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**PRACTICAL GUIDANCE FOR
IMPLEMENTATION OF NCRP
STATEMENT NO. 14 “INSTRUMENT
RESPONSE VERIFICATION AND
CALIBRATION FOR USE IN
RADIATION EMERGENCIES”**

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**PRACTICAL GUIDANCE FOR IMPLEMENTATION OF
NCRP STATEMENT NO. 14 "INSTRUMENT RESPONSE VERIFICATION
AND CALIBRATION FOR USE IN RADIATION EMERGENCIES "**

Prepared by:

**CRCPD's HS/ER-17 Task Force for Guidance Development for Radiological
Respiratory Protection for Ancillary Emergency Workers**

Members

Ken Evans, Chair (Life)
David Asselin (Michigan)
Robin Phillips (Texas)
Ruben Cortez (Texas)

Resource Individuals

Adela Salame-Alfie (Life, formerly CDC)

HS/ER-17 Practical Guidance for Implementation of NCRP Statement No. 14

Introduction

The National Council on Radiation Protection and Measurements (NCRP) issued Statement 14 “Instrument Response Verification and Calibration for Use in Radiation Emergencies” in 2022 to support the emergency response community in their efforts to maintain their radiation measurement instruments in a state of readiness for use in a large-scale nuclear or radiological emergency, without having to spend very limited resources in sending equipment for annual calibration when such calibration is not needed. The recommendations in Statement 14 consider not only the objectives of making emergency radiation measurements but also the practical aspects of maintaining equipment that is not used for regulatory compliance and that might be used only rarely.

This document is intended as a companion to Statement 14¹. The purpose of this document is to use the recommendations provided in Statement 14 to provide practical information for the responder community who may have limited knowledge of radiation detection instrumentation and how to conduct and document checks to ensure equipment readiness.

The focus of this document is on radiological instruments that are not used in routine health physics operations, regulatory compliance or law enforcement activities. Rather, the radiological instruments are intended to support decisions during a radiological emergency, such as the determination of a radiation hazard; emergency worker exposure control; screening people, vehicles, equipment, or buildings for radioactive contamination; assessing the potential for population exposure; and prevention/counterterrorism efforts.

This document is based on the conclusions and recommendations from Statement 14, which were derived from empirical data from calibration records provided by four state, local, and laboratory instrument calibration programs. Such data indicated that for these sample groups most instruments maintain their calibration within an acceptable range for responder and public safety, for several years.

Statement 14 provides a generalized, three-tiered, mission-oriented approach to maintaining instrument readiness for emergency response where Tier 1 is the most rigorous.

Statement 14 defines Tiers by the type of mission for which the instrument would be used. Following are the definitions of each tier and examples of types of equipment that may fit into each Tier. For details, please consult Statement 14.

¹ https://ncrponline.org/wp-content/themes/ncrp/PDFs/2022/Statement_14.pdf

Tier 1

Tier 1 is the most rigorous level of instrument maintenance. Tier 1 classification is recommended for instruments that are intended to be used to perform surveys in the vicinity of a radiological incident. These instruments are used for the mission of performing radiation measurements for exposure rate monitoring and control, exposure measurements, and identifying specific radioisotopes. Individuals and organizations with a specific radiological response role including state radiation control programs, emergency response organizations for a nuclear power plant, and radioactive materials licensees typically possess this type of equipment.

Maintenance includes annual calibration and quarterly operability check for battery strength and response to a known check source. Note that Tier 1 may not apply to some organizations.

Tier 2

Tier 2 designates a moderate level of equipment maintenance. These types of instruments may be used by first responders to detect if radiation is present and may apply to your organization.

These instruments are not used to obtain specific measurements but instead will support the mission of providing confirmation of the presence of radiation. These instruments may not be used routinely. Individuals and organizations who use these instruments do not have a primary role in radiological emergency preparedness/response activities.

Maintenance includes periodic operability and quantitative source-response checks (meaning acceptable response to a specific measurable quantity). See Attachment 1 *"Instructions for Instrument Operability Checks."*

Tier 3

Tier 3 designates minimal or no maintenance. These types of instruments may be used by first responders to detect if radiation is present and may apply to your organization.

These instruments can detect radiation. These instruments are not used routinely and most likely are kept in storage. If needed in an emergency, these instruments would only be acceptable for the mission of basic confirmation of the presence of radiation.

Maintenance is not typically performed on these instruments. Just-in-time use would include an operability check and qualitative source response checks. These instruments are not typically calibrated and may not have any records or documentation showing when they were last calibrated. These instruments would be used as a last resort by individuals and

organizations who do not have access to any radiation detection equipment that meets the criteria for a higher Tier.

Equipment Tier Determination

Determine the Tier categories for the instruments in your jurisdiction.

