Testing and Evaluation Protocol for Spectroscopy-Based Portal Monitors Used for Homeland Security

T&E Protocol N42.38, 2010

Version 1.02

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1. Scope

This document establishes the protocol for testing alarming personal radiation detectors based on the performance requirements established in ANSI N42.38, "American National Standard for Evaluation and Performance of Radiation Detection Portal for Use in Homeland Security."

2. References

This protocol shall be used in conjunction with the following documents:

[R1] ANSI N42.38, "American National Standard for Evaluation and Performance of Radiation Detection Portal for Use in Homeland Security."

[R2] ANSI/IEEE N42.42, "Data Format Standard for Radiation Detectors Used for Homeland Security."

[R3] NIST Handbook 150:2006, NVLAP Procedures and General Requirements

[R4] NIST Handbook 150-23:2007 (DRAFT) NVLAP Radiation Detection Instruments

3. Compliance Level Information

Instrument under test might meet all the requirements listed in the ANSI/IEEE N42.38 standard. Therefore, different agencies developed documents describing the compliance levels required for particular applications of the instruments under test. Examples of such compliance level requirements are those required by the Graduated Rad/Nuc Detector Evaluation and Reporting (GRaDER^{SM}) program. For this program, information can be found in the "Compliance Level for GRaDER Instrument Performance" document located at http://www.dhs.gov/GRaDER .

4. Test and evaluation steps

It is recommended that testing laboratories perform the tests listed in this protocol in the following order:

- Check all items listed in the general requirements
- Perform the radiological tests
- Perform the temperature and humidity tests
- Perform the entire electrical and electromagnetic test except the Electrostatic Discharge (ESD) test
- Perform the impact and the vibration tests
- Perform the moisture and dust test
- Perform the ESD test
- Perform the drop test, as required

Excel template sheets are provided by NIST to the testing laboratory to guarantee that all data required is being provided in the test report.

5. Recording test results

This Test and Evaluation protocol contains data sheets that shall be used to record and report all test results. Each data sheet is associated with a specific section(s) of the referenced ANSI standard, N42.38. An electronic version of the data sheets is provided in the form of spreadsheets that may be used to record and report the results of the tests. These spreadsheets were verified and validated (V&V) using Microsoft Excel 2007 (compatibility mode).

Instrument status shall be recorded on the "Test Summary" sheet as testing is performed. The comment section in each data sheet shall be used to record changes to the test requirements and methods listed in the ANSI standard. The comment section shall also include the rational of the changes.

6. Test report

A test report summarizing the results of the test shall include the following sections:

a. Laboratory equipment information:
   1. Identify all participating laboratory facilities. Include points of contact names, mailing address, telephone number, and electronic mail addresses.
   2. Identify the tests performed in the different facilities.
   3. List all supporting equipment name, model number and last day of calibration used for each test.

b. Test equipment information :
   1. Include manufacturer name, instrument model, instrument serial number, software and firmware version identification, and last day of calibration.
   2. List the operating modes and parameter setting of the instrument and accessory kit(s) used in each test.

c. Data sheets:
   1. The data sheets listed in this document shall be completed and provided as part of the report.
   2. Include changes to the ANSI standard test requirements or methods and rational to the changes.

7. Guidance for testing ANSI N42.42 data format requirements

The standard associated with this Test and Evaluation Protocol requires verification that an output data file is created that complies with ANSI/IEEE N42.42 standard requirements. The range of

complexity of the N42.42 compliant instrument output file is extremely broad. Data output files from these instruments are simple files that can be checked manually using a text editor such as Notepad or WordPad. These files can also be verified using additional tools. In principle, all data output files that meet ANSI N42.42 can be verified manually using a text editor as these files are XML files. File reading software, such as Altova XMLSpy® 2009 Standard Edition can also be used for manual viewing and validating of structure and content.

N42.42 schemas can be used to validate the file format as specified in the ANSI/IEEE N42.42 standard. These schemas are available at the NIST web site **http://physics.nist.gov/Divisions/Div846/Gp4/ANSIN4242/xml.html**.

There are several XML validators that can be used to verify the XML structure of the N42.42 compliant instrument output file. Examples of these validators can be found at **http://www.xmlvalidation.com/** or http://validator.w3.org/.

8. Test modifications from ANSI/IEEE N42.38-2006 requirements

Some issues were observed and new considerations were taken about the enrichment of some of the sources listed in the ANSI/IEEE N42.38 standard. The testing laboratories should note that the source enrichment to be used for all the tests described in the ANSI/IEEE N42.38 standard is the following: HEU has an enrichment that is $\geq 90\%$ ^{235}U, DU at 0.2% ^{235}U, and U_{nat} at 0.7% ^{235}U, RGPu containing $\geq 10\%$ ^{240}Pu, and WGPu $\leq 6\%$ ^{240}Pu.

9. Considerations

The standard establishes exposure rates for test in Roentgen per hour (R/h). When testing instruments that read in rem per hour, the test field shall be in rem/h instead of R/h. Refer to the "Units and Uncertainties" section in the standard for additional information.

Test Summary Sheet
ANSI N42.38

Manufacturer:
Model:

Test Number	Serial# Date	Status	Serial# Date	Status	Serial# Date	Status
5.3						
5.4						
5.5						
5.6						
5.7						
5.8						
5.9						
5.10						
5.11.1						
5.11.2.1						
5.11.2.2						
5.11.2.3						
5.11.2.4						
6.2						
6.3						
6.4						
6.5						
6.6						
6.7						
6.8.1						
6.8.2.2						
6.8.2.3						
6.8.3						
6.8.4						
6.8.5						
6.8.6						
6.9						
6.10						
7.1						
7.2						
7.3						
8.1						
8.2						
8.3						
8.4						
8.5						
8.6						
9.1						
9.2						
10.0						

Comments:

Setup
Data Sheet and Report

Instrument:	
Model:	**Serial Number:**
Date Performed:	**Test Location:**

Requirement: Following the manufacturer-provided information, it shall be possible to set up the monitor for use. The manufacturer shall provide the designation type for testing purposes (pedestrian, vehicle, rail, and/or package).

The evaluation shall be performed without the benefit of any radiation shielding against the natural background, except for that shielding which is a permanent feature of the monitor.

NOTE - If the monitor has multiple uses, it should be tested for each usage designation.

Test Protocol: Set up the monitor for use using the technical manual as a guide. The actual set-up process may be performed by the manufacturer at the usage or test location while being observed by the testing organization. Document the results indicating whether all steps and information needed are available in the supplied technical information.

Note: Comments are required when the requirement is not verified.

Test Results

Classification:	(choose one)	☐ Pedestrian		☐ Package	
		☐ Vehicle		☐ Rail	
Setup performed by:	(choose one)	☐ Manufacturer		☐ Test Organization	
Were all steps for setup clearly defined?		☐ Yes		☐ No	
Was it necessary to seek technical assistance from the manufacturer?		☐ Yes		☐ No	
Did the technical manual provide all steps necessary for setup?		☐ Yes		☐ No	
Was all information necessary for setup (diagrams, schematics, etc.) provided in the technical manual?		☐ Yes		☐ No	

Comments:	

Completed by:		**Date:**
Reviewed by:		**Date:**

Pre-Test
Data Sheet and Report

Instrument:

Model: **Serial Number:**

Date Performed: **Test Location:**

Requirement: Verify that the manufacturer supplied an operation and maintenance manual containing the information listed below.

Test Protocol: Review the information provided and indicate whether the required information has been provided. Also verify that the documentation is complete and understandable. The documentation should not be in draft form with incomplete sections.

Note: Comments are required when the requirement is not verified.

