13. SURVEY INSTRUMENT CALIBRATION

13.1 CALIBRATION SERVICES

Survey instruments are routinely calibrated by the Radiation Safety staff, currently free of charge. Instruments needing calibration should be taken to the Radiation Safety Office, Rooms 407-416, 4550 Scott Ave., (314–362–3476). The turn-around time is typically a week. After an instrument is calibrated, it is returned by Radiation Safety personnel to the user group. Radiation Safety maintains a computer listing of our institution's inventory of survey instruments. Authorized users are notified by e-mail at one month and, again, at two weeks prior to the expiration of the annual calibration that the instrument should be submitted for re–calibration. The user-group should replace the batteries in each survey instrument before submitting it for calibration. In addition, personnel from Radiation Safety perform constancy–of–response tests of all the survey instruments at their locations of use. Descriptions of the calibration and reference check methods and records of the measurements are maintained at the Radiation Safety Office.

Survey instruments may be calibrated by an outside firm. The user group should then forward a copy of the calibration certificate along with the name of the authorized user to the Radiation Safety Office via either campus mail (WUSM Box 8053) or fax (314–362–1995).

13.2 CALIBRATION FREQUENCY

Survey instruments must be calibrated at least annually and subsequent to servicing.

13.3 CALIBRATION PROCEDURE

The calibration source must be an approximate point source and the source activity or the exposure rate at a specified distance must be traceable to a standard certified within 5 percent accuracy by the National Institute of Standards and Technology (NIST).

The source should be of sufficient strength to produce an exposure rate of approximately 30 mR/hr at 1 meter.

The inverse square law and the radioactive decay law must be used to correct for changes in exposure rate due to changes in distance and decay. In addition, attenuators whose attenuation factors are certified by the supplier may be used to modify the exposure rates for purposes of calibration.

Radiation Safety personnel check the status of the batteries of each survey unit and replace them prior to calibration unless the battery check mode clearly shows that they are adequate.

A particular calibration point on the instrument's scale may be considered satisfactorily calibrated if the indicated exposure rate differs from the calculated exposure rate by less than 10 percent.
Readings within ± 20% will be considered acceptable for research low-level use if a correction chart or graph is prepared and attached to the unit.

Each linear scale of an instrument must be calibrated for at least two points such that the points are approximately 1/3 and 2/3 of full scale. Instruments with logarithmic scales must have two calibration points per decade at approximately 1/3 and 2/3 of the decade.

Exposure rates greater than 1 R/hr need not be calibrated. However, such scales should be checked for operation and approximately correct response.

13.4 REFERENCE CHECKS

The response of the instrument to a reference check source of long half-life positioned in a specific geometry is observed and recorded by Radiation Safety personnel subsequent to each calibration. Radiation Safety then conducts in-the-field constancy tests each time a laboratory is inspected, for our institution's entire inventory of survey instruments used in research and laboratory medicine (> 500 units). It is recommended that users also determine the response of each of their survey instruments immediately after calibration to a long-lived reference source and to use the source to verify constancy-of-response before and after subsequent use of the instruments for recorded surveys. A record of the user's constancy tests is not required.

13.5 CALIBRATION RECORDS

Radiation Safety prepares a report of each survey instrument calibration. The report includes the following:

- The name of the authorized user,
- identification of the unit that includes the manufacturer, model number, serial number and type of detector,
- the condition of the batteries and an indication of whether the batteries were replaced,
- for each calibration point, the calculated exposure rate and the measured exposure rate,
- the angle between the radiation field and the detector axis,
- the measured response of the check source, and
- the name of the person who performed the calibration and the date of the calibration.

In addition, Radiation Safety has on file a description of the calibration source and of the calibration procedure as well as certifications of exposure rate and attenuator factors.

The following information is provided on a sticker that is affixed to each instrument after calibration:
• the radionuclide used to calibrate the instrument,

• for each scale or decade, one of the following, as appropriate:

  • the average correction factor,

  • a graph from which the correction factor can be obtained

  • an indication that the scale was checked for function but not calibrated or

  • an indication that the scale or decade is inoperative.

• the angle between the radiation field and the axis of the detector during calibration, and

• the date of calibration.

The Radiation Safety Office maintains the records of calibration and constancy tests.

13.6 REPAIR SERVICES

Occasionally, survey instruments require repair. A list of companies that repair radiation survey instruments may be obtained from the Radiation Safety Office by calling 314-362-3476.