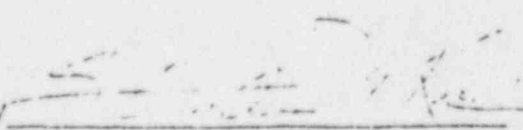


CALIBRATION OF RADIATION SURVEY INSTRUMENTS

Approved by  8/1/78
Stephen M. Kim Date
Executive Vice President

REVISIONS

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CALIBRATION OF RADIATION SURVEY INSTRUMENTS

1.0 PURPOSE

The purpose of this procedure is to provide operational instructions for calibration of radiation survey instruments so that correct, consistent results are obtained and proper radiation safety methods are utilized.

2.0 SCOPE

The scope of this procedure is limited to the safe and proper methods to be used for calibration of radiation survey instruments. This procedure does not describe use of radiation sources for other purposes.

3.0 DEFINITIONS

As used in this procedure:

- 3.1 Radiation Survey Instrument (or meter) - a device, usually portable, used to quantitatively measure radiation.
- 3.2 "Attenuator" means the devices used to reduce the radiation beam intensity to convenient levels as necessary. For convenience, each attenuator is denoted by its nominal reduction factor (e.g. the X 100 attenuator refers to that attenuator which reduces the intensity of the radiation beam by a factor of approximately 100). NOTE: The actual value of each attenuator is a known value.

4.0 REFERENCES

- 4.1 Radiation Protection procedures (RMC procedure R-9).
- 4.2 Operating manual for Series 28 Calibration Facilities, J. L. Sheppard and Associates.
- 4.3 Exposure rate data for Series 28, serial number 603 irradiator. This is a table of source output versus distance from source and attenuator used.
- 4.4 Certificates of calibrations for all radiation sources, pulsed and other instruments used.
- 4.5 Abstracts of instrument manufacturers technical manuals and/or RMC procedures describing the actual calibration method for each specific survey instrument.
- 4.6 Use of Cs-137 Gamma Calibrator (RMC procedure T-15).
- 4.7 Quality Assurance Program for survey instrument calibration and repair.

5.0 SAFETY PRECAUTIONS

- 5.1 Observe applicable radiation safety regulations as described in reference 4.1.
- 5.2 Wear assigned personal monitoring device when utilizing any of the

5.2 calibration sources.

5.3 Avoid electrical shock hazards and instrument damage by turning survey instrument off before opening the case.

6.0 APPARATUS

6.1 Survey instrument to be calibrated.

6.2 Calibration source(s).

6.3 Template for positioning instrument relative to calibration source(s).

6.4 Small screwdriver for adjusting calibration potentiometers.

6.5 Closed circuit television camera with remote display.

7.0 INSTRUCTIONS

7.1 Preliminary Instructions

7.1.1 All shipments of survey instruments are to be accompanied by an "inventory sheet" specifying; client, date of shipment, signature of client shipping/receiving agent, signature of RMC receiving/shipping agent, type of instrument(s), model number(s), serial number(s) and a comment describing reason for calibration/repair. If this information is not forwarded by client with the instrument(s), a sheet containing this information is to be completed prior to commencement of any calibration or repair work.

7.1.2 Promptly after receipt, assign each instrument a unique identification number (RMC #). This is done by filling out all indicated spaces in the master sample receipt log (instrument section) with the information obtained from the instrument inventory sheet.

7.1.3 Prepare a calibration data sheet for each instrument. Fill out all indicated spaces on the form. This form (one for each instrument) is to accompany the instrument(s) throughout its calibration or repair.

7.1.4 Inspect each instrument for any damages or deficiencies. Note pertinent observations on the remarks section of the Calibration Data Sheet.

7.1.5 If applicable check the condition of the battery using the test switch on the instrument. Record the status of the battery on the Calibration Data Sheet.

7.1.6 If the battery check shows weak batteries, replace according to the instructions in the appropriate instrument manual. Record the type and number of batteries that were replaced

- 7.1.6 in the remarks section of the Calibration Data Sheet. Be sure to check the new batteries with the battery strength test switch. Tag for repair any instruments that do not yield a correct indication following the second battery test.
- 7.1.7 Check instrument desiccant and replace or recharge if necessary. NOTE: Some instruments require separate desiccant for both the electronic portion and the detector chamber.
- 7.1.8 Turn the instrument on and allow for a suitable warm up period as specified by the manufacturer's specifications.