Test Results

Requirement	Yes		No
Operating instructions and restrictions	☐		☐
Electrical connection schematic	☐		☐
Spare parts list	☐		☐
Troubleshooting guide.	☐		☐
Description and protocol for communication methods of transmitting and receiving data	☐		☐
Contact information for the manufacturer including name, address, telephone #, fax #, email address, etc.	☐		☐
Power supply requirements	☐		☐
Recommended operational parameters such as: detector response and false alarm probability	☐		☐
Complete description of system or unit	☐		☐
Enclosure specification classification	☐		☐
Inclusion of any hazardous material that may require additional regulation	☐		☐
Description of data analysis software and radionuclide identification procedure	☐		☐
Description of operation and performance of the system or unit	☐		☐

Comments:

Completed by: **Date:**

Reviewed by: **Date:**

Section 5.3 Spectral identification
Data Sheet and Report

Instrument:						
Model:				**Serial Number:**		
Date Performed:				**Test Location:**		

Requirement: a) A displayed gamma-ray spectrum is not required during routine operation. The spectrum display shall be available by manufacturer-defined user actions.

b) The monitor shall have the ability to internally store at least 1000 complete occupancy data sets. For monitors that do not use occupancy sensors, the monitor shall have the ability to store 3 hours of measurement data as defined in item c).

c) Each occupancy data set shall contain collection and identification results information including:

1) Unprocessed spectrum (spectra for multi-detector systems) obtained during a single occupancy,
2) Time and date
3) Real time for alarm spectrum
4) Run time for alarm spectrum
5) Identified radionuclides, categories, and confidence level (if available)
6) Occupancy time
7) Monitor identification
8) Alarm condition (gamma-ray and/or neutron)
9) Background (gamma-ray and neutron) count rate and spectrum (includes real time and run time)
10) Gamma-ray count rate
11) Neutron count rate
12) Vehicle speed (if available)

d) The monitor shall have the ability to store background count rate and spectra, and transfer that information at user selectable intervals to an external device, such as a computer.

e) The monitor shall have the ability to store gamma-ray and neutron count rate time-history data.

f) An indication shall be displayed or otherwise provided (e.g. "not identified") if a radionuclide cannot be identified when or after a measurement takes place.

g) If a reliability or confidence level is associated with the identification of a radionuclide(s), the confidence level shall be provided in the data set and the manufacturer shall describe the meaning of the displayed value.

h) The monitor shall have the ability to perform identification measurements with an object stationary in the detection zone. This function shall be user selectable and does not supersede the requirements stated in 6.8. The recommended measurement time shall be stated by the manufacturer and should be less than or equal to 1 min.

Note: Comments are required when the requirement is not verified.

Test Results		Yes	No
Is the spectrum display available by manufacturer-defined user actions?		⊔	⊔
The monitor has the ability to internally store at least 1000 complete occupancy data sets as defined in item c)? For monitors that do not use occupancy sensors, the monitor has the ability to store 3 hours of measurement data as defined in item c)?		⊔	⊔

Each occupancy data set shall contain collection and identification results information including:	Verify	
	Yes	No
Unprocessed spectrum (spectra for multi-detector systems) obtained during a single occupancy?		
Time and date?		
Real time for alarm spectrum?		
Run time for alarm spectrum?		
Identified radionuclides, categories, and confidence level (if available)?		
Occupancy time?		
Monitor identification?		
Alarm condition (gamma-ray and/or neutron)?		
Background (gamma-ray and neutron) count rate and spectrum (includes real time and run time)?		
Gamma-ray count rate?		
Neutron count rate?		
Vehicle speed (if available)?		

	Yes	No
The monitor has the ability to store background count rate and spectra, and transfer that information at user selectable intervals to an external device, such as a computer?	⊔	⊔
The monitor has have the ability to store gamma-ray and neutron count rate time-history data?	⊔	⊔
An indication is displayed or otherwise provided (e.g. "not identified") if a radionuclide cannot be identified when or after a measurement takes place?	⊔	⊔
If a reliability or confidence level is associated with the identification of a radionuclide(s), the confidence level is provided in the data set and the manufacturer described the meaning of the displayed value?	⊔	⊔
The monitor has the ability to perform identification measurements with an object stationary in the detection zone. This function is user selectable and does not supersede the requirements stated in 6.8. The recommended measurement time is stated by the manufacturer and should be less than or equal to 1 min?	⊔	⊔

Comments:

Completed by: **Date:**

Reviewed by: **Date:**

Section 5.4 Indication Features
Data Sheet and Report

Instrument:

Model: **Serial Number:**

Date Performed: **Test Location:**

Requirement: The monitor shall provide an indication of its operational status and alarm condition, and be capable of transmitting these signals to additional remote stations. The user shall have the ability to select the visibility of the status indication.

All alarm indicators shall automatically or manually reset as defined by the user.

Test Protocol: Perform each action with the monitor set to automatically reset. Although there are many actions required by this test, acceptance is based on pass or failing each action.

Note: Comments are required when the requirement is not verified.

Test Results

	Yes	No
With the monitor operating normally and with all indicators functioning (remote and/or local), verify that the indicators show the monitor is operating normally. Perform a measurement and verify that this action is indicated as required.	☐	☐
Repeat the measurement using a radiation source that will cause an alarm and verify that this is indicated.	☐	☐
Verify that this alarm automatically resets after the user enterable reset time.	☐	☐
Remove a component such as a detector panel and verify that this failure is indicated.	☐	☐
Reconnect the detector panel, and after the monitor returns to normal indication, remove line power and verify that this is indicated.	☐	☐
Repeat the alarm test with the monitor set for manual reset and verify that the monitor will not reset without user action.	☐	☐

Comments:

Completed by: **Date:**

Reviewed by: **Date:**

Section 5.5 Occupancy and Speed Sensors for Vehicle Monitors
Data Sheet and Report

Instrument:	
Model:	**Serial Number:**
Date Performed:	**Test Location:**

Requirement: Monitors shall have the ability to support occupancy sensors and should have the ability to measure speed.

If used, occupancy and speed sensors:
- Shall be able to detect presence and to estimate vehicle speed to within ±30% of a known speed, indicate if a vehicle stops within the detection zone, and not count a single vehicle or object in the detection zone more than once,
- Should be capable of operating on a mix of traffic (cars, vans, pickup trucks, buses, cargo trucks, trains, etc.), and
- Should function under all environmental conditions stated in this standard.

Rail monitors should have the ability to approximate the location of an alarm when monitoring multi-car trains.

For test purposes, a system that incorporates an occupancy sensor should have the ability to perform a user selected series of consecutive occupancies automatically without the need to activate the occupancy sensor. Function variables such as occupancy time and time between occupancies shall be user-selectable.

Note: Comments are required when the requirement is not verified.

Test Results

	Verify	
	Yes	**No**
The monitor has an occupancy sensor?		
If yes,		
Can it detect the presence of a vehicle?		
It is capable to operate in mix traffic?		
Can indicate if a vehicle or object stops within the detection zone?		
Does it count a single vehicle or object more than once?		
The monitor has a speed sensor?		
If yes,		
Can it estimate the vehicle speed?		
For rail monitors, does it have the ability to approximate the location of an alarm when monitoring multi-car trains?		

Comments:	

Completed by:		**Date:**	
Reviewed by:		**Date:**	

Section 5.6 Markings
Data Sheet and Report

Instrument:						
Model:			**Serial Number:**			
Date Performed:			**Test Location:**			

Requirement: Internal controls shall be identified through markings on circuit boards and identification in technical manuals.

Markings shall be easily readable and permanently fixed under normal conditions of use.

Exterior markings shall be limited to the manufacturer's unique serial number, voltage and current requirements, if equipped with an outlet plug, and shall meet minimum applicable municipal, state, federal, and international code requirements.

Test Protocol: Open detector cabinets or other protected components and verify that the items as marked in the technical manual match those marked in each detection assembly and other components, such as a remote alarm panel.

CAUTION
Perform the following with line and battery power removed from the monitor.

Using a damp cloth, wipe at some of the markings to verify that they are permanently affixed to the component.

Verify that only the minimal markings exist on the exterior of the unit.

Note: Comments are required when the requirement is not verified.

Test Results

	Yes	No
Are internal controls on electrical circuit boards and/or individual components marked as identified in the technical manuals?	☐	☐
REMOVE THE POWER FROM THE MONITOR. Using a damp cloth wipe at some of the markings. Are the makings permanently fixed?	☐	☐
Are the exterior markings limited to the ones listed in the requirement?	☐	☐

Comments:

Completed by:		**Date:**
Reviewed by:		**Date:**

Section 5.7 Power Supply
Data Sheet and Report

Instrument:

Model: **Serial Number:**

Date Performed: **Test Location:**

Requirement: Line-operated assemblies should be designed to operate from a single-phase AC supply voltage of 100 V to 240 V and from 47 Hz to 63 Hz.

The monitor shall be able to operate, including storing measurement data for a minimum of 3 h, if there is a loss of external power. Compliance shall be based on tests performed at the reference temperature of 22 °C.

Note: Comments are required when the requirement is not verified.

Temperature: _____ ° C **Humidity:** _____ % **Pressure:** _____ in. Hg.

Test Data

Source Data:

	Nominal Voltage				Isotope Key		Acceptance Range - Gamma			
	Gamma Response	Neutron Response	Isotopes Identified							
1					A -	^{137}Cs				
2					B -					
3					B -		#DIV/0!	to	#DIV/0!	(add units)
4					C -		-15%		+15%	
5					D -					
6							Acceptance Range - Neutron			
7										
8							#DIV/0!	to	#DIV/0!	(add units)
9							-15%		+15%	
10										
Mean	#DIV/0!	#DIV/0!								

