PORTABLE RADIATION SURVEY INSTRUMENTS USE AND CALIBRATION

PURPOSE

This procedure provides basic criteria and methods for calibration of instruments used for radiation detection, measurements, or surveys.

POLICY

All instruments used for measuring exposure rates or determining the quantities of radioactivity present in samples or on surfaces (as contamination) are to be calibrated **at least once a year**. Calibrations are to be performed by individuals who meet the specified qualifications and using sources and procedures that assure compliance with federal and state regulations and license conditions.

DEFINITIONS

Calibration - the determination and correction of the response of an instrument relative to a series of known radiation values over the range of the instrument.

Check Source (Reference Source) - a radioactive source (not necessarily calibrated) used to confirm the satisfactory operation of an instrument.

Contamination Detection - the direct detection of radioactivity present on persons, objects, or surfaces; any numerical values obtained by direct detection of contamination must always be regarded as qualitative rather than quantitative.

Directional Response - the variation in response of an instrument to a radiation field of constant intensity as a result of changes in orientation of the instrument with respect to the radiation source.

Efficiency - a term used to describe (1) the intrinsic response of a specific detector, or (2) the overall response of a measurement system, to a standard source of radiation emissions (see the following specific definitions).

> Detector Intrinsic Efficiency - the fraction of nuclear particles or photons reaching a detector that interact with the detector in such a way as to deposit detectable energy.
>
> Measurement (Overall) Efficiency- the fraction of the particles or photons emitted by a standard source during a fixed time period that are detected by an instrument during the same time interval. The overall measurement efficiency includes the detector intrinsic efficiency, geometry factor, absorption corrections, scatter corrections, etc. (see "Yield" for more details).
>
> Point-Source Efficiency - the fraction of the particles or photons emitted by a **discrete or point source** detected by the survey instrument. A "point source" need not actually be a point, but a source with an active diameter much smaller than either the detector diameter or the source-to-detector distance.

Energy Dependence - a change in instrument response with respect to the energy of radiation at a constant exposure or exposure rate.

Exposure (Rate) Measurement - the determination of the intensity of a radiation field. Although the term "exposure" technically applies only to measurements of electromagnetic radiation by means of ionization in air, it is used here also in a general sense to refer to any measurement of field intensity, e.g. beta particles or neutrons, regardless of the detection mechanism.

Geometry Factor - the fraction of all photons or nuclear particles emitted from a radiation source that would be intercepted by a detector if not scattered or absorbed. For a point source, it is the solid angle subtended by a detector external to the source divided by 4π.

Response Check - the verification of proper operation of a survey instrument by observing its response to a check source.

Standard Source - a radiation source exhibiting a disintegration, emission or exposure rate certified by or traceable to the U.S. National Institute of Standards and Technology (NIST).

Survey Instrument - a portable instrument used for direct detection and/or measurement of radioactivity or radiation field intensities.

Transfer Instrument - an instrument or dosimeter exhibiting high precision which has been calibrated against a standard source.

Transfer Standard - a radiation source whose emission or exposure rate has been determined and documented by comparison with one or more standard sources.

"Yield", or overall efficiency, for a radiation-measuring instrument depends upon physical characteristics of the detector and of the source, the geometric relationship between the source and the detector, and the medium between the source and the detector, all of which may be dependent upon the energy of the radiation.

Y = $I F_s B G F_m F_w E$, where:

Y = yield, or "overall efficiency" (counts/disintegration)

I = intensity of radiations of type to be detected, i.e. number of emissions per disintegration of a source nucleus

F_s = fraction of emissions within the source that actually escape the source (always # 1), i.e. 1 - fractional self-absorption within the source

F_b = fractional contribution from emissions back-scattered from the material that supports the source (always ∃ 1), i.e. the total radiation directed toward the detector divided by the amount of radiation originally emitted in the direction of the detector

G = geometry factor, or fraction of 4-pi solid angle subtended by the effective window of the detector (always # 1)

F_m = fraction of emissions leaving the source that pass through the intervening medium and reach the detector (always # 1), i.e. 1 - fractional absorption in the medium

F_w = fraction of the radiation reaching the window of the detector that passes through the detector to the sensitive volume (always # 1), i.e. 1 - absorption in the window

E = intrinsic efficiency of detection, i.e. the fraction of the radiation entering the sensitive volume of the detector that produces a measurable pulse (always # 1)

If a contamination survey instrument is calibrated with a source of the same nuclide as that which is to be detected, and mounted on a similar substrate, etc., most of the components of total counting yield are automatically included in the efficiency determined during calibration. However, it is important to always be aware of the factors that affect total yield when different sources or media are encountered.

