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CP4-RP-1309 **FRev. 1**	**TITLE**: Setup For Operability Tests of Portable Field Instruments	Page 1 of 11

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REVISION/CHANGE LOG

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FR 0	Bluesheet	All	10/20/2017
FR 1	Non-Intent Changes for Bluesheet Incorporation	All	12/19/17

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1.0 PURPOSE AND SCOPE

1.1 Purpose

The purpose of this procedure is to provide a means of assuring that a radiological instrument is operating properly and accurately, that performance criteria are established for each instrument and used for developing quantitative radiological data. These criteria are typically source response and background levels, but may include other parameters; depending on the specific instrument type and application. Performance criteria are established by the Paducah Gaseous Diffusion Plant (PGDP) Deactivation and Remediation (D&R) Instrumentation Group following the guidance in this procedure. After the criteria are established, instrument users or other designated personnel must routinely test the instrument performance, relative to these criteria, on each day the instrument is to be used for radiological measurement purposes, following the direction in the appropriate instrumentation operating procedure.

1.2 Scope

This procedure applies to PGDP D&R individuals performing setup for operability tests of portable field instruments.

2.0 REFERENCES

2.1 Use References

None

2.2 Source References

- ANSI N42.17, *Performance Specifications for Health Physics Instrumentation*
- ANSI N323A-1997, *American National Standard Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments*
- CP2-RP-0001, *Radiation Protection Program*
- CP2-RP-0002, *Radiation Protection Program Glossary*
- CP3-RP-1302, *Radioactive Source Control*
- CP3-RP-1401, *Radiation Protection Program Records*
- DOE G 441.1-1C, *Radiation Protection Programs Guide for use with Title 10, Code of Federal Regulations, Part 835, Occupational Radiation Protection*
- DOE-STD-1098-2008, *Radiological Control Standard*
- Title 10, *Code of Federal Regulations*, Part 835 (10 CFR 835), *Occupational Radiation Protection*

3.0 COMMITMENTS

None

4.0 RESPONSIBILITIES

4.1 Radiation Protection Manager

4.1.1 Implements the requirements of this procedure.

4.1.2 Ensures that qualified Radiological Control Technicians (RCTs) are properly trained.

4.2 Radiological Control Technician

4.2.1 Ensure Boundary Control Station (BCS) portable alarming instruments are set to 50 cpm above background for an alpha and 100 cpm above background for beta/gamma probes and can detect the surface contamination values in Appendix B of CP3-RP-1109, Radioactive Contamination Control and Monitoring.

4.2.2 Performs the calibrations and maintenance of the instruments as required in this procedure.

4.2.3 Completes the required documentation set forth in this procedure.

4.2.4 Completes the applicable instrument Job Performance Measures (JPMs).

5.0 GENERAL INFORMATION

The area Radiation Protection Project Manager (RPPM), RCT Supervisor, or Lead RCT reviews the daily and/or weekly test sheet for technical accuracy at the completion of each month.

6.0 INSTRUCTIONS

6.1 Instrument Setup

RCT

6.1.1 Instrument Performance Test Setup – Verify Initial reference response setup for performance testing shall be conducted:

- After receipt and configuration (pairing) of instrument and detector at the instrument laboratory.
- After receipt of instrument at a remote or satellite site, a new “Initial Response Test” is required only if the remote site uses different test sources.

6.1.2 Confirm that the instrument calibration is current based on the affixed calibration label on the instrument.

6.1.3 Obtain the appropriate test sheet for the instrument to be tested. The Test Sheet form consists of two parts:

- Part 1: contains the general instrument setup conditions and the acceptable performance information to be developed by the Radiation Protection Instrument Group in accordance with this procedure.

- Part 2: used by the instrument operator to record the performance test results, obtained in accordance with the appropriate instrumentation operating procedure.

6.1.4 Following the sequence of actions and guidance provided in the appropriate instrumentation operating guide, perform the following:

A. Verify probe and instrument serial numbers are paired correctly as indicated on calibration label, test battery power, high voltage, input sensitivity (threshold), window setting, audible signal, average flow rate, etc.

B. **If** there is a zero adjust, **then** perform this adjustment.

C. Verify that all parameters are as indicated in Part 1 of the appropriate Daily Test Sheet.

D. Ensure battery tests, for digital instruments, are greater than 4.8 volts (for the Ludlum Model 2221) and battery tests for analog instruments are indicated in the "battery OK" range.

E. **If** there are discrepancies, **then** replace the batteries **and** re-test.

F. **If** the problem persists, **then** remove the instrument from service **and** contact the RPPM, RCT Supervisor, or Lead RCT.