	Voltage + 12% of Nominal			Voltage - 12% of Nominal		
	Gamma Response	Neutron Response	Isotopes Identified	Gamma Response	Neutron Response	Isotopes Identified
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
Mean	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	

	Frequency at 58 Hz			Frequency at 62 Hz		
	Gamma Response	Neutron Response	Isotopes Identified	Gamma Response	Neutron Response	Isotopes Identified
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
Mean	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	

Test Report

	Gamma Response		Neutron Response		Isotope Identification	
	Yes	No	Yes	No	Yes	No
- 12 %	☐	☐	☐	☐	☐	☐
+ 12 %	☐	☐	☐	☐	☐	☐
58 Hz	☐	☐	☐	☐	☐	☐
62 Hz	☐	☐	☐	☐	☐	☐

Comments:

Completed by: **Date:**

Reviewed by: **Date:**

Section 5.8 Battery Lifetime
Data Sheet and Report

Instrument:	
Model:	**Serial Number:**
Date Performed:	**Test Location:**

Requirement: Monitors shall be able to operate including storing measurement data for up to 3 hours if there is a loss of external power.

Note: Comments are required when the requirement is not verified.

	Yes	No
Did the monitor performed within specification for the entire 3 h period?	☐	☐
Did the monitor store all the required information from each occupancy within the 3 h?	☐	☐
Was the low-battery indication activated?	☐	☐

Comments:

Completed by:		**Date:**
Reviewed by:		**Date:**

Section 5.9 Protection of Switches
Data Sheet and Report

Instrument:

Model: **Serial Number:**

Date Performed: **Test Location:**

Requirement: Switches and other controls should be designed to ensure that the monitor is operated properly while minimizing accidental switch operation.

Note: Comments are required when the requirement is not verified.

Test Results

	Yes	No
External switches or controls are protected to prevent accidental operation	☐	☐

Comments:

Completed by: **Date:**

Reviewed by: **Date:**

Section 5.10 Effective Range of Measurement
Data Sheet and Report

Instrument:

Model: **Serial Number:**

Date Performed: **Test Location:**

Requirement: The effective gamma-ray energy response range shall be stated by the manufacturer, and should be at least 25 keV to 3 MeV.

The manufacturer shall state the range for gamma-ray count rate measurement and for neutron count rate indication.

Note: Comments are required when the requirement is not verified.

	Verify	
	Yes	**No**
Is the effective gamma-ray energy response stated by the manufacturer?		
Does the gamma-ray energy range go from 25 keV to 3 MeV?		
Is the gamma-ray count rate measurement range stated by the manufacturer?		
Is the neutron count rate measurement range stated by the manufacturer?		

Energy response range:

Gamma-ray count rate range:

Neutron count rate range:

Comments:

Completed by: **Date:**

Reviewed by: **Date:**

Section 5.11.1 Communications Protocol and Data Format
Data Sheet and Report

Instrument:	
Model:	**Serial Number:** 0
Date Performed:	**Test Location:**

Requirement: The monitor shall have the ability to transfer data to an external device, such as a computer. The transfer shall be based on a commonly available technology such as Ethernet, USB, RS-232, wireless (e.g., 802.11), or RS-485. Consideration should be given to data security when using wireless data transfer techniques. When used, wireless techniques shall have the ability to be encrypted.

The transfer protocol and format shall be fully described in the technical manual and shall also be freely distributable.

Data format shall be as defined in ANSI N42.42.

Note: Comments are required when the requirement is not verified.

	Verify	
	Yes	**No**
Does the monitor have the ability to transfer data to an external device?		
Is the transfer based on commonly available technology? (e.g. Ethernet, wireless, USB, RS-232)		
If the transfer is wireless, does it have the ability to encrypt the data?		
Is the transfer protocol described in the technical manual?		
Is the format described in the technical manual?		
Is it freely distributable?		
The data format complies with ANSI N42.42 requirements?		

Describe method used by monitor to transfer data:

Comments:

Completed by:		**Date:**	
Reviewed by:		**Date:**	

Section 5.11.2.1 Visual Indicators
Data Sheet and Report

Instrument:

Model: **Serial Number:**

Date Performed: **Test Location:**

Requirement: The monitor should provide a color-based visual indication for the following actions:

Alarm color	Type
Red	Neutron alarm
Blue	SNM identification and user-selectable high-radiation alarms
Orange	Other gamma-ray alarms (e.g., NORM)
Amber	System error/failure
Green	Power/system Okay
White	Checking

Note: Comments are required when the requirement is not verified.

	Verify	
	Yes	**No**
Neutron alarm? (Red)		
SNM identification and user-selectable high-radiation alarms? (Blue)		
Other gamma-ray alarms (e.g., NORM)? (Orange)		
System error/failure? (Amber)		
Power/system Okay? (Green)		
Checking? (White)		

Describe visual indicators:

Comments:

Completed by: **Date:**

Reviewed by: **Date:**

Section 5.11.2.2 Warning indicators
Data Sheet and Report

Instrument:				
Model:		**Serial Number:**		
Date Performed:		**Test Location:**		

Requirement: The following indications shall be provided at the user interface as a minimum.

- Background changes during non-occupancies that can affect the overall sensitivity of the monitor
- Hi-Lo detector count rate conditions
- Energy stabilization invalid or not acceptable
- Occupancy sensor failure, if occupancy sensors are used
- Changes in operational status (i.e., occupied, alarm, monitoring background, fault, blocked, etc.)
- Loss of line power
- Battery status

Note: Comments are required when the requirement is not verified.

Test Results

The following indications are provided:	Yes	No
Background changes during non-occupancies that can affect the overall sensitivity of the monitor?	⊔	⊔
Hi-Lo detector count rate conditions?	⊔	⊔
Energy stabilization invalid or not acceptable?	⊔	⊔
Occupancy sensor failure, if occupancy sensors are used?	⊔	⊔
Changes in operational status (i.e., occupied, alarm, monitoring background, fault, blocked, etc.)?	⊔	⊔
Loss of line power?	⊔	⊔
Battery status?	⊔	⊔

Comments:

Completed by:				**Date:**	
Reviewed by:				**Date:**	

Section 5.11.2.3 Basic Indications and Functions
Data Sheet and Report

Instrument:

Model: **Serial Number:**

Date Performed: **Test Location:**

Requirement: The following information and control shall be provided for the trained user.

- View operational status
- View alarm indication.
- Ability to reset alarms
- View identified radionuclide(s) (user selectable through advanced or supervisory access)

Note: Comments are required when the requirement is not verified.

	Verify	
	Yes	**No**
The operational status can be viewed?		
The alarm indication can be viewed?		
The trained user has the ability to reset the alarms?		
The identified radionuclides can be viewed?		
Is the viewing of identified radionuclides user selectable through advance or supervisory access?		

Comments:

Completed by: **Date:**

Reviewed by: **Date:**

Section 5.11.2.4 Advanced Indications and Functions
Data Sheet and Report

Instrument:	
Model:	**Serial Number:**
Date Performed:	**Test Location:**

Requirement: The following information and control shall be provided for the supervisory user through the use of access controls or special commands.

- Access to and control of operating parameters (radionuclide library, alarm control),
- Access to and control of data logging intervals,
- Access to alarm history,
- Access to spectra,
- Access to radionuclide identification results and control of basic indication function,
- Access to occupancy data set (if occupancy sensors are used),
- Access to vehicle photo (if available),
- Access to radiation profiles (count rate time history data),
- Access to background radiation information,
- Access to alarm selection criteria including the ability to select specific radionuclides
- Access to energy and/or efficiency calibration information

Note: Comments are required when the requirement is not verified.

Test Results

	Yes	No
Access to and control of operating parameters (radionuclide library, alarm control)	☐	☐
Access to and control of data logging intervals	☐	☐
Access to alarm history	☐	☐
Access to radionuclide identification results and control of basic indication function	☐	☐
Access to spectra	☐	☐
Access to occupancy data set (if occupancy sensors are used)	☐	☐
Access to vehicle photo (if available)	☐	☐
Access to radiation profiles (count rate time history data)	☐	☐
Access to radiation profiles (count rate time history data)	☐	☐
Access to background radiation information	☐	☐
Access to alarm selection criteria including the ability to select specific radionuclides	☐	☐
Access to energy and/or efficiency calibration information	☐	☐

Comments:		
Completed by:	**Date:**	
Reviewed by:	**Date:**	

Section 6.2 False Alarms
Data Sheet and Report

Instrument:

Model: _____ **Serial Number:** _____

Date Performed: _____ **Test Location:** _____

Requirement: When tested in an area with a stable background (only natural fluctuations) at the levels stated in Table 4, the false alarm rate shall be less than 1 per 1000 occupancies for systems that use occupancy sensors or one alarm over a 2 h time period for monitors that do not use occupancy sensors. In addition, the monitor shall not identify a radionuclide that is not present during the test period.