7.2 Instructions Proper

- 7.2.1 Survey instruments are to be calibrated at a minimum of one point per scale for linear readout instruments and a minimum of one point per decade for logarithmic readout instruments. Refer to the exposure rate data for the Cs-137 irradiator or to the Calibration Certificates for alpha and beta sources to determine the actual outputs of these sources that can be utilized. Record these values under the "Calibration Points" column of the Calibration Data Sheet. These values are the reference points for comparison of instrument response.
- 7.2.2 Position the detector of the survey instrument with respect to the radiation source so that the output of the radiation source corresponds to one of the predetermined calibration points.
- 7.2.3 If the Cs-137 irradiator is being used, position and focus the closed circuit television camera to view the meter response of the survey instrument. Position the remote display screen so that it can be conveniently viewed from behind the operator console of the source.
- 7.2.4 Expose the survey instrument to the radiation and record the response in the "BEFORE CALIBRATION" column of the Calibration Data Sheet.
- 7.2.5 Repeat steps 7.2.2 and 7.2.4 for all of the predetermined calibration points. NOTE: It is important to note the before calibration response of the instrument since this information is useful for any instrument that may need repair.
- 7.2.6 If the initial response of the survey instrument was acceptable, record this as the final reading. If the initial response of the survey instrument was not acceptable, refer to the specific calibration method for this instrument for instructions on adjustment. Follow these adjustment instructions for each of the predetermined calibration points until either a valid calibration is obtained or it is determined that the instrument cannot be calibrated.

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- 7.2.6 A valid calibration is complete if all instrument readings are within $\pm 10\%$ of the known radiation values. Readings within $\pm 20\%$ shall be accepted if a calibration chart or graph is prepared and made available with the instrument. NOTE: Some clients may require a stricter tolerance for acceptable calibrations.
- 7.2.7 Complete the required information on the Calibration Data Sheet as it is performed, making sure the initial, true and final instrument response readings are properly recorded. Sign and date the data sheet and submit this to the individual supervising the calibration of survey instruments. Supervisor's signature on the data sheet indicates a valid calibration has been obtained.
- 7.2.8 After a valid calibration of the survey instrument is obtained, replace the old calibration sticker with an updated one, making sure to fill out all applicable spaces.
- 7.2.9 If a valid calibration cannot be obtained, tag the instrument for repair and note the apparent deficiency on the Calibration Data Sheet. Refer to procedure T-17 for survey instrument repair procedure. After repair, all survey instruments are to be calibrated according to this procedure.
- 7.2.10 For the purpose of maintaining quality assurance, all instruments that have been assigned RMC numbers ending in 00 or 50 shall be recalibrated by a different individual. Any discrepancies will be noted and resolved by the Supervisor, Instrument Calibration.

8.0 REPORTING

- 8.1 Results of the calibration are reported to clients as previously arranged. The usual practice will be to return calibration data with survey instruments.
- 8.2 Survey instruments are to be securely boxed and returned to client according to pre-arranged terms.
- 8.3 If an instrument was recalibrated as part of the quality assurance program (step 7.2.10), send both copies of the calibration data to the supervisor of instrument calibration for review.

9.0 RECORDING

- 9.1 The individual supervising the calibration/repair of survey instruments is responsible for examining all data sheets for completeness and accuracy. The supervisor signifies his approval by signing in the space provided.
- 9.2 As a minimum, each instrument returned to a client after calibration and/or repair shall have:
- 9.2.1 A valid calibration sticker placed on the instrument.

9.2.2 An Instrument Shipping/Receiving Inventory Sheet as indicated in 7.1.1.

9.2.3 A Calibration Data Sheet.

9.2.4 An Instrument Service/Repair Report, when applicable.

9.3 Sufficient copies of above forms should be retained for RMC files.

10.0 ATTACHMENTS

10.1 Instrument Shipment and Receipt Inventory Sheet.

10.2 Calibration Certificate Sheet.

10.3 Instrument Service/Repair Sheet.

INSTRUMENT SHIPMENT
AND RECEIPT INVENTORYSHIPPED BY: _____
Representative

DATE:

RECIEVED BY: _____
RMC Representative

RECEIPT

INSTRUMENT	SERIAL NO.	DATE	REQUEST FOR SERVICE
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REMARKS:

RMC ID#:	DATE RECEIVED:	CALIBRATION DATE:
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INSTRUMENT INFORMATION:

Name: _____
Address: _____

P.O.#: _____

Make: _____
Model: _____ Serial #: _____
Probe: _____ Serial #: _____

INSTRUMENT CALIBRATION DATA

[illegible]

COMMENTS: _____

INSTRUMENT CALIBRATED

BY: _____
DATE: _____

I CERTIFY THAT THE ABOVE INFORMATION IS CORRECT.

Authorized Agent: _____

Title: _____ Date: _____

NMC certifies that the instrument listed above was calibrated and inspected prior to shipment and that it met all of the manufacturers published operating specifications. We further certify that our calibration measurements are traceable to the National Bureau of Standards. (We are not responsible for damage incurred during shipment or use of this instrument).

INSTRUMENT SERVICE/REPAIR

Date		Service Order No.	
Customer		Customer Purchase Order No.	
Equipment	Manufacturer	Warranty Status In Out	
Model No.	Serial No.		

Description of Defect

Corrective Action

CUSTOMER APPROVAL - THE SERVICE RENDERED BY RMC HAS BEEN COMPLETED SATISFACTORILY

Signature _____ Title _____ Date _____

Office Use Only

QTY.	PART NO.	DESCRIPTION	U/P	TOTAL	DL CODE	R	P	RATE	AMOUNT
					PMC				
					REPAIR				
					DOWN				
					TRAVEL				
					EXPENSE				
					Total				
					Time				
					TOTAL				
REKS:					TOTAL REPAIR COST				