CONTAMINATION MEASUREMENTS

Portable survey instruments are commonly used to detect and measure radioactive contamination on surfaces. The validity and accuracy of a direct measurement of a surface depends on a knowledge of the instrument's response to the contaminant nuclides and on the accessibility of the surface. The detector should be positioned approximately 1 cm from the surface. Measurement efficiency is then used to convert the instrument response to surface contamination density (dpm per 100 cm^2).

Removable contamination on surfaces is evaluated by wiping areas of 100-300 cm^2 with a filter paper or other absorbent material. In many situations, measurements of the activity on the wipe medium can be made with adequate sensitivity, accuracy and precision with a portable survey instrument with no need for more quantitative laboratory analyses.

For most beta-gamma emitting radionuclides, the recommended limits for removable contamination in unrestricted areas are 200 or 2000 dpm per 100 $cm^{2.}$. For alpha emitters it is 20 dpm per 100 cm^2. To improve sensitivity, **wipes of 300 cm5 may be used if the wiped object has a surface area greater than 300 cm^2.** A draft ANSI standard (1987) states that these limits are for the average over 1 m^2, and that any individual area of 100 cm^2 shall not exceed 3 times the limit. An NRC Regulatory Guide (1.86, 1974) applicable to nuclear reactors states that maximum values of 3 times the average limit apply only to the total contamination (fixed plus removable), implying that it does not apply specifically to removable contamination. Therefore, the activity on a wipe that must be detected with acceptable accuracy is in the range of 20 to 6000 dpm.

In general, a survey meter that is appropriate for making direct measurements of surface contamination is also appropriate for measuring removable activity on a wipe test. The question that must be addressed is: **At a specified limit for removable contamination on a wipe, is the expected count rate on the survey instrument sufficiently above background to make an unambiguous decision that the activity is below the limit?** In other words, what is the minimum detectable activity (MDA) for the measurement?

Energy vs Absorption

When radioactivity is to be measured on a filter, one factor to be considered is the fraction of the emitted radiation absorbed within the filter (F_{ABS}). For any alpha or beta emitter with sufficient energy to be detected by a thin-window GM tube, the absorbed fraction is rarely greater than 0.2; therefore, a conservative estimate of the unabsorbed fraction would be 80%. Therefore, **the overall counting efficiency (yield) for measuring activity on a filter area that is no larger than the window of the detector would be 80% of the point-source efficiency, or 0.8 (Eff_P)**.

Background Count Rate and Minimum Detectable Activity

The variability of the background for a rate-meter instrument depends on the count rate and on the time constant of the meter. For measuring activity, the longest available time constant should be used and both background and sample readings should be long enough to allow the meter to stabilize. Observation of the meter for a few seconds allows one to estimate both the average and the upper limit of the meter readings.

A typical rate meter with a thin-window GM detector might indicate a background rate in the range of 50 to 100 cpm in a low-radiation area. If the meter has a fairly long time constant, close observation should demonstrate that the reading rarely fluctuates to a value of more than 20 cpm above the average. This observation would be expected on the basis of radioactive decay statistics, since the standard deviation of the number of counts obtained in any one minute would be in the range of 7-10 cpm and 20 cpm would represent at least 2 standard deviations. Therefore, **for typical GM survey meters, the minimum <u>net</u> response that is clearly above background would be approximately 20 cpm and the minimum detectable activity (MDA) on a filter would then be estimated as:**

MDA (dpm) = (Min. Net Rate)/(F_{ABS} x Eff_P)

= 20/(0.8 x Eff_P)

Typical GM Survey Meter Response

Typical point-source efficiencies for a thin-window GM survey meter are 4% for C-14, 22% for P-32 and 10% for alphas, for which the estimated MDAs on a filter would be:

MDA (C-14) = 20 cpm/(0.8 x 0.04) = 625 dpm

1 RCL (C-14) = 1 nCi x 0.04 x 0.8 x 2,220 dpm/nCi
= 70 cpm net

MDA (P-32) = 20 cpm/(0.8 x 0.22) = 114 dpm

1 RCL (P-32) = 0.1 nCi x 0.22 x 0.8 x 2,220 dpm/nCi
= 40 cpm net

MDA (Alpha) = 20 cpm/(0.8 x 0.1 x 2,220 dpm/nCi)
= 0.1 nCi

1 RCL (U) = 0.1 nCi x 0.8 x 0.1 x 2,220 dpm/nCi
= 18 cpm net

1 RCL (Am) = 0.01 nCi x 0.8 x 0.1 x 2,220 dpm/nCi
= 2 cpm net

Obviously, a contamination survey instrument such as a TBM-3 is easily able to detect less than 1 RCL on a wipe filter for some nuclides, but not for others. Precision is of little importance since the intent is to rapidly identify areas that require decontamination.

Leak Tests of Sealed Sources

For all nuclides except radium-226, the leak test limit is 5 nCi on a wipe of the source capsule or the accessible portions of the source housing. The appropriate instrument for measuring activity on a filter used for a leak test of a sealed source depends on the emissions from the source nuclide.

For alpha emitters and medium-energy beta emitters, e.g. Co-60 and Cs-137, the TBM-3 point-source efficiency is about 0.1. The expected net count rate for the leak test limit of 5 nCi on a wipe is:

Net Rate = 5 nCi x 0.1 x 0.8 x 2,220 dpm/nCi
= 888 cpm

To be on the safe side, round downward to 800 cpm as the acceptance criterion.

For Sr-90, the TBM-3 point-source efficiency is about 0.2, resulting in a leak test acceptance criterion of 1,600 net cpm.

Laboratory instruments should be used for counting wipes from gamma-only emitters such as Co-57 or Ba-133 since portable instruments with calibrated efficiencies for these nuclides are usually not readily available.

PERSONNEL QUALIFICATIONS FOR INSTRUMENT CALIBRATION

Calibrations of instruments used for radiation protection purposes are to be performed by, or under the direct supervision of, individuals who have had specific training on the following subjects:

1. Principles and practices of radiation protection.

2. Radioactivity measurement standardization, monitoring techniques and instruments.

3. Mathematics and calculations pertinent to the use and measurement of radioactivity.

4. Normal operating procedures and emergency procedures for all calibration sources to be used.

Evidence of appropriate training may include satisfactory completion of formal academic courses on the subjects listed above, certification by the American Board of Health Physics, certification in radiological physics by the American College of Radiology, registration by the National Registry of Radiation Protection Technologists, or by specific training and examination administered by the RSO.

CALIBRATION SOURCES

Exposure rate: The 50-curie Cs-137 "Radiac" calibrator is used for essentially all photon exposure-rate calibrations. (The complete designation of the unit is the Radiac Calibrator AN/UDM-1A, also sometimes referred to as the "UDM".) The source provides three radiation field intensities by means of a rotatable source container and a movable aperture plug. The calibration room permits a range of calibration distances from approximately 0.5 to 5.0 meters. An adjustable calibration table rolls on a track to provide precise positioning of the instruments to be calibrated. Available exposure rates range from approximately 0.5 mR/hr to nearly 100 R/hr; these exposure rates have been verified many times with a variety of transfer instruments, resulting in a high degree of confidence in the radiation field intensity.

A 1 mCi Cs-137 source (Amersham CDC.701, X.7) is available for calibration of exposure rates below 0.5 mR/hr.

Alpha activity: Alpha survey instruments are calibrated with a set of electrodeposited Pu-239 sources ranging from 1.1×10^3 to 1.44×10^6 alpha particles per minute emitted from the source surfaces (i.e. 2π emission).

Beta activity: Calibration sources containing various beta-emitting nuclides are available for determining the energy response of survey instruments. Other sources containing various amounts of the same nuclide are available for determining the linearity of beta-detecting instruments over several operating ranges.

For testing linearity of response, the calibration sources consist of sets of 4 planchets containing Tc-99 with activities covering 4 orders of magnitude. The sources are calibrated for 2π-emission rates, i.e. beta particles per minute emitted from the source surfacesFor testing energy dependence of the instrument response, sets of sources containing several nuclides, e.g. C-14, Cl-36, Sr-Y-90 and Pm-147, are available.

Low-energy photon fluence:

I-129 sources are available for calibration of instrument response to I-125. Although the photon energies are essentially identical, the yield of photons in the 27-33 keV range is 77.5% for I-129 compared with 146.2% for I-125. This difference in yield (ratio = 1.89) must be accounted for in the calibration.