Note: Comments are required when more than one alarm and/or identification other than background is observed.

Test Results

Background Reading: _____ (add units)

Temperature: _____ ° C **Humidity:** _____ % **Pressure:** _____ In. Hg.

Number of Occupancies or test time	Number of gamma alarms	Number of neutron alarms	Number of identifications

Comments:

Completed by: _____ **Date:** _____

Reviewed by: _____ **Date:** _____

Section 6.3 Response to Gamma-ray Radiation
Data Sheet and Report

Instrument: _____

Model: _____   Serial Number: _____

Date Performed: _____   Test Location: _____

Requirement: A monitor shall alarm when gamma-ray exposure rate (i.e., overall count rate) measured as an object transits through the detection zone at the speed stated for that specific application (see Table 2) is greater than the alarm setting. The monitor shall alarm a minimum of 49 times in 50 occupancies. The visual indication shall be activated as defined in step 5.11.2.1.

Note: Comments are required when the requirement is not verified.

Test Results

Background Reading: _____ (add units)

Temperature: _____ ° C   Humidity: _____ %   Pressure: _____ In. Hg.

Source:	^{57}Co		^{133}Ba	
Source Data:				
	Number of occupancies	Number of alarms	Number of occupancies	Number of alarms
Bottom				
Mid-Point Bottom/Middle				
Middle				
Mid-Point Middle/Top				
Top				

Comments: _____

_____

_____

_____

Completed by: _____   Date: _____

Reviewed by: _____   Date: _____

Section 6.4 Response to Neutron Radiation
Data Sheet and Report

Instrument:

Model: **Serial Number:**

Date Performed: **Test Location:**

Requirement: A monitor shall alarm when the neutron exposure rate (i.e., count rate) measured as an object transits through the detection zone at the speed stated for that specific application (see Table 2), is greater than the alarm setting.

The monitor shall alarm a minimum of 49 times in 50 occupancies. The visual indication shall be activated as defined in step 5.11.2.1.

Note: Comments are required when the requirement is not verified.

Test Results

Background Reading: _____ (add units)

Temperature: ____ ° C   **Humidity:** _____ %   **Pressure:** ____ In. Hg.

	Number of occupancies	Number of alarms
Source:	^{252}Cf	
Source Data:		
Bottom		
Mid-Point Bottom/Middle		
Middle		
Mid-Point Middle/Top		
Top		

Comments:

Completed by: _____   **Date:** _____

Reviewed by: _____   **Date:** _____

Section 6.5 Overload
Data Sheet and Report

Instrument:

Model: **Serial Number:**

Date Performed: **Test Location:**

Requirement: If a monitor is subjected to an exposure rate that is greater than the manufacturer-stated maximum during an occupancy or when performing measurements without an occupancy sensor, an alarm indicating, for example "high background" or "high counts," shall be activated and shall remain activated until the exposure rate is reduced or the alarm is reset/acknowledged by the user. The visual indication for the user selectable high radiation alarm shall be activated as defined in step 5.11.2.1.

The time required to return to non-alarm condition after the exposure rate is returned to background shall be not greater than 1 min.

Note: Comments are required when the requirement is not verified.

Test Data

Background Reading: _____ (add units)

Temperature: _____ °C   **Humidity:** _____ %   **Pressure:** _____ In. Hg.

Source Data:

Maximum exposure rate stated by manufacturer: _____ (add units)

	Count Rate Beginning	Alarm		Count Rate End		The time to recover is ≤1min	
		Y	N			Yes	No
1		☐	☐				
2		☐	☐				
3		☐	☐				

	Yes	No
Did the monitor remain in alarm until the exposure rate was reduced to the pre-test level?		

Comments:

Completed by: _____   **Date:** _____

Reviewed by: _____   **Date:** _____

Section 6.6 Neutron Indication in the Presence of Photons
Data Sheet and Report

Instrument:

Model: **Serial Number:**

Date Performed: **Test Location:**

Requirement: Gamma radiation at exposure rates of up to 10 mR/h (at the face of the center of the detection assembly) shall not trigger the neutron alarm.

Note: Comments are required when the requirement is not verified.

Background Reading: _____ (add units)

Temperature: ___ ° C   **Humidity:** ___ %   **Pressure:** ___ In. Hg.

Source Data:

Test Data		
	Neutron Alarm	
	Y	N
1	☐	☐
2	☐	☐
3	☐	☐

Comments:

Completed by: _____   **Date:** _____

Reviewed by: _____   **Date:** _____

Section 6.7 Background Effects
Data Sheet and Report

Instrument:

Model: **Serial Number:**

Date Performed: **Test Location:**

Requirement: The monitor shall provide a warning indication when a change in background is large enough to cause a substantial change in alarm probability. The indication shall be visual and audible and shall be different than monitoring alarms.

Note: Comments are required when the requirement is not verified.

Test Data

Background Reading: _____ (add units)

Temperature: ____ ° C   **Humidity:** ____ %   **Pressure:** _____ In. Hg.

Source Data: _____

Test Number	^{137}Cs Background Change Indication (Choose One)			^{252}Cf Background Change Indication (Choose One)		
1	☐ Yes		☐ No	☐ Yes		☐ No
2	☐ Yes		☐ No	☐ Yes		☐ No
3	☐ Yes		☐ No	☐ Yes		☐ No

	Verify	
	Yes	**No**
Is the visual indication for gammas different from the gamma monitoring alarm?		
Is the audible indication for gammas different from the gamma monitoring alarm?		
Is the visual indication for neutrons different from the neutron monitoring alarm?		
Is the audible indication for neutrons different from the neutron monitoring alarm?		

Comments: _____
_____
_____
_____

Completed by: _____ **Date:** _____

Reviewed by: _____ **Date:** _____

Section 6.8.1 Radionuclide Categorization
Data Sheet and Report

Instrument:

Model: **Serial Number:**

Date Performed: **Test Location:**

Requirement: The manufacturer shall state the radionuclides that the monitor can identify and their category. The categories selected should be based on the list shown in 6.8.1. The following tests shall be performed based on the manufacturer-provided list.

- Special Nuclear Materials: Uranium (used to indicate 233U, 235U), 237Np, Pu.

- Medical radionuclides: 18F, 67Ga, 51Cr, 75Se, 89Sr, 99Mo, 99mTc, 103Pd, 111In, Iodine (123I, 125I, 131I), 153Sm, 201Tl, 133Xe.

- Naturally occurring radioactive materials (NORM): 40K, 226Ra, 232Th and daughters, 238U and daughters.

- Industrial radionuclides: 57Co, 60Co, 133Ba, 137Cs, 192Ir, 204Tl, 226Ra, and 241Am.

Note: Comments are required when the requirement is not verified.

Test Results

	Yes	No
The manufacturer states the radionuclides that the monitor can identify by category?	☐	☐
The monitor can identify (at a minimum) the four different categories of radionuclides listed in the requirement?	☐	☐

Comments:

Completed by: **Date:**

Reviewed by: **Date:**

Section 6.8.2.2 Single Radionuclide Identification - Unshielded Data Sheet and Report

Instrument:

Model: **Serial Number:**

Date Performed: **Test Location:**

Requirement: The monitor shall identify the following radionuclides, or at least those stated by the manufacturer at the reference speed for that specific application, or measurement cycle time as stated by the manufacturer:

— 40K, 57Co, 60Co, 67Ga, 99mTc, 131I, 133Ba, 137Cs, 192Ir, 201Tl, 226Ra, 232Th, DU, 241Am

Note: Comments are required when the requirement is not verified.