- a. Tier 1 instruments are routinely calibrated and may be associated with a regulated program. These are the types of instruments used by state radiation control programs, facilities possessing radioactive materials licenses, and nuclear power plant emergency response organizations. It is likely that most first responders will not have a large inventory of Tier 1 instruments.
- b. If the instruments in your jurisdiction do not meet the definition of tier 1 above, classify them into Tier 2 or Tier 3.
- c. If an instrument's status is unknown, assign it to Tier 3.

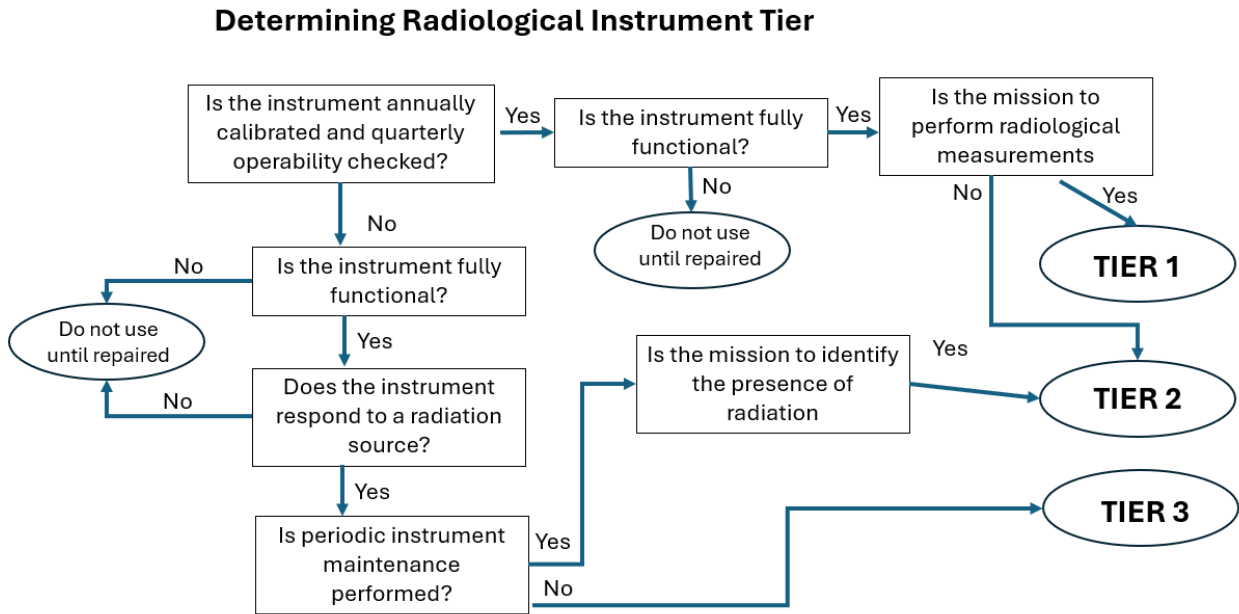
Instrument Selection by Tier

An instrument operability check may be performed by ensuring that the batteries are functioning and then verifying the response of the instrument to a known check source. Instrument checks should be documented. Attachment 1 provides additional guidance on instrument operability checks.

When the instrument is only needed to detect the presence of radiation, a functional instrument from any Tier is acceptable.

- a. Tier 1 instruments are fully functional and calibrated. They may be used according to the manufacturer's intended use. When the accuracy and precision of data are important, use a Tier 1 instrument.
- b. Tier 2 instruments are fully functional, may not have been calibrated recently, and respond to within about 20% of a known radiation field. They can be used to detect and quantify radiation but may be less accurate than Tier 1 instruments.
- c. Tier 3 instruments that respond to radiation can be used in a reserve capability if no other Tier 1 or Tier 2 instruments are available. Tier 3 instruments that do not function properly may be prioritized for calibration or repair, if possible, as resources are available.

Figure 1. Determining Radiological Instrument Tier.



Regardless of the tier or type of instrument, it is very important to document that the instruments have been checked prior to use. A simple table listing the instrument and the date that the instrument was last checked will provide information on whether the instrument is ready to be used.

If the first response organization requires additional guidance on how to perform radiological instrument maintenance and/or calibration, the following entities are recommended and should be able to assist, or know where to go for assistance:

- State Radiation Control Program (<https://online.flippingbook.com/view/1024977783/>)
- Manufacturer of instrument
- Local Emergency Management
- State Fire Marshal