Neutron fluence rates:

Two neutron sources are available for checking the response of neutron survey meters:

a. 10 mCi of Am-Be ($.2 \times 10^4$ n/s)

b. 2 Ci of Pu-Be ($.4 \times 10^6$ n/s)

CALIBRATION PROCEDURES

Exposure Rate Instruments

Before attempting to calibrate an instrument, verify that the instrument is not damaged, is not contaminated and that the batteries are in good condition, i.e. that the instrument responds satisfactorily to a check source. The mechanical zero of the meter should be checked with the instrument off and resting or held in a normal position. **The mechanical adjustment screw on the meter movement is to be used only for setting the mechanical zero point of the meter and never for adjusting the electrical zero response point.** Unless the meter has been heavily jarred or tampered with the mechanical zero should need no adjustment.

Directional and energy response characteristics of survey instruments are normally taken from manufacturers' specifications. Calibrations are performed with the detector oriented toward the source in a manner comparable to that in which it is ordinarily used. Ionization chamber survey instruments with air-equivalent wall materials normally exhibit little directional dependence throughout the hemisphere directly facing the detector chamber. For calibration using a gamma source of moderate to high energy (e.g. Cs-137), the ion chamber is positioned with its axis perpendicular to the primary radiation beam. This allows greater precision in determining the distance from the source to the effective center of the chamber.

Select calibration source configurations and distances to provide two exposure rates for each linear meter scale (or switch-selectable digital readout range) to be used. The two exposure rates should be within the lower 1/3 and the upper 1/3 of the range, as close as possible to 25% and 75% of full scale. Calibration points on ion chambers used for medical areas shall be separated by 50 percent of the scale reading. Select one exposure rate near the midpoint of each decade for an instrument with a logarithmic meter readout (or non-switchable digital readout). Set the calibration table at the appropriate distance and observe the background radiation reading of the instrument at that position. Be sure that the instrument reading is visible through the mirror to the source control position outside the calibration room. Leave the room, expose the source and observe the instrument reading. Return the source to the safe position.

If the instrument response is within ∀10% of the true exposure rate at the calibration distance, record the results and proceed to the next exposure rate configuration. If the instrument response deviates by more than 10% from the true exposure rate, adjust the instrument according to the manufacturer's recommendations until it reads correctly. After any instrument adjustments, previous measurements may require recalibration as the adjustments may be interdependent. Repeat the above procedure until all calibration points have been recorded on the "EXPOSURE RATE METER CALIBRATION RECORD" (RPR 52A).

For ionization chambers that are not hermetically sealed, corrections for air density (temperature and barometric pressure) can be made in two ways. For instruments to be used only on the University campus, or at the same elevation, the preferred method is to adjust the instrument to read exposure rate directly at this altitude. The instrument will then give correct readings without the use of correction factors; this fact should be noted on the calibration record (RPR 52A) and on the calibration sticker attached to the instrument.

The second method is to adjust the instrument readings to those which would have been attained if the instrument had been calibrated at sea level. This method requires a correction for barometric pressure and temperature, both at the time of calibration and at the time of use.

If the instrument response is within ∀20%, but not within ∀10%, of the true exposure rate on all scales, the instrument may be used provided it is accompanied by a calibration chart or graph that permits the correction of instrument readings to true exposure rates. If all readings are within ∀10%, a calibration graph is not required. Affix a green calibration label (RPR 52G) indicating the calibration date and results.

Check Sources

Immediately after the instrument has been calibrated, the regular user of the instrument should record its response to a convenient, long-lived check source. The instrument response to the check source should be verified each day the instrument is used and recorded at least quarterly. For instruments calibrated for low exposure rates (<0.5 mR/hr), a Coleman lantern mantle is adequate as a check source (see RPR 52E).

Contamination and Wipe-Test Survey Instruments

Instruments used to detect surface contamination are not calibrated in the same sense as are exposure rate survey instruments. Instead of adjusting the instrument response to a predetermined value, the response to any given source is simply recorded, as long as it is within the normal range for the instrument. Because the absorption correction factors cannot be quantitatively determined, direct surveys for surface contamination are always qualitative by nature. However, surface contamination measurements and wipe-test results must be reported as activity per 100 cm^2 and data must be provided for translating instrument readings into appropriate units, e.g. dpm per 100 cm^2.

