

levels at low (10 mr/hr) and high (1000 mr/hr) ranges. This procedure, recommended by the instrument manufacturer, accounts for the agreement between the calculated and measured values at the extremes. Intermediate radiation checks were then conducted by locating the source at calculated distances corresponding to convenient intensities. The linearity of the instrument produces observed monitor readings that are the same as the value produced by the standard cobalt source (the "calculated value") over the entire calibration range. However, for reasons not determinable, the technician used an incorrect value for the radiation intensity from the standard cobalt source in 1981. This technical error was carried forward through 1983 by virtue of the fact that the 1981 calculated values were corrected for decay to the 1982 and 1983 dates. In light of the disclosed variances, the ORCBS has modified its procedures to require that all calibrations be independently checked by a second person to insure that technical errors are identified at the point of their occurrence.

(d) Between 1983 and 1986, the calibration procedure omitted the adjustment of the zero and span controls. A simple comparison was made between the calculated and observed radiation levels. The 1984 source intensity was correct since a different radioisotope standard source was utilized.

(e) The agreement between the "calculated" and measured intensities at the 1000 and 4000 mr/hr levels in 1983 and 84 (even though the instrument was not corrected) is still under investigation. MSU will submit the results of this investigation as soon as possible.

Question No. 2:

The following are presented as evidence that calibrations of the reactor area radiation monitor were actually and properly performed during time periods other than 1981-84:

(a) Prior to 1981, the written calibration procedure called for the adjustment of the zero and span of the instrument to match the calculated radiation levels. Examination of the ORCBS records indicates that calibrations of the radiation monitor were actually and properly performed prior to 1981.

(b) In addition to the ORCBS records, the calibrations are sometimes recorded in the Reactor Maintenance Record (a step not required by the procedure). An examination of this log indicates calibration activities on 12/12/69, 7/7/75, 6/24/76, 5/12/77, 2/26/80, and 3/26/85 (in addition to the years mentioned in the reply to Question No. 1 above). While it was not required to document annual calibrations in the Reactor Maintenance Record, those that are recorded stand as independent evidence that calibrations of the monitor were performed since that log is maintained by the Reactor Staff, not ORCBS.

(c) The calibration procedure in 1983, 1984, 1985 and 1986 did not include zero and span adjustments of the remote area monitor.

(d) The calibration procedure has reincorporated the adjustment of both zero and span as recommended by the remote area monitor manufacturer.

(e) During the 18 years of reactor operations, an estimated 10 different persons (combined reactor and ORCBS staff) have been involved in the calibration of the area monitor. The Reactor Safety Committee has reviewed the procedures with 3 of these people and another 2 people have presented evidence to individual members of the Committee. It is the opinion of the Reactor Safety Committee that the remote area monitor in question was safely operating during the entire license period.

Question No. 3:

The following are presented as evidence that other calibrations and work performed by individuals involved in the calibrations in question were properly performed in accordance with license requirements:

(a) All other reactor radiation monitoring instruments (criticality monitor, hand held GM survey meters, particulate monitor) were calibrated with the concurrence and participation of the Nuclear Reactor Staff since access to the laboratory is restricted as noted in the reply to Question No. 1 above.

(b) The ORCBS calibration records for radiation safety instruments involved in the reactor operation have been reviewed by ORCBS Administration and no unexplained discrepancies were found. Examples of explained discrepancies found include variations of up to 50% in the counting efficiencies of some of the survey meters and the particulate air monitor. These were due to variations in the probe used or the geometry of the source-detector array used in the calibrations and are not significant from a safety point-of-view in light of the low contaminations and particulate release experience of the reactor. Although such records are not required and are not part of the procedure, the Reactor Maintenance Records nevertheless confirm dates for about 50% of the calibrations reported by ORCBS.

(c) Calibrations and work performed under other Michigan State University NRC licenses involve over 350 radioisotope laboratories and cover a time span from mid-60's to the present. It is not possible to confirm that a second person was actually present during all calibrations. However, several people including the Director of ORCBS (Mr. Warren Malchman) have made spot, random checks of records on the calibrations and work performed on instruments picked up from and returned to these laboratories. Although the records show a few obvious typographical errors (several cases where the calibration sources were not properly identified, decimal point errors in counting efficiency, unrealistically high counting efficiency with one beta source for a few records), the examination of these records confirm that the calibrations in question were properly performed in accordance with the license requirements.

Summary

In summary, the investigation by the University's Reactor Safety Committee and the Office of the Vice President for Research and Graduate Studies of MSU's radiation instrument calibration records and the statements made by the professionals involved (G. Thompson, P. Miller, J. Carrick, M. Mitchell, B. Wilkinson, W. Malchman) confirm that all of the required tests of radiation monitoring equipment used for the MSU Triga Nuclear Reactor were actually conducted. It is confirmed that some of the measurements made with the area

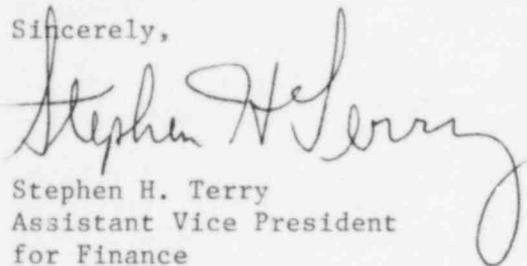
Mr. James G. Keppler

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monitor in the 1981-84 period were technically in error. Since the error caused higher, not lower, radiation levels to be indicated by the area monitor, at no time during that period was there any resulting danger to employees from these errors. Over the years there have been numerous NRC inspections of the MSU broad license, Co-60 irradiator license, special nuclear material licenses as well as the reactor. In general, MSU has received favorable reports from these inspections and the number of items of noncompliance have been very few. MSU will continue diligently to seek to maintain this good record.

Sincerely,



Stephen H. Terry
Assistant Vice President
for Finance

SHT:jec