Transitory measurements

Single Radionuclide Identification Unshielded Sources Test Data

Date Performed:

	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
			^{40}K		
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
			^{57}Co		
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
			^{60}Co		
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
			^{67}Ga		
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
			^{99m}Tc		
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

		^{131}I			
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

		^{133}Ba			
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

		^{137}Cs			
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed: _____

		^{192}Ir			
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed: _____

		^{201}Tl			
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed: _____

		^{226}Ra			
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
			^{232}Th		
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
			DU		
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
			^{241}Am		
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Source Information

Date	Radionuclide	Activity	Exposure rate	(add units)
	^{40}K			
	^{57}Co			
	^{60}Co			
	^{67}Ga			
	^{99m}Tc			
	^{131}I			
	^{133}Ba			
	^{137}Cs			
	^{192}Ir			
	^{201}Tl			
	^{226}Ra			
	^{232}Th			
	DU			
	^{241}Am			

Stationary measurements

Single Radionuclide Identification Unshielded Sources Test Data

Measurement time: _____ min

Date Performed: _____

	^{40}K				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed: _____

	^{57}Co				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed: _____

	^{60}Co				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed: _____

	^{67}Ga				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

	^{99m}Tc				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

	^{131}I				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

	^{133}Ba				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

	^{137}Cs				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

	^{192}Ir				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

	^{201}Tl				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

	^{226}Ra				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

	^{232}Th				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

	DU				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

	^{241}Am				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Source Information				
Date	Radionuclide	Activity	Exposure rate	(add units)
	^{40}K			
	^{57}Co			
	^{60}Co			
	^{67}Ga			
	^{99m}Tc			
	^{131}I			
	^{133}Ba			
	^{137}Cs			
	^{192}Ir			
	^{201}Tl			
	^{226}Ra			
	^{232}Th			
	DU			
	^{241}Am			

Comments:

Completed by: **Date:**

Reviewed by: **Date:**

Section 6.8.2.3 Unshielded SNM
Data Sheet and Report

Instrument:

Model: **Serial Number:**

Date Performed: **Test Location:**

Requirement: The monitor shall identify the following radionuclides, or at least those stated by the manufacturer at the reference speed for that specific application, or measurement cycle time as stated by the manufacturer:

‒ HEU, RGPu, and WGPu.

Note: Comments are required when the requirement is not verified.

Transitory measurements

Single Radionuclide Identification SNM Unshielded Test Data

Date Performed:

	HEU				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

	RGPu				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

	WGPu				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Source Information				
Date	Radionuclide	Activity	Exposure rate	(add units)
	HEU			
	RGPu			
	WGPu			

Stationary measurements

Single Radionuclide Identification SNM Unshielded Test Data

Measurement time: _____ min

Date Performed:

	HEU				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

	RGPu				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

	WGPu				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Source Information				
Date	Radionuclide	Activity	Exposure rate	(add units)
	HEU			
	RGPu			
	WGPu			

Comments:

Prepared by: **Date:**

Reviewed by: **Date:**

Section 6.8.3 Identification of Shielded Radionuclides
Data Sheet and Report

Instrument:			
Model:		Serial Number:	
Date Performed:		Test Location:	

Requirement: **6.8.3.1 Requirements based on shielding related to shipping containers**

The manufacturer shall provide a list of shielded radionuclides that the monitor can identify. For this standard, the source is surrounded by 3 cm of steel on all sides. The list shall contain the following radionuclides, as a minimum:

– 133Ba, 137Cs, and 60Co

NOTE—3 cm steel is based on possible shipping container configurations and attenuation of gamma-ray emissions from each radionuclide.

6.8.3.2 Requirements based on medical treatments

The manufacturer shall provide a list of radionuclides that the monitor can identify when monitoring people with medical treatments. For this standard, the source is surrounded by 7.62 cm of polymethyl methacrylate (PMMA). See Table 3 for additional information. The list shall contain the following radionuclides, as a minimum:

– 67Ga, 99mTc, 131I, 201Tl

Note: Comments are required when the requirement is not verified.

Transitory measurements

Identification of Shielded Radionuclides Test Data

Date Performed:

	^{133}Ba				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed: _____

		^{137}Cs			
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed: _____

		^{60}Co			
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed: _____

		^{67}Ga			
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed: _____

^{99m}Tc				
Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Corr				

Date Performed: _____

^{131}I				
Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Corr				

Date Performed: _____

^{201}Tl				
Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Corr				

Source Information

Date	Radionuclide	Activity	Exposure rate	(add units)
	^{60}Co			
	^{67}Ga			
	^{99m}Tc			
	^{131}I			
	^{133}Ba			
	^{137}Cs			
	^{201}Tl			

Stationary measurements

Identification of Shielded Radionuclides Test Data

Measurement time: _____ **min**

Date Performed: _____

^{133}Ba					
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed: _____

^{137}Cs					
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed: _____

		^{60}Co			
	Bottom	**Mid-point Bottom and Middle**	**Middle**	**Mid-point Top/Middle**	**Top**
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed: _____

		^{67}Ga			
	Bottom	**Mid-point Bottom and Middle**	**Middle**	**Mid-point Top/Middle**	**Top**
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed: _____

		^{99m}Tc			
	Bottom	**Mid-point Bottom and Middle**	**Middle**	**Mid-point Top/Middle**	**Top**
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed: _____

^{131}I				
Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Corr				

Date Performed: _____

^{201}Tl				
Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Corr				

Source Information				
Date	Radionuclide	Activity	Exposure rate	(add units)
	^{60}Co			
	^{67}Ga			
	^{99m}Tc			
	^{131}I			
	^{133}Ba			
	^{137}Cs			
	^{201}Tl			

Comments: _____
_____
_____
_____

Completed by: _____ **Date:** _____

Reviewed by: _____ **Date:** _____

Section 6.8.4 Simultaneous Radionuclide Identification
Data Sheet and Report

Instrument:
Model: **Serial Number:**
Date Performed: **Test Location:**

Requirement: a. The monitor shall have the ability to identify more than one radionuclide simultaneously. Simultaneous identification ability shall consist of radionuclides from separate categories (e.g., ^{99m}Tc + ^{137}Cs, ^{131}I + RGPu).

b. The monitor shall have the ability to identify a radionuclide of interest when combined with other radionuclides.

Note: Comments are required when the requirement is not verified.

Transitory measurements

Simultaneous Radionuclide Identification Test Data

Date Performed:

^{40}K + ^{226}Ra + ^{232}Th + RGPu				
Bottom	**Mid-point Bottom and Middle**	**Middle**	**Mid-point Top/Middle**	**Top**
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Corr				

Date Performed:

	^{40}K + ^{226}Ra + ^{232}Th + DU				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

	^{99m}Tc + DU				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

	^{131}I + RGPu				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Source Information

Date	Mix	Radionuclide	Activity	Exposure rate	(add units)
	$^{40}K + ^{226}Ra + ^{232}Th + RGPu$	^{40}K			
		^{226}Ra			
		^{232}Th			
		RGPu			
	$^{40}K + ^{226}Ra + ^{232}Th + DU$	^{40}K			
		^{226}Ra			
		^{232}Th			
		DU			
	$^{99m}Tc + DU$	^{99m}Tc			
		DU			
	$^{99m}Tc + RGPu$	^{99m}Tc			
		RGPu			

Stationary measurements

Simultaneous Radionuclide Identification Test Data

Measurement time: _____ **min**

Date Performed: _____

	$^{40}K + ^{226}Ra + ^{232}Th + RGPu$				
	Bottom	**Mid-point Bottom and Middle**	**Middle**	**Mid-point Top/Middle**	**Top**
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

	$^{40}K + \,^{226}Ra + \,^{232}Th + DU$				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

	$^{99m}Tc + DU$				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Date Performed:

	$^{131}I + RGPu$				
	Bottom	Mid-point Bottom and Middle	Middle	Mid-point Top/Middle	Top
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Corr					

Source Information					
Date	Mix	Radionuclide	Activity	Exposure rate	(add units)
	$^{40}K + ^{226}Ra + ^{232}Th + RGPu$	^{40}K			
		^{226}Ra			
		^{232}Th			
		RGPu			
	$^{40}K + ^{226}Ra + ^{232}Th + DU$	^{40}K			
		^{226}Ra			
		^{232}Th			
		DU			
	$^{99m}Tc + DU$	^{99m}Tc			
		DU			
	$^{99m}Tc + RGPu$	^{99m}Tc			
		RGPu			

Comments:

Completed by: **Date:**

Reviewed by: **Date:**

Section 6.8.5 Overload Characteristics for Identification
Test Data and Report

Instrument:

Model: _____   **Serial Number:** _____

Date Performed: _____   **Test Location:** _____

Requirement: The manufacturer shall state the maximum gamma-ray exposure rate (μR/hr) relative to ^{137}Cs for identification.

Note: Comments are required when the requirement is not verified.

Maximum exposure rate stated by manufacturer: _____ (add units)

Background Reading: _____ (add units)

Temperature: _____ ° C   **Humidity:** _____ %   **Pressure:** _____ In. Hg.

Source Data: _____

Transitory measurements

Test Data			Test Report		
Radionuclides Identified					
				Yes	No
1			The monitor correctly identified ^{60}Co in 8 out of 10 trials	☐	☐
2					
3					
4					
5					
6					
7					
8					
9					
10					
Correct	0%	(Enter Yes/No)			

Stationary measurements

Measurement time: _____ **min**

Test Data	
Radionuclides Identified	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Correct	0%	(Enter Yes/No)

Test Report		
	Yes	No
The monitor correctly identified ^{60}Co in 8 out of 10 trials	⊔	⊔

Comments: _____

_____

_____

_____

Completed by: _____ **Date:** _____

Reviewed by: _____ **Date:** _____

Section 6.8.6 Pile-Up Effects
Test Data and Report

Instrument:

Model: **Serial Number:**

Date Performed: **Test Location:**

Requirement: The monitor shall correctly identify radionuclides that are associated with people who have recently received radiation therapy treatments (131I).

