrument consisting of an indicator assembly with accelerometers and alarm lights, a channel selector, a recorder with audio playback and channel selection capability and connections to interface with a spectrum analyzer. The LPMS continuously monitors the reactor and the reactor primary coolant system for indications of loose parts. The LPMS has six channels. Each channel has a piezoelectric sensor that generates a charge signal in proportion to the amplitude of vibration (mechanical and acoustic) at the sensor. The charge signal is input to a charge converter preamplifier that has a voltage output proportional to the charge input. The electrical voltage is input to a signal processor that uses analog and digital circuits for generating indication and alarms. A local vibration alarm annunciates when a channel signal exceeds a preset level for signal frequencies of 17 KHz and less, and a local loose parts alarm annunciates in the main control room when a channel signal exceeds a preset level for signal frequencies greater than 17 KHz but less than 25 KHz. A four-channel tape recorder records real-time signals for later analysis. The LPMS has other design features including automatic starting of the tape recorder when a channel changes to alarm status, a speaker and audio jack for listening to a selected channel, and a meter display for observing the selected channel amplitude. The LPMS alarms for loose parts are annunciates in the Main Control Room (MCR) at panel 5067 window 2K.

The six sensors are positioned at different locations. Two sensors (channels one and two) are mounted on opposite sides of the vessel bottom on the control rod drive housings as close as possible to the vessel. Two sensors (channels three and four) are mounted on the recirculating water pump suction lines immediately outside the primary shield wall. The remaining two sensors (channels five and six) are mounted on the feedwater lines immediately outside the primary shield wall.

Chronological Sequence

Prior to declaring the LPMS inoperable on August 8, 1994, alarms from channel six had been occurring intermittently while a continuous alarm from channel three was locked-in. Close examination of the tape recording from the time of each alarm and the ongoing audio showed no evidence of any actual loose parts. Typically, because of LPMS sensitivity, numerous alarms are received during and immediately following certain plant evolutions (i.e., start-up, power ascension, etc.) At the time, CPS was performing a plant start-up and power ascension following a maintenance outage, and therefore, some alarm activity was expected. However, the nature of the alarms being received was atypical, and it was therefore determined that the LPMS should be declared inoperable. The Technical Specification 3.3.7.10 Action was therefore entered on August 8, 1994.

After seven days of plant operation (August 15, 1994), channel three was no longer locked-in, channel six was alarming less frequently, and the LPMS continued to show no indication of any actual loose part(s). As the plant continued to operate at or near 100% power, channel three alarmed less frequently and continued to show no indication of any actual loose part(s). Channel three was performing as expected but channel six was intermittently alarming often enough to be considered a Main Control Room (MCR) nuisance alarm (requiring continuous efforts by operators to verify, by listening to the audio signals, that the alarm was not due to any actual loose part.) Maintenance Work Request (MWR) D58961 was initiated to investigate and correct the problem.

A recorder was connected to the channel six output. Subsequent tape playback did not show evidence of any actual loose part(s). On August 24 through 25, the channel six sensor was disconnected from channel six charge converter and a test sensor was connected in its place. Channel six subsequently operated for 24 hours without any alarm. When an impact test was performed with the test sensor still connected, channel six responded correctly with an alarm. The testing showed channel six had probably been alarming because of increased background noise/vibration at the channel six sensor location. Surveillance testing was then performed on the LPMS, and the LPMS passed the required surveillances, including the channel functional test and channel check. On August 29 the system engineer made a written recommendation to Operations to declare the LPMS operable. On September 1, 1994, the LPMS was declared operable.

From September 2 through September 5, 1994, alarms were received on channel three and channel six, and appropriate response was taken for each alarm. Audio monitoring of the real time channel and the tape playback showed no evidence of any actual loose part(s), and the LPMS remained in operable status. However, on September 6, 1994, because of the frequency of alarms on channel three and channel six, and because continued audio monitoring of channel three and channel six showed no evidence of any actual loose part(s), the LPMS was again declared inoperable and the TS Action statement was entered again. MWR D58961 was extended to continue troubleshooting and maintenance. On September 7, 1994, channel three and channel six were recorded continuously. Audio monitoring ascertained again that there was no evidence of any actual loose parts. Due to the continued problem with LPMS alarms, a special team with members from Maintenance, Engineering and Operations was formed on September 14, 1994, to coordinate the efforts dedicated for corrective maintenance of the LPMS.

On September 26, 1994, Temporary Modification 94-024 was installed for the LPMS, and it has remained in place to date. This temporary modification precludes the channel six loose parts alarm from alarming at the associated annunciator window yet permits the vibration alarm of channel six to be available. Channel six audio will also continue to be available for monitoring with the speaker and recording on the tape playback. With the temporary modification installed, channels one through five function

exactly per design as they are unaffected by the temporary modification. So, while the temporary modification is installed, the LPMS will have nearly full monitoring capability in that channels one through five will be completely and totally available even though the LPMS will continue to have an inoperable status. In addition, channel six will be available for audio monitoring with the speaker and tape recording and will continue to be capable of providing a local vibration alarm. Channel six will not, however, be capable of providing annunciation of loose parts locally or in the main control room.

On September 27, 28 and 29 IP enlisted the assistance of a contractor to collect data and analyze signals from all six channels of the LPMS. A preliminary report was issued. The report provides an assessment of the cause of the alarms being received and thus provides a basis for IP's plans to restore the LPMS to a fully operable status.

Based on IP's evaluation of the report and on IP's own investigation, IP concluded that although the LPMS is inoperable per the CPS Technical Specifications, the LPMS is operating acceptably and the LPMS signals are valid and appropriate for plant conditions except for certain conditions identified for channels three and six. Channel three is functioning, but has 60 Hz interference that will be investigated. The false alarms associated with channel six have been determined to be a result of the alarm level being conservatively set and high background noise due to flow turbulence. IP plans to recalibrate channel six utilizing improved procedural techniques that will reduce the number of false alarms. Further, IP is planning maintenance and repair of the LPMS to restore the LPMS to a completely operable status during RF-5.