The detection efficiency will vary tremendously with the type of radiation and its energy. Low energy gamma, detectors, e.g. thin-window scintillation probes; thin-window, gas-filled detectors, e.g. GM or proportional counters, usually exhibit approximately the same detection efficiency over the entire window area. The overall measurement efficiency should be expressed as a fraction, representing the ratio of instrument response to source activity, e.g. counts per disintegration or cpm per dpm.

The point-source efficiency should be determined for each appropriate radiation beta-particle or gamma energy range. If the instrument is used exclusively for measuring a single nuclide, the calibration need be done only for that nuclide. Instruments used for a wide variety of nuclides should be calibrated for one nuclide in each beta-particle energy range, e.g C-14 (low), Cl-36 (medium) and Sr-Y-90 (high) and/or gamma energy, e.g. I-125 (low). Since each of these nuclides is not available in several sources with a range of activities, a single measurement is made for each nuclide, **with the source at 1 cm from the center of the detector window** is used to determine the point-source efficiency. Table 1 lists a few nuclides by energy groups and typical instrument measurement efficiencies for each energy group.

Gamma counters, such as the TA=s TBS-6, possessing an external low-energy photon scintillator may be used for surveys and wipe-testing for I-125. When using calibration sources that do not emit the detected particle or photon with every disintegration, it is important to include the abundance of emissions in the calculation of efficiency. The efficiency should be calculated as the fraction of the appropriate emissions that are detected. To calculate the actual emission rate, multiply the source disintegration rate (e.g. dpm) by the fractional abundance of the detected emission. Note in Table 1 that the emission abundances for some sources are less than 1 and some are greater than 1.

The linearity of response on all usable ranges of the instrument is determined only for Tc-99. The calibration data should be recorded on "CONTAMINATION METER CALIBRATION RECORD" (RPR 52B).

Alpha scintillation probes are generally larger than thin-window GM probes and may exhibit very significant differences in detection efficiency at various positions across the detector window. An average of at least 5 measurements distributed over the window area should be used as the measurement efficiency.

The measurement efficiency for radionuclides most often encountered should be on the label attached to the instrument (RPR 52Y) or in some place of ready reference if estimates of quantitative surface contamination are needed.

Immediately after the instrument has been calibrated, the regular user of the instrument should determine and record its response to a convenient, long-lived check source. The instrument response to the check source should be verified each day before being used to make measurements. Coleman lantern mantles are often used as check sources for contamination survey meters and low-range exposure-rate meters. For reproducibility and record keeping, a combined holder and record of check-source readings is available for routine use of these check sources (RPR 52E).

Neutron Instruments

If a neutron survey instrument is to be used to make dose-rate measurements, it must be calibrated by a qualified vendor, since the University has no calibrated neutron source. The response may be checked after calibration by a vendor, and before using the instrument with either the 10 mCi Am-Be source or the 2 Ci Pu-Be source.

REFERENCES

American National Standards Institute, *Radiation Protection Instrumentation Test and Calibration*, ANSI N323-1978.

- *Surface Radioactivity Guides for Materials, equipment and Facilities to be Released for Uncontrolled Use*, ANSI P/N13.12, 1987 (draft).

International Commission on Radiation Units and Measurements, - *Determination of Dose Equivalents Resulting from External Radiation Sources*, ICRU Report 39, 1985.

National Council on Radiation Protection and Measurements, *Instrumentation and Monitoring Methods for Radiation Protection*, NCRP Report No. 57, 1978.

Calibration of Survey Instruments for the Assessment of Ionizing Radiation Fields and Radioactive Surface Contamination, NCRP Report No. 112, 1991.

U.S. Nuclear Regulatory Commission, 1980, *Guide for the Preparation of Applications for Medical Programs*, Reg. Guide 10.8, Rev. 1, Appendix D, Calibration of Instruments.

- *Termination of Operating Licenses for Nuclear Reactors*, NRC Reg. guide 1.86, 1974.
U.S. Nuclear Regulatory Commission, 1999, AInstrument Specifications and Model Survey Instrument and Air Sampler Calibration Program,@ NUREG-1556, Vol.11, Appendix O.