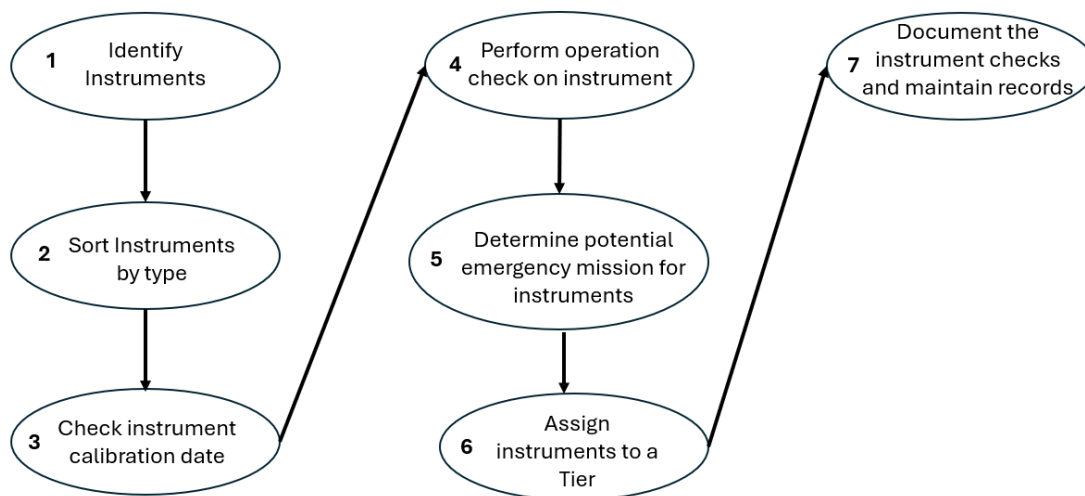
Procedure for implementation of instrument response verification

1. Perform an inventory to identify the number and types of instruments you have (for example, pancake GM, ion chamber, PRND), sort them by type. You can create a simple electronic table or spreadsheet to capture this information and other information listed below, and update it periodically as you check your instruments, so the information is readily available when you need to use the instruments.

2. Locate calibration records for your instrument. If you don't have records, you may check the date for the latest manufacturer calibration that is posted on the sticker in the instrument. Input that information in the inventory table. If that information is not available, list it as N/A.
3. Identify the potential emergency mission for each type of instrument in your jurisdiction. Example missions include performing surveys near the incident, setting up hot line, responder safety, personnel monitoring, vehicle monitoring, contamination monitoring, detecting presence of radiation, etc.
4. Based on the mission as previously identified, categorize your instrument by tier and follow the recommendations for instrument verification listed in Attachment 1.

Figure 2. Maintaining Radiological Instrument Readiness

Maintaining Radiological Instrument Readiness



References

NCRP Statement 14 “Instrument Response Verification and Calibration for Use in Radiation Emergencies,” June 22, 2022. https://ncrponline.org/wp-content/themes/ncrp/PDFs/2022/Statement_14.pdf

Conference of Radiation Control Program Directors. A link to the “Directory of Personnel Responsible for Radiological Health Programs” is found on the main page. CRCPD.org

Attachment 1 – Instructions for Instrument Operability Checks

These activities should also be performed prior to use.

A wide selection of equipment exists for detecting radiation. Instruments should be checked prior to use in accordance with their manufacturer's instructions. This checklist may be used as generalized guidance for count rate and exposure meters when instrument-specific guidance is unavailable. Highly specialized instruments such as Radioisotope Identifiers (RIIDs) should be operationally checked in accordance with their manufacturer's instructions.

- Inspect the instrument for obvious damage. If damaged, seek a replacement instrument or send it in for repair.
- Check the batteries and replace them as needed. Batteries can be checked by turning the meter knob to select the battery test position (on some meters). For many analog models, if the battery is adequately charged, the meter needle will swing to the battery test position on the meter face.
- Verify that the instrument responds to the presence of radiation. A check source with a known quantity of radioactive material is recommended.
- Compare the instrument's response to a check source with the expected response value. If it does not respond as expected, seek a replacement instrument or send it in for calibration.
 - Ideally each instrument should be paired with a check source and have a pre-established range of acceptable response values indicated on a sticker affixed to the instrument.
 - For instruments that do not have a sticker, place a check source near the detector (e.g., at one inch). Note the value and then move the check source to twice the original distance (e.g., two inches) and read the instrument again. The rate should have dropped to $\frac{1}{4}$ of the first reading.
 - If the observed meter response differs from the expected response by more than 20%, the meter should be classified as Tier 3. Consider sending the instrument for calibration.
- Take a "background reading" in a location away from radioactive materials and check sources. The instrument should detect low-level naturally occurring radioactivity in the environment or indoors. If the meter's background reading is substantially greater than

expected, confirm that there are no unexpected sources of radiation or radioactive materials in the vicinity. Call for reach back capability (e.g., the State radiation control authority) if needed.

- Create a record indicating whether the instrument passed the operational tests. Do not use an instrument that did not respond to the check source. Instruments that respond to radiation but do not read within 20% of the expected value should not be used for qualitative measurements. Maintain documentation of the operability checks.

If assistance is needed, consult with a trained health physicist, Radiation Safety Officer, or State Radiation Control Agency.