Note: Comments are required when the requirement is not verified.

Background Reading: (add units)

Temperature: ° C   **Humidity:**   %   **Pressure:**   In. Hg.

Source Data:

Transitory measurements

Test Data	
Identified	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Correct	0%	(Enter Yes/No)

Test Report		
	Yes	No
The monitor correctly identified ^{131}I in 8 out of 10 trials	⊔	⊔

Stationary measurements

Measurement time: _____ **min**

Test Data	
Identified	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Correct	0%

(Enter Yes/No)

Test Report		
	Yes	No
The monitor correctly identified ^{131}I in 8 out of 10 trials	⊔	⊔

Comments: _____

_____

_____

_____

Completed by: _____ **Date:** _____

Reviewed by: _____ **Date:** _____

Section 6.9 Determination of Efficiency
Data Sheet

Instrument:			
Model:		**Serial Number:**	
Date Performed:		**Test Location:**	

Requirement: The manufacturer shall state the full-energy-peak efficiency for 57Co (122 keV at 85.51%, T1/2 = 272 d), 133Ba (356 keV at 62.05%, T1/2 = 10.5 y), 137Cs (662 keV at 85.1%, T1/2 = 30 y), and 60Co (1173 and 1332 keV at 99.857% and 99.983%, respectively, T1/2 = 5.27 y).

NOTE—Data from Evaluated Nuclear Structure Data File (ENSDF) and Bureau National de Métrologie-Laboratoire National Henri Becquerel/Commissariat á l'énergie atomique (BNM-LNHB/CEA)

Notes: Comments are required when the requirement is not verified.

Test Results (Peak Efficiency)

Ambient Conditions:		°C		%RH		in HG

Test Equipment Used:

Note: if the monitor uses multiple detectors the information below needs to be recorded for each detector

Detector 1

Efficiency Results

Source	Measured Efficiency	Manufacturer Stated Efficiency
Co-57	#VALUE!	
^{60}Co, Pk1	#VALUE!	
^{60}Co, Pk2	#VALUE!	
Ba-133	#VALUE!	
Cs-137	#VALUE!	

Test Measurements (Peak Efficiency)

Table 1. Peak dps computations

Source	ID	Decayed activity to date (uCi)	Decayed Activity (Bq)	Abundance (Abd)	Peak (gammas/s)
^{57}Co			#VALUE!	0.8551	#VALUE!
^{60}Co, Pk1			#VALUE!	0.99857	#VALUE!
^{60}Co, Pk2			#VALUE!	0.99983	#VALUE!
^{133}Ba			#VALUE!	0.6205	#VALUE!
^{137}Cs			#VALUE!	0.851	#VALUE!

Table 2. Net Peak cps computations

Source	Gross Peak Area	Peak Bkg	Net Peak Area	Acquisition time seconds	Net Peak Count Rate	Measured efficiency
^{57}Co			#VALUE!		#VALUE!	#VALUE!
^{60}Co, Pk1			#VALUE!		#VALUE!	#VALUE!
^{60}Co, Pk2			#VALUE!		#VALUE!	#VALUE!
^{133}Ba			#VALUE!		#VALUE!	#VALUE!
^{137}Cs			#VALUE!		#VALUE!	#VALUE!

Detector 2

Efficiency Results

Source	Measured Efficiency	Manufacturer Stated Efficiency
Co-57	#VALUE!	
^{60}Co, Pk1	#VALUE!	
^{60}Co, Pk2	#VALUE!	
Ba-133	#VALUE!	
Cs-137	#VALUE!	

Test Measurements (Peak Efficiency)

Table 1. Peak dps computations

Source	ID	Decayed activity to date (uCi)	Decayed Activity (Bq)	Abundance (Abd)	Peak (gammas/s)
^{57}Co			#VALUE!	0.8551	#VALUE!
^{60}Co, Pk1			#VALUE!	0.99857	#VALUE!
^{60}Co, Pk2			#VALUE!	0.99983	#VALUE!
^{133}Ba			#VALUE!	0.6205	#VALUE!
^{137}Cs			#VALUE!	0.851	#VALUE!

Table 2. Net Peak cps computations

Source	Gross Peak Area	Peak Bkg	Net Peak Area	Acquisition time seconds	Net Peak Count Rate	Measured efficiency
^{57}Co			#VALUE!		#VALUE!	#VALUE!
^{60}Co, Pk1			#VALUE!		#VALUE!	#VALUE!
^{60}Co, Pk2			#VALUE!		#VALUE!	#VALUE!
^{133}Ba			#VALUE!		#VALUE!	#VALUE!
^{137}Cs			#VALUE!		#VALUE!	#VALUE!

Comments:

Completed by: **Date:**

Reviewed by: **Date:**

Section 6.10 Determination of Full Width Half Maximum (FWHM)
Data Sheet and Report

Instrument:	
Model:	**Serial Number:**
Date Performed:	**Test Location:**

Requirement: The manufacturer shall state the FWHM as defined in the IEEE standard appropriate to the detector used for 137Cs (662 keV at 85.1%).

Notes: Comments are required when the requirement is not verified.

Ambient Conditions: °C   %RH   in HG

Test Equipment Used:

Source Data:

Note: if the monitor uses multiple detectors the information below needs to be recorded for each detector

Detector 1

Full Width Half Maximum Measurements

Manufacturer's Stated FWHM Cs-137 (keV)	Measured value FWHM Cs-137 (keV)

Acceptance Range (Based on Manufacturer's	
0.00	0.00
- 20 %	+ 20 %

Detector 2

Full Width Half Maximum Measurements

Manufacturer's Stated FWHM Cs-137 (keV)		Measured value FWHM Cs-137 (keV)

Acceptance Range (Based on Manufacturer's	
0.00	0.00
- 20 %	+ 20 %

Comments:

Completed by: **Date:**

Reviewed by: **Date:**

Section 7.1 Ambient Temperature
Test Data and Report

Instrument:

Model: Serial Number:

Date Performed: Test Location:

Requirement: The monitor shall be able to operate over an ambient temperature range from −30°C to +55°C.

It is permissible, but not recommended, to test the system by testing components only, such as detector(s) and any components designed for use in an uncontrolled environment. If cooling or heating systems are part of the detection system it is not possible to test components only.

This test should be carried out in an environmental chamber. Humidity levels should be low enough to prevent condensation (<65% RH) and the rate of change of temperature shall not exceed 10°C per hour.

NOTE: Level 1 Modification - Temperature range needs to be from -10°C to 40°C

Note: Comments are required when the requirement is not verified.

Test Data

Gamma Background Reading: _____ (add units)

Neutron Background Reading: _____ (add units)

Humidity: _____ %   Pressure: _____ In. Hg.

Gamma Source Data:

Neutron Source Data:

	Pre-test 22°C				Isotope Key			Acceptance Range - Gamma		
	Gamma Response	Neutron Response	Isotopes Identified							
	(add units)	(add units)			A - ^{57}Co					
1					B - ^{60}Co			#DIV/0!	to	#DIV/0!
2								-15%		+15%
3										
4								**Acceptance Range - Neutron**		
5										
6								#DIV/0!	to	#DIV/0!
7								-15%		+15%
8										
9								**Identification Acceptance Range**		
10									of	
Mean	#DIV/0!	#DIV/0!								
STD	#DIV/0!	#DIV/0!								
CV	#DIV/0!	#DIV/0!								

- 30°C

	Beginning			8hrs			16 hrs		
	Gamma Response	Neutron Response	Isotopes Identified	Gamma Response	Neutron Response	Isotopes Identified	Gamma Response	Neutron Response	Isotopes Identified
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
Mean	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	
STD	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	
CV	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	

	-20°C			0°C			40°C		
	Gamma Response	Neutron Response	Isotopes Identified	Gamma Response	Neutron Response	Isotopes Identified	Gamma Response	Neutron Response	Isotopes Identified
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
Mean	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	
STD	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	
CV	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	

55°C

	Beginning			8hrs			16 hrs		
	Gamma Response	Neutron Response	Isotopes Identified	Gamma Response	Neutron Response	Isotopes Identified	Gamma Response	Neutron Response	Isotopes Identified
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
Mean	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	
STD	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	
CV	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	

	Post-test 22°C		
	Gamma Response (add units)	**Neutron Response** (add units)	**Isotopes Identified**
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	#DIV/0!	#DIV/0!	
STD	#DIV/0!	#DIV/0!	
CV	#DIV/0!	#DIV/0!	