TABLE 1. TYPICAL INSTRUMENT RESPONSE

Nuclide, E (Average), Abundance	Appropriate Survey Instrument	Response to Calibration Source: Efficiency	Response to Calibration Source: cpm/nCi
Very low-energy electron/beta emitters			
H-3, 6 keV, 100%	Portable instruments are not applicable; use liquid scintillation		
Fe-55, 6 keV, 60%			
Ni-63, 17 keV, 100%			
Low-energy beta emitters			
C-14, 50 keV, 100%	Thin-window GM, e.g.TA TBM-3 or TBS-6	0.04	80
S-35, 50 keV, 100%			
Ca-45, 70 keV, 100%			
Tc-99, 101 keV, 100%	Thin-window GM, e.g. TA TBM-3 or TBS-6	0.1	200
Medium-energy beta emitters			
Cl-36, 279 keV, 98%	Thin-window GM, e.g. TA TBM-3 or TBS-6	0.20	400
High-energy beta emitters			
Sr-Y-90, 565 keV, 200%	Thin-window GM, e.g. TA TBM-3 or TBS-6	0.25	500
P-32, 695 keV, 100%			
Photon emitters with no particulate emissions:			
Low-energy photons			
I-125, 27-35 keV, 147%	Thin-crystal NaI scintillator,	0.20	400
I-129, 29-40 keV, 78%	e.g. external probe on TA TBS-6		
Medium-energy photons			
Co-57, 122 keV, 86%			
136 keV, 11%			
Cr-51, 320 keV, 10%			

RPR 52A. EXPOSURE RATE METER CALIBRATION RECORD

Responsible User: ________________________________ Group #: ________ Task #: _______

Location: ____ Phone: ____________ ____________________

INSTRUMENT: Manufacturer: _____________________ Model: ___________ Ser.#: ____________

☐ Batteries: Replaced OK, not replaced

Detector/Probe: _____________________________ Hermetically sealed? **Yes** **No**

Temperature, **T** = _________ °C Pressure, **P** = _________ mm Hg

Air Density Correction Factor = 760≅(273 + **T**)/295≅**P** = ___________ (should be . 1.2)

Detector Orientation to Radiation Field _________ Perpendicular __________ Parallel

CALIBRATION SOURCE(S):

☐ 50 Ci Cs-l37, AN/UDM-1A for gamma exposure rates >0.5 mR/hr

☐ 1 mCi Cs-137, Amersham CDC.701, X.7 for exposure rates <0.5 mR/hr

☐ 10 mCi Am-Be or 2 Ci Pu-Be for neutron response check

☐ Other: _________________________________

RESULTS:

Distance (cm)	Exposure Rate (mR/hr, R/hr)	Scale	Instrument Response (mR/hr, R/hr) As Found	As Left	Corrected	Error as Left #∀10%	#∀20%

If error on any scale to be used exceeds 20%, the instrument is unacceptable; affix RED LABEL.
If error exceeds 10%, but is less than 20%, the instrument is acceptable ONLY IF a calibration chart must be attached to the instrument.
If the error is within 10%, the instrument is acceptable without a calibration chart.
If the instrument is acceptable, affix a GREEN LABEL.

Calibrated by: ________________________________ Date: ___________________

RPR 52B. CONTAMINATION SURVEY METER EFFICIENCY CALIBRATION RECORD

Responsible User: ______________________________ Group #: ________ Task #: _______

Location: ______________________________________ Phone: ____________ ____________________

INSTRUMENT: Manufacturer: ____________________ Model: ___________ Ser.#: ____________

☐ Batteries: Replaced OK, not replaced

Detector/Probe: ___________________________________

Window thickness: _________________ mg/cm^2 Window area: ________________ cm^2

CALIBRATION SOURCE(S):

☐ Eberline Pu-239 source set, ID#: _____ for alpha activity

☐ Eberline Tc-99 source set (DNS-19), ID#: ____ for beta linearity response

☐ N.E.N. multiple nuclide set (NES-269), ID#: ____ for beta energy response

☐ N E N I-129 (NES-269), ID#. for I-125 energy response

☐ Other: ______________________

POINT SOURCE CALIBRATION RESULTS: (Source at 1 cm from center of detector window)

					Instrument Response		Detection Efficiency	
Nuclide	**Activity**	**Units**	**Scale**	**Units**	**As Found**	**As Left**	**Cal. Point (cpm/dpm)**	**Scale Avg. (cpm/dpm)**

If detection efficiencies for the same nuclide on different scales are within ∀10% of each other, and the efficiencies for different energies are within the expected (nominal) range, affix a YELLOW LABEL to the instrument.

Calibrated by: ________________________________ Date: ______________________

RPR 52D. SURVEY INSTRUMENT CALIBRATION LABELS

Reduce to 13" X 22" (64%) before printing; permanent self-adhesive labels.

CONTAMINATION SURVEY METERS - YELLOW LABEL, RPR 52Y:

CONTAMINATION SURVEY METER

	C-14	**P-32**	**I-125**
Efficiency:	________	______	______

Note: ____

By: ____________ S/N:_______________ Date: _____________

Check Source Reading (if any): _________ Date: _____________

Due By: ______________________

Radiological Health Department (801-581-6141) RPR 52Y (12/2013)

EXPOSURE RATE SURVEY METERS - GREEN LABEL, RPR 52G:

EXPOSURE RATE SURVEY METER

[ ] WITHIN 10% ON ALL USABLE SCALES.
(Indicate uncalibrated scales)

[ ] WITHIN 20%; USE CALIBRATION GRAPH.

Cs-137 calibration: consult instrument manual for response at other energies.

By: _______________________ Date: _____________________

S/N: ______________________ Due By: ____________________

Radiological Health Department (801-581-6141) RPR 52G (12/2013)

OUT OF SERVICE METERS- FLUORESCENT RED LABEL, RPR 52FR:

In the case where the instrument is Red Tagged and the laboratory(s) has access to the other survey meters, or the lab(s) does not want to repair the instrument, or the meter is unrepairable; then the instrument will be wrapped with the OUT OF SERVICE label.

OUT OF SERVICE

Date:___________________________

Radiological Health Department (801-581-6141) RPR 52FR (12/2013)

FAILED CALIBRATION METERS – RED CARDSTOCK, RPR 52R:

Red Tag means to affix a notice to an instrument which has failed calibration and needs to either be sent back to the manufacturer for appropriate service, onsite repair/decontamination if available, or the instrument may require parts. If the instrument, during calibration at RHD, fails then it should be labeled with the RED TAG.

> **FAILED CALIBRATION METER**
>
> Meter Make ________________
> Model ______________________
> S/N ________________________
>
> **DO NOT USE UNTIL**
> Meter Calibrated/Repaired/Decontaminated
> - Check Electronics
> - Check Audio
> - Check Detector
> - Calibrated
> - Repaired
> - Decontaminated
>
> Date:
> Name:
> Comments:
>
> ***Radiological Health Department (801-581-6141)***
>
> RPR 52R (12/2013)

BATTERY REPLACEMENT METERS – FLUORESCENT LIME GREEN LABEL, RPR 52FLG:

In some cases, lack of batteries in the instrument may cause a false reading. The instrument should be checked with the proper battery style; if the problem is related to the battery issue, lab(s) personnel may label it on their own. Use the proper Tag for this reason which, after correction, lab(s) personnel can remove it.

> **DO NOT USE THIS METER**
> **UNTIL BATTERIES ARE REPLACED**
> **Date: ______________________**
>
> ***Radiological Health Department (801-581-6141)***
>
> RPR 52FLG (12/2013)

RPR 52E. CHECK SOURCE RESPONSE

Instrument reading should be recorded immediately after calibration
and at least quarterly thereafter.

Manufacturer	Model	Serial #	Date	Reading	Date	Reading
______	____	____	____	____	____	____
______	____	____	____	____	____	____
______	____	____	____	____	____	____
______	____	____	____	____	____	____
______	____	____	____	____	____	____
______	____	____	____	____	____	____
______	____	____	____	____	____	____
______	____	____	____	____	____	____
______	____	____	____	____	____	____
______	____	____	____	____	____	____
______	____	____	____	____	____	____
______	____	____	____	____	____	____
______	____	____	____	____	____	____
______	____	____	____	____	____	____
______	____	____	____	____	____	____
______	____	____	____	____	____	____
______	____	____	____	____	____	____
______	____	____	____	____	____	____

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Instrument Check Source Property of

Instructions:
Cut a 1" diameter hole
centered on the cross lines.
Mount Coleman lantern mantle
inside the folded card.
Take reading with the detector
centered on the cross lines.

For replacement, call:
Radiological Health
Ext 1-6141

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