INOVISION
Radiation Measurements

6045 Cochran Road
Cleveland OH 44139
Phone: 440 248-9300
FAX: 440-349-2307
www.inovision.com
www.surveymeters.com

To: Document Control Desk, U.S. Nuclear Regulatory Commission

From: Inovision Radiation Measurements

Date: July 11, 2001

Re: 10CFR Part 21 Report (Follow-up to Interim Report submitted May 11, 2001)

IE19

Component containing defect: Firmware in Type IIA 960 Systems with a Real Time Clock (RTC) integrated circuit, programmed for use in pulse counting applications, and equipped with the following controller modules:

- Model 960CD-220 (P/N 960CD-220-10)
- Model 960CD-221 (P/N 960CD-221-10)
- Model 960CD-223 (P/N 960CD-223-10)

Monitors utilizing ionization chamber detectors are not affected.

The above controllers were equipped with Real Timer Clock and additional firmware to control the RTC.

Affected facilities: The Pacific Gas and Electric's Diablo Canyon Nuclear Power Plant is the only domestic, NRC licensed user affected by this defect. Their purchase orders ZS-7204A-AAO and ZS-7204B-AAO are affected and were shipped from 1991-1993. There were 20 potentially affected PROMs from those orders. Other potentially affected customers are located in Korea (KEPCO, KAREI) and in Belgium (SEMO, Electrabel). Notifications have been or will be sent to the affected facilities with further specific information. A complete list of potentially affected users is provided as an attachment.

Nature of the Defect and the Safety Hazard:

BACKGROUND: The initial problem was identified Feb. 4, 2001, by KEPCO personnel at the KORI 2 Nuclear Power Plant, near Pusan, Korea. The monitor affected was:

- Monitor R11
- Containment Atmosphere Monitor
- PROM P/N 94960A53
- Original Ship Date, 1993

After researching and testing the potential causes for the spurious alarms, the source of the anomaly was determined to be in the monitor operational firmware. The anomaly was identified March 27, 2001, and a Beta PROM was sent to the customer for evaluation. On April 18, 2001, the customer reported the Beta PROM provided has resolved the anomaly initially reported. During the last 2 months, the impact on other 960 System Users' has been addressed.

GENERAL DESCRIPTION: The spurious alarms were determined to be caused by a programming error in the software time of day update routine in the Hardware Clock Module, causing the 4 NMI TICK clock to be erroneously reset. The result was a spurious increase in the count rate, up to a 50 % increase in the actual count rate, that is highly visible when the monitor is operating at high-count rates and when the TARGET COUNT algorithm is in use. Both of these conditions were applicable to

the original KEPCO anomaly. The increase in count rate resulted in tripping of the Warn and High alarms. A contributing factor to the anomaly was the radioactive contamination of the Users' sample volume, where the background count rate went from a normal value of less than 100 counts per minute, in December, 2000 to over 16,000 counts per minute, in January, 2001. At the elevated background count rate, the anomaly in the TARGET COUNT algorithm exhibited itself. The anomaly was highly visible, and readily identified by the User.

Subsequent investigation by INOVISION identified that the potential exists for a less severe counting error to periodically occur with the TARGET COUNT algorithm disabled. The error, however, was determined to be less than 1.0% of the actual count rate.

It was noted that to date, the KORI plant is the only 960 User that operates with the TARGET COUNT algorithm enabled. The remaining Users' operate with the TARGET COUNT routine disabled (i.e. the TARGET COUNT set point is set to 0.00). These Users' may experience the lower, 1% counting error. Because the counting error is small, it is not detectable during normal plant operation, or during detector calibration.

ACTION TAKEN: The anomaly was reproduced in our shop, and a revision to the firmware, to disable the erroneous reset of the 4 NMI TICK clock, was prepared for test purposes. The revised firmware was found to operate accurately with the TARGET COUNT algorithm both enabled and disabled. A Beta PROM was provided to KEPCO for evaluation, and has been found to operate satisfactorily.

SAFETY IMPACT: The safety impact of these anomalies is summarized below:

TARGET COUNT ENABLED: With the target count enabled, it is possible the system may report a higher than actual count rate. With the actual activity overstated, we do not believe a significant hazard to the public or the plant exists, though the false high reading is an inconvenience to the facility. The error exhibits itself as a spiking in the count rate, at a 50 % increase in the actual rate, which should, as in the case of the original report, result in an investigation into the fluctuation in the count rate, and the subsequent tripping of the alarm.

Earlier concerns regarded the possibility of an unmonitored release, but in reviewing the actual function of the system it was determined this would not happen. When the radiation reading spikes into the extended range, indicators on the system and on the remote display in the control room would alert personnel that the radiation monitor had climbed into the extended or " accident" range, even if only temporarily, prompting investigation. When it does this, the normal range detectors are by-passed, and all detection is measured in this extended range. Though the display might say the radiation present is zero because the spiking has abated and the level is now below the detectable range for the extended range detectors, the display indicating the tripping of the extended range would remain, letting them know there was a problem.

TARGET COUNT DISABLED: In this case, the count rate may either increase or decrease periodically by up to 1% of the actual value. The magnitude and frequency of the error is based on the relative accuracy of the NMI clock and the real time clock. Although the count rate will be in error, the error is very small, and well within the following overall factory detector calibration tolerance limits:

1:1 Scintillation detectors: +/- 2%, Set-up: +/- 6%, overall
10: 1 Attenuated Scintillation detectors: +/- 2%, Set-up: +/- 10%, overall
100: 1 Attenuated Scintillation detectors: +/- 2%, Set-up: +/- 15%, overall
Geiger-Mueller tube detectors: +/- 15%

We do not believe a significant hazard to the public or the plant exists in either case.

It was, however, felt that a 10CFR21 Notification be provided to all affected Users'.

Corrective Action: Although there is a sporadic firmware program problem, we do not believe that problem represents a significant safety concern. It is our intention to notify the customers that are potentially affected by this anomaly and to identify for them the affected monitors/channels within their facility within 30 days. The problem is only potentially present if the facility has the TARGET COUNT algorithm enabled. We will recommend that the facilities discontinue use of this algorithm. (Diablo Canyon does not use this function).

As discussed earlier, a preliminary firmware fix has been identified. The decision to take further action will be addressed with each of the potentially affected facilities.

Report submitted by:
Janice K. Brownlee
Janice K. Brownlee, Director of Regulatory Affairs and Quality Assurance
July 11, 2001

For further information contact: George Buck, 440-542-3647