IMMEDIATE NEEDS FOR MQA TESTING AT STATE SECONDARY CALIBRATION LABORATORIES

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Abstract - The Calibration Laboratory attempts to provide services that satisfy the needs and requests for a variety of customers. New needs and requests have resulted in calibration of instrumentation outside the original laboratory designs. These tasks require several changes at the laboratory and a need for new support services, especially measurement quality assurance (MQA). The MQA tests are gamma (Cs-137) below 0.5 mrem (5μSv) per hour and x-ray kVp. Modification to the current gamma (Cs-137) MQA test is recommended because lower intensity fields are commonly measured.

INTRODUCTION

The Illinois Radiation Instrument Calibration Laboratory operates a State Secondary Calibration Facility, accredited by the Conference of Radiation Control Program Directors, Inc., (CRCPD). The CRCPD requires the laboratory be evaluated against prescribed laboratory operating criteria and successfully participate in periodic (MQA) testing provided by the National Institute of Standards and Technology (NIST). Laboratory calibration services are available for instruments used by state or local radiation monitoring programs. Calibrations are offered for x-ray monitors in the medical diagnostic energy range and portable radiation survey equipment.

The Laboratory has routinely participated in MQA testing since 1984. The testing is used to verify accuracy in producing and measuring, radiation reference fields using Cs-137 and various x-ray techniques. Test results have confirmed traceability to national standards and claimed accuracies for instrument calibrations.. Until recently, MQA testing has satisfied the needs of laboratory credibility concerning the types of calibration services offered.

Demands on the laboratory for instrument calibrations have increased in number, variety, and accuracy in the past few years. These demands result from evolving regulations which expand the scope and detail of radiological surveillance, inspection, and remediation. These regulations require

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determination of radiation exposures well below 0.5 mrem (5μSv) per hour; hence, they dictate the use of micro "R"-type survey meter and/or thermoluminescent dosimeters (TLDs). Of the laboratory instrument workload, 13% is micro "R" meters. About 2,000 environmental TLD measurements are made by the laboratory each year.

In general, the survey work performed with the remaining survey instruments involves detection and measurement of low-level radiation. Hundreds of survey meters are calibrated by the laboratory annually. Most ranges on these instruments are less than 500 mrem (5mSv) per hour. To date, the laboratory has not been tested below approximately 400 mrem (4mSv) per hour on gamma calibrations. This dose rate is greater than that in which most calibration work is performed and that encountered in the majority of surveys performed by the Department. Because of these factors, it seems reasonable that gamma radiation MQA testing be designed to evaluate laboratory calibration abilities at lower intensities.

State regulations concerning mammography equipment present another need for MQA testing beyond what is currently provided for x-ray calibration. In addition to testing laboratory accuracy of x-ray exposure measurements, it is now important to determine kVp in the energy range appropriate for mammography. MQA testing for x-ray kVp in the mammography energy range would provide the laboratory with a basis to assess estimated kVp uncertainties. This might also allow the laboratory to develop methods for testing non-invasive kVp meters currently used in x-ray inspection programs.

However, prior to implementing testing of this nature and in order to provide a basis for kVp regulatory measurement, it seems appropriate that a national standard for x-ray kVp be established.

Following are some of the regulatory changes affecting the Illinois Laboratory's workload:

The new 10 CFR Part 20 specifies a maximum allowable exposure to the public of 100 mrem (1mSv) per year. Many facilities are currently designed to a 500 mrem (5mSv) per year level--500 mrem (5mSv) per year or approximately 57 μrem (0.57μSv) per hour is easily measured with existing dosimetry and survey meters; 100 mrem (1mSv) per year is not as easy to directly measure. This dose rate is approximately 10 μrem (0.1μSv) per hour or about twice natural background radiation.

New suggested state regulations concerning Naturally Occurring Radioactive Material (NORM) are dealing with issues such as recycling of scrap metals. Recycling facilities need to make immediate go, no-go decisions as to the disposition of materials received at radiation levels of 50 μrem (0.5μSv) per hour. Piping from the oil industry and deep water wells contaminated with Ra-226 are a common example of a NORM matter.

A U.S. Nuclear Regulatory Commission (NRC) proposed decontamination and decommissioning standard addresses cleanup or actual removal of contaminated facilities. Several projects of this nature are being addressed in Illinois simultaneously, e.g., removal of mill tailings, decontamination of a steel fabricating facility. Many decisions made during this work are based on surveys of very low dose rates.

FEMA REP-14 presents another area of issues that require calibration work at the laboratory using very low levels of radiation. This work deals with instrumentation calibrated for use in the event of a nuclear power station accident. Personnel contamination screening for large population areas require use of portal monitors set to alarm at 0.1 mrem (1μSv) per hour above background. Surveys

performed with micro "R"-type instruments are used in evaluating re-entry decisions for evacuated areas.

A final issue recently affecting the laboratory workload results from state regulations concerning mammography. Inspections of mammography and other x-ray facilities require accurate determination of kVp, half-value layer, and exposure output regardless of machine target/filter material or power supply type. The interest in mammography has directed the laboratory to investigate an x-ray technique to calibrate equipment used to inspect mammography machines. If adopted, the laboratory's x-ray workload would triple.

SUMMARY

In summary, the calibration laboratory, working within constraints of staffing, funding, and physical capabilities, attempts to provide calibrations according to the needs of its users. This has concentrated the laboratory workload in areas not currently tested. In order to provide verification that the majority of laboratory calibration work is as accurate as claimed, MQA testing is sought to model the actual tasks performed. Specifically, test laboratory abilities calibrating to at least 0.5 mrem (5μSv) per hour and non-invasive testing of x-ray kVp.