Test Report

Verify if monitor responses are within the acceptance ranges

	Gamma Response		Neutron Response			Identification	
	Yes	**No**	**Yes**	**No**		**Yes**	**No**
55°C	☐	☐	☐	☐		☐	☐
40°C	☐	☐	☐	☐		☐	☐
0°C	☐	☐	☐	☐		☐	☐
-20°C	☐	☐	☐	☐		☐	☐
-30°C	☐	☐	☐	☐		☐	☐

Comments:

Section 7.2 Relative Humidity
Test Data and Report

Instrument:
Model: **Serial Number:**
Date Performed: **Test Location:**

Requirement: The monitor shall be able to operate during and after exposure to relative humidity (RH) levels of up to 93% RH at an ambient temperature of +40°C.

There shall not be any observable effects from the exposure.

It is permissible, but not recommended, to test to test the system by testing components only, such as detector(s) and any components designed for use in an uncontrolled environment. If cooling or heating systems are part of the detection system, it is not possible to test components only.

Note: Comments are required when the requirement is not verified.

Test Data

Gamma Background Reading: (add units)

Neutron Background Reading: (add units)

Gamma Source Data:

Neutron Source Data:

65% Relative Humidity at 22°C

	Gamma Response	Neutron Response	Isotopes Identified
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	#DIV/0!	#DIV/0!	
STD	#DIV/0!	#DIV/0!	
CV	#DIV/0!	#DIV/0!	

Isotope Key	
A -	^{57}Co
B -	^{60}Co

Acceptance Range - Gamma		
#DIV/0!	to	#DIV/0!
-15%		+15%

Acceptance Range - Neutron		
#DIV/0!	to	#DIV/0!
-15%		+15%

Identification Acceptance Range	
of	

93% Relative Humidity at 40°C

	Hour 1			Hour 2			Hour 3		
	Gamma	Neutron	Isotope ID	Gamma	Neutron	Isotope ID	Gamma	Neutron	Isotope ID
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
Mean	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	

93% Relative Humidity at 40°C

	Hour 4			Hour 5			Hour 6		
	Gamma	Neutron	Isotope ID	Gamma	Neutron	Isotope ID	Gamma	Neutron	Isotope ID
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
Mean	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	

93% Relative Humidity at 40°C

	Hour 7			Hour 8			Hour 9		
	Gamma	Neutron	Isotope ID	Gamma	Neutron	Isotope ID	Gamma	Neutron	Isotope ID
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
Mean	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	

93% Relative Humidity at 40°C

	Hour 10			Hour 11			Hour 12		
	Gamma	Neutron	Isotope ID	Gamma	Neutron	Isotope ID	Gamma	Neutron	Isotope ID
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
Mean	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	

93% Relative Humidity at 40°C

	Hour 13			Hour 14			Hour 15		
	Gamma	Neutron	Isotope ID	Gamma	Neutron	Isotope ID	Gamma	Neutron	Isotope ID
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
Mean	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	

93% Relative Humidity at 40°C / 65% Relative Humidity at 40°C

	Hour 16					Gamma	Neutron	Isotope ID
	Gamma	Neutron	Isotope ID					
1					1			
2					2			
3					3			
4					4			
5					5			
6					6			
7					7			
8					8			
9					9			
10					10			
Mean	#DIV/0!	#DIV/0!			Mean	#DIV/0!	#DIV/0!	

65% Relative Humidity at 22°C

	Gamma	Neutron	Isotope ID
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Mean	#DIV/0!	#DIV/0!	

Test Report

Verify if monitor responses are within the acceptance ranges

	Gamma Response		Neutron Response			Identification	
	Yes	No	Yes	No		Yes	No
93% Relative Humidity at 40°C	⊔	⊔	⊔	⊔		⊔	⊔
65% Relative Humidity at 40°C	⊔	⊔	⊔	⊔		⊔	⊔

Comments: _____

_____

_____

_____

Completed by: _____   Date: _____

Reviewed by: _____   Date: _____

Section 7.3 Dust and Moisture
Test Data and Report

Instrument:

Model: **Serial Number:**

Date Performed: **Test Location:**

Requirement: The monitor, including components designed for use in an unprotected environment, shall meet the requirements stated for IP code 54 (see IEC 60529), protected from the ingress of dust and splashing water. For IP54, the ingress of dust is not totally prevented, but dust shall not penetrate in a quantity to interfere with satisfactory operation of the instrument or to impair safety, and water splashed against the enclosure from any direction shall have no harmful effects.

Note: Comments are required when the requirement is not verified.

Test Data - Dust

Temperature: _____ °C   **Humidity:** _____ %   **Pressure:** _____ in Hg.

Source Data:

	Pre-Test ^{137}Cs	Post-Test ^{137}Cs		Acceptance Range - Gamma		
1				#DIV/0!	to	#DIV/0!
2				-15%		+15%
3						
4						
5				Inspection Results		
6						
7						
8						
9						
10						
Mean	#DIV/0!	#DIV/0!				
STD	#DIV/0!	#DIV/0!				
CV	#DIV/0!	#DIV/0!				

Test Data - Moisture

	Pre-Test	Post-Test
	^{137}Cs	^{137}Cs
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Mean	#DIV/0!	#DIV/0!
STD	#DIV/0!	#DIV/0!
CV	#DIV/0!	#DIV/0!

Acceptance Range - Gamma

#DIV/0!	to	#DIV/0!
-15%		+15%

Inspection Results

Test Report

Verify if monitor responses are within the acceptance ranges

	Yes	No
Dust Exposure	☐	☐
Moisture Exposure	☐	☐

Comments:

Completed by: _____   Date: _____

Reviewed by: _____   Date: _____

Section 8.1 Electrostatic Discharge (ESD)
Test Data and Report

Instrument:

Model: **Serial Number:**

Date Performed: **Test Location:**

Requirement: The monitor shall function properly after exposure to electrostatic discharges at intensities of up to 6 kV.

Note: Comments are required when the requirement is not verified.

Temperature: °C **Humidity:** % **Pressure:** in Hg.

Test Equipment:

Gamma Source Data:

Neutron Source Data:

	Pre-Test			Pre-Test			Acceptance Range		
	Ambient Gamma Background	Gamma		Ambient Neutron Background	Neutron Response		Gamma Background		
							#DIV/0!	to	#DIV/0!
1			(add units)			(add units)	-15%		+15%
2									
3							**Acceptance Range - Gamma**		
4							#DIV/0!	to	#DIV/0!
5							-15%		+15%
6									
7							**Acceptance Range**		
8							Neutron Background		
9							#DIV/0!	to	#DIV/0!
10							-15%		+15%
Mean	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!				
STD	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		**Acceptance Range - Neutron**		
COV	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	to	#DIV/0!
							-15%		+15%

Occupancy Mode without Sources (Check if alarms) - 2kV

	Point 1		Point 2		Point 3		Point 4		Point 5	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Alarms										

Occupancy Mode with Sources (Check if out of tolerance) - 2kV

	Point 1		Point 2		Point 3		Point 4		Point 5	
	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Mean	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Non-Occupancy Mode without Sources (Check if alarms) - 2kV

	Point 1		Point 2		Point 3		Point 4		Point 5	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Alarms										

	Non-Occupancy Mode with Sources (Check if out of tolerance) - 2kV									
	Point 1		Point 2		Point 3		Point 4		Point 5	
	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Mean	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

2kV - Test Report		
	Yes	No
In occupancy mode, system alarm		
In occupancy mode, readings within range		
In non-occupancy mode, system alarm		
In non-occupancy mode, readings within range		

	Occupancy Mode without Sources (Check if alarms) - 4kV									
	Point 1		Point 2		Point 3		Point 4		Point 5	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Alarms										

Occupancy Mode with Sources (Check if out of tolerance) - 4kV

	Point 1		Point 2		Point 3		Point 4		Point 5	
	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Mean	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Non-Occupancy Mode without Sources (Check if alarms) - 4kV

	Point 1		Point 2		Point 3		Point 4		Point 5	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Alarms										

Non-Occupancy Mode with Sources (Check if out of tolerance) - 4kV

	Point 1		Point 2		Point 3		Point 4		Point 5	
	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Mean	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

4kV - Test Report

	Yes	No
In occupancy mode, system alarm		
In occupancy mode, readings within range		
In non-occupancy mode, system alarm		
In non-occupancy mode, readings within range		

Occupancy Mode without Sources (Check if alarms) - 6kV

	Point 1		Point 2		Point 3		Point 4		Point 5	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Alarms										

Occupancy Mode with Sources (Check if out of tolerance) - 6kV

	Point 1		Point 2		Point 3		Point 4		Point 5	
	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Mean	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Non-Occupancy Mode without Sources (Check if alarms) - 6kV

	Point 1		Point 2		Point 3		Point 4		Point 5	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Alarms										

Non-Occupancy Mode with Sources (Check if out of tolerance) - 6kV

	Point 1		Point 2		Point 3		Point 4		Point 5	
	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Mean	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

6kV - Test Report

	Yes	No
In occupancy mode, system alarm		
In occupancy mode, readings within range		
In non-occupancy mode, system alarm		
In non-occupancy mode, readings within range		

Comments:

Completed by: _____ Date: _____

Reviewed by: _____ Date: _____

Section 8.2 Radio Frequency (RF)
Test Data and Report

Instrument:

Model: **Serial Number:**

Date Performed: **Test Location:**

Requirement: The monitor should not be affected by RF fields over the frequency range of 20 MHz to 2500 MHz at an intensity of 10 volts per meter (V/m).