G. Verify that the areas where tests are to be performed are **NOT** impacted by elevated background. **If** the background is elevated, **then** remove sources, if possible, **or** relocate the instrument to an area where background will not interfere with the setup activities.

6.1.5 Test instruments at levels typical of those anticipated in actual applications. A minimum of one scale should be tested. To avoid unnecessary personnel exposure, neutron dose rate instruments should be checked on lower scales, assuming an appropriate source is available.

6.1.6 Enter the instrument identification and operating parameter information from the instrument calibration form.

6.1.7 **For scalers**: Use the appropriate Radiological Instrument Initial Setup spreadsheet, or other approved method.

A. Enter the instrument serial number and probe serial number.

B. Enter the efficiency, or efficiencies for dual instruments, indicated on the instrument calibration sticker into the spreadsheet.

C. For portable contamination monitoring instrumentation equipped with a single-use detector and scaler, perform **and** record ten (10) one (1) minute background counts. Enter the results of the background counts into the appropriate block(s).

D. For dual instruments (i.e., Ludlum Model 2929 or 3030), perform and record one (1) ten (10) minute background count. Perform **and** record one (1) five (5) minute background count for the Ludlum Model 2224-1. Enter the results of the background count into the appropriate block(s).

6.1.8 Obtain a check source(s) of appropriate radiation type, energy, and activity level for the instrument. **If** unsure as to the appropriate source(s) to be used, **then** consult with the RPPM. Enter the check source radionuclide and check source identification number.

6.1.9 Obtain the source holder (jig), appropriate for the instrument. **If** unsure as to the appropriate source holder to be used, **then** consult with RADCON Supervision.

A. Document the geometry selected for the reference test on Part 1 of the form.
B. For portable contamination monitoring instrumentation equipped with a single-use detector and scaler, perform **and** record ten (10) one (1) minute source counts.
C. Enter the results of the source counts into the appropriate block(s).

6.1.10 For dual instruments (i.e., Ludlum Model 2929 or 3030), perform **and** record ten (10) one (1) minute source counts for alpha and beta. For the Ludlum Model 2224-1, perform **and** record ten (10) one (1) minute source counts for alpha and beta. Enter the results of the source counts into the appropriate block on the Radiological Instrument Initial Setup spreadsheet.

6.1.11 Upon entering all information into the Radiological Instrument Initial Setup spreadsheet, save **and** print the completed sheet. Review the associated Lc/MDC/CF card that is generated to ensure information is accurate. Present the completed Radiological Instrument Initial Setup spreadsheet to the Area RPPM or RCT Supervisor for his or her review.

6.1.12 Laminate the Lc/MDC/CF card to the appropriate instrument, as applicable.

6.1.13 **For analog instruments**: **When** establishing a background level for analog instruments, use the slow response setting **and** allow the meter to stabilize for thirty to forty seconds.

A. Record the resulting background reading. The maximum alpha background acceptable is 5 cpm for all alpha detectors of 100 cm, or less; for large surface area detectors and dual scintillation probes, the acceptable maximum alpha background level is 10 cpm. Calculate +/- twenty percent (20%) of the average beta background level to establish minimum and maximum beta background levels.
B. This average reading shall be within the typical range, indicated in the instrumentation operating procedure.
C. **If** the results do **NOT** fall within the acceptable range, **then** repeat the test.
D. **If** there are still discrepancies, **then** remove the instrument from service **and** contact RADCON Supervision.

NOTE:

Background ranges for floor monitor probes and sodium iodide probes should be calculated to plus or minus (+/-) 20% of the background average.

6.1.14 Calculate 20% of the average source response **and** record the range of the average plus or minus (+/-) 20% as the accepted source response range.

6.2 Setup of Dose Rate Instruments

6.2.1 Setup Ion chambers

A. **If** setting-up an ion chambers or telescoping instruments (RO-20, RSO-50, 6112B, etc.) **then**, obtain the appropriate source. Instruments are typically setup and response checked with a Sr-90 thumbwheel source, but may be setup with different sources depending upon setup location.

B. **When** response checking ensure the instrument's window is in the open position, if applicable, **and** tested according to Section **6.1.5**.

C. **When** using a thumbwheel or slide-type source jig with different ranges of source strength, the source slide should be opened for each range tested.

6.2.2 Setup Microrem Instruments

A. Turn on the instrument **and** allow it to appropriately warm up.

B. **If** using a Thermo Scientific or Bicron Micro Rem, **then** obtain a background by turning the instrument to its lowest scale. Allow the instrument to stabilize **and** record the reading indicated on the instrument face. The background reading must be less than (<) 5 µrem/hr.

C. **If** the background is greater than (>) 5 µrem/hr., **then** ensure the source is **NOT** affecting the background reading. **If** the source is affecting the background reading, **then** remove the source from the area **or** obtain a background reading in another location, if possible.

D. **If** the background is greater than (>) 5 µrem/hr. and the source is **NOT** affecting the instrument, **then** tag the instrument out of service.

E. Microrem instruments are typically setup and response checked with a Sr-90 thumbwheel source, but may be setup with different sources depending upon setup location. **When** response checking the microrem instrument with a Sr-90 thumbwheel source, the instrument shall be placed on the "x10" scale and the source shall be placed in the "0-500m/R" position. The source should not be exposed (slide should be closed).

F. Place the instrument on the source by lining up the "+" marks on the sides of the instrument with the marks indicated on the source jig to ensure repeatability during the daily source check process.

G. Allow the instrument to stabilize **and** record the reading indicated on the instrument face on RP-F-0069, *Dose Rate Instrument Daily Test* form. Verify repeatability.

6.2.3 Setup Neutron Instruments

> NOTE:
>
> Neutron instruments with Neutron Rate Dosimeter (NRD) detectors may be source checked using an Am-241 source.

A. Source Check the NRD detector by placing the detector against the right end of the box containing the Am-241 source.

B. Perform a one minute count when determining background levels. The background reading must be obtained in an area that will **NOT** interfere with the setup activities (e.g., C-743 Room 130 Count Lab or other low background area).

C. Perform a one minute count when confirming source response of the instrument. On the ASP2E, this is accomplished by switching the instrument to "Scaler" which automatically commences a one minute count. Additional one minute counts may be obtained by pressing the Starkey.

D. Record the results of these one minute background and source counts in the appropriate blocks of the daily test sheet.

6.2.4 Setup Telescoping dose rate instruments

> NOTE:
>
> Telescoping dose rate instruments (i.e., Eberline 6112B and Automess 6150 AD2) may be setup with different sources and in different configurations, depending upon setup location.

A. Test instruments in accordance with Section **6.1.5**.

B. **If** using a thumbwheel or slide-type source jig with different ranges of source strength, the source slide should be opened for each range tested.

C. Contact Radiation Control RADCON supervision for guidance in the proper setup of these instruments.

6.3 Setup of Lapel Air Samplers

6.3.1 Obtain a copy of the calibration certificate.

6.3.2 Obtain RP-F-0046, *Lapel Air Sampler Daily Instrument Performance Check Log*.

6.3.3 Ensure the sampler is in calibration.

6.3.4 Determine the average flow rate, as determined during calibration. This is typically indicated on the calibration certificate in the "Reproducibility" section.

6.3.5 Calculate Plus or minus (+/-) ten percent (10%) of the average flow rate, as determined during calibration, **and** record on RP-F-0046.

6.3.6 Record the appropriate filter type (e.g., "AA") on RP-F-0046.

6.4 Test Sheets

6.4.1 Have the designated area RPPM, RCT Supervisor, or Lead RCT review **and** sign the Test Sheet.

6.4.2 Place the Test Sheet in a file binder or other designated location, as instructed by the Radiation Protection Manager (RPM), RPPM, RCT Supervisor, or Lead RCT. **If** the response test information is maintained by automated methods, **then** forward a copy of the Test Sheet to the appropriate data input group as identified by the RPPM or RCT Supervisors.

7.0 RECORDS

7.1 Records Generated

The following records may be generated by this procedure:

- RP-F-0046, *Lapel Air Sampler Daily Instrument Performance Check Sheet*
- RP-F-0065, *Dual Instrument Daily Test Sheet*
- RP-F-0067, *Contamination Instrument Daily Test Sheet*
- RP-F-0069, *Dose Rate Instrument Daily Test Sheet*
- *Radiological Instrument Initial Setup spreadsheet, or equivalent*

Forms are to be completed in accordance with CP3-RP-0024, *Forms Control*.

7.2 Records Disposition

The records are to be maintained in accordance with CP3-RD-0010, *Records Management Process*.

Appendix A – Acronyms/Definitions

ACRONYMS

BCS – Boundary Control Station

CFR – Code of Federal Regulations

D&R – Deactivation and Remediation

JPM – Job Performance Measure

NRD – Neutron Rate Dosimeter

PGDP –Paducah Gaseous Diffusion Plant

RADCON – Radiation Control

RCT – Radiological Control Technician

RPM – Radiation Protection Manager

RPPM – Radiation Protection Project Manager

DEFINITIONS

None

Appendix B - Active Surface Areas of Detectors

Following are the active surface areas of common detector probes used at the PGDP D&R location:

- Ludlum Model 44-9/44-9-18/44-40: 15.51 cm^2
- Ludlum Model 43-5: 76 cm^2
- Ludlum Model 43-89: 125 cm^2
- Ludlum Model 43-92: 100 cm^2