Note: Comments are required when the requirement is not verified.

Temperature: _____ °C   **Humidity:** _____ %   **Pressure:** _____ in Hg.

Test Equipment Used:

Frequency Scan Observations Without Sources

With Cs-137 and Cf-252 Sources

	Nominal No RF Gamma
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Mean	#DIV/0!
STD	#DIV/0!
COV	#DIV/0!

Gamma Source Data: _____

Neutron Source Data: _____

Acceptance Range (Gamma)

#DIV/0!	to	#DIV/0!
low (-15%)		high (+15%)

Acceptance Range (Neutron)

#DIV/0!	**to**	#DIV/0!
low (-15%)		high (+15%)

	Nominal No RF Neutron
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Mean	#DIV/0!
STD	#DIV/0!
COV	#DIV/0!

Frequency Scan Observations with Sources

Comments: _____

Completed by: _____ **Date:** _____

Reviewed by: _____ **Date:** _____

Section 8.3 Radiated Emissions
Test Data and Report

Instrument:

Model: **Serial Number:**

Date Performed: **Test Location:**

Requirement: The emission limits when measured at three meters from the monitoring system shall be less than what is shown below:

Emission Frequency Range (MHz)		Field Strength (micro volts/meter)
30 – 88		100
88 – 216		150
216 – 960		200
>960		500

Note: Comments are required when the requirement is not verified.

Occupancy operations

Test Report		
	Yes	No
Emissions were within acceptable limits	⊔	⊔

Non-occupancy operations

Test Report		
	Yes	No
Emissions were within acceptable limits	☐	☐

Comments:

Completed by: _____ **Date:** _____

Reviewed by: _____ **Date:** _____

Section 8.4 Conducted Disturbances Induced by Bursts and Radio Frequencies
Test Data and Report

Instrument:

Model: Serial Number:

Date Performed: Test Location:

Requirement: The monitor should not be affected by RF fields that can be conducted onto the monitor through an external conducting cable.

Note: Comments are required when the requirement is not verified.

Temperature: _____ °C   Humidity: _____ %   Pressure: _____ in Hg.

Occupancy Mode

Test Equipment Used:

Frequency Scan Observations Without Sources

With Cs-137 and Cf-252 Sources

	Nominal No RF Gamma	
1		(add units)
2		
3		
4		
5		
6		
7		
8		
9		
10		
Mean	#DIV/0!	
STD	#DIV/0!	
COV	#DIV/0!	

Gamma Source Data: _____

Neutron Source Data: _____

Acceptance Range (Gamma)

#DIV/0!	to	#DIV/0!
low (-15%)		high (+15%)

Acceptance Range (Neutron)

#DIV/0!	**to**	#DIV/0!
low (-15%)		high (+15%)

	Nominal No RF Neutron	
1		(add units)
2		
3		
4		
5		
6		
7		
8		
9		
10		
Mean	#DIV/0!	
STD	#DIV/0!	
COV	#DIV/0!	

Frequency Scan Observations with Sources

Non-Occupancy Mode

Test Equipment Used: _____

Frequency Scan Observations Without Sources

With Cs-137 and Cf-252 Sources

Gamma Source Data: _____

Neutron Source Data: _____

	Nominal No RF Gamma	
1		(add units)
2		
3		
4		
5		
6		
7		
8		
9		
10		
Mean	#DIV/0!	
STD	#DIV/0!	
COV	#DIV/0!	

Acceptance Range (Gamma)

#DIV/0!	to	#DIV/0!
low (-15%)		high (+15%)

Acceptance Range (Neutron)

#DIV/0!	**to**	#DIV/0!
low (-15%)		high (+15%)

Frequency Scan Observations with Sources

	Nominal No RF Neutron	
1		(add units)
2		
3		
4		
5		
6		
7		
8		
9		
10		
Mean	#DIV/0!	
STD	#DIV/0!	
COV	#DIV/0!	

Comments: _____

_____

_____

_____

Completed by: _____   Date: _____

Reviewed by: _____   Date: _____

Section 8.5 Magnetic Field
Test Data and Report

Instrument:								
Model:				**Serial Number:**				
Date Performed:				**Test Location:**				

Requirement: The monitor should be unaffected by a 30 Amperes/m (A/m) 60 Hz magnetic field.

NOTE -- 1 A/m is equivalent to a free space induction of 1.26 mTesla.

Note: Comments are required when the requirement is not verified.

Temperature:		°C	**Humidity:**		%	**Pressure:** _____ in Hg.
Test Equipment:						
Gamma Source Data:						
Neutron Source Data:						

Test Data with Sources

	Gamma Response	Neutron Response				
1				**Acceptance Range - Gamma**		
2						
3				#DIV/0!	**to**	#DIV/0! (add units)
4				**-15%**		**+15%**
5						
6				**Acceptance Range - Neutron**		
7						
8				#DIV/0!	**to**	#DIV/0! (add units)
9				**-15%**		**+15%**
10						
Mean	#DIV/0!	#DIV/0!				
STD	#DIV/0!	#DIV/0!				
CV	#DIV/0!	#DIV/0!				

		Initial Orientation				Second Orientation			
		Nominal Zero Intensity		30 A/m 60 Hz		Nominal Zero Intensity		30 A/m 60 Hz	
		Gamma	Neutron	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
	Mean	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Test Data without Sources

		Initial Orientation 30 A/m 60 Hz				Second Orientation 30 A/m 60 Hz			
		Gamma Alarms		Neutron alarms		Gamma Alarms		Neutron alarms	
		Yes	No	Yes	No	Yes	No	Yes	No
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
	Number of alarms								

Comments: _____

_____

_____

_____

Completed By: _____ **Date:** _____

Reviewed By: _____ **Date:** _____

Section 8.6 Surges and Oscillatory Waves
Test Data and Report

Instrument:

Model: **Serial Number:**

Date Performed: **Test Location:**

Requirement: The monitor should not be affected by surges or oscillatory waves of up to 2 kV that are classified as ring waves or combination waves at 1.2/50 µs and 8/20 µs.

Note: Comments are required when the requirement is not verified.

Temperature: °C **Humidity:** % **Pressure:** in Hg.

Test Equipment:

Gamma Source Data:

Neutron Source Data:

	Pre-Test			Pre-Test				Acceptance Range		
	Ambient Gamma Background	Gamma		Ambient Neutron Background	Neutron Response			Gamma Background		
								#DIV/0!	to	#DIV/0!
								-15%		+15%
1			(add units)			(add units)		Acceptance Range - Gamma		
2										
3								#DIV/0!	to	#DIV/0!
4								-15%		+15%
5										
6										
7								Acceptance Range		
8								Neutron Background		
9								#DIV/0!	to	#DIV/0!
10								-15%		+15%
Mean	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!					
STD	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!			Acceptance Range - Neutron		
COV	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!					
								#DIV/0!	to	#DIV/0!
								-15%		+15%

Occupancy Mode

	Without Sources (Check if alarms)			Cs-137 Source With Sources (Check if out of tolerance)			Cf-252 Source With Sources (Check if out of tolerance)		
	Combination Wave	Ring Wave		Combination Wave	Ring Wave		Combination Wave	Ring Wave	
1						(add units)			(add units)
2									
3									
4									
5									
6									
7									
8									
9									
10									
Mean				#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	
STD				#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	
COV				#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	

Non-Occupancy Mode

	Without Sources (Check if alarms)			Cs-137 Source With Sources (Check if out of tolerance)			Cf-252 Source With Sources (Check if out of tolerance)		
	Combination Wave	Ring Wave		Combination Wave	Ring Wave		Combination Wave	Ring Wave	
1						(add units)			(add units)
2									
3									
4									
5									
6									
7									
8									
9									
10									
Mean				#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	
STD				#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	
COV				#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	

	Yes	No
In occupancy mode, system alarm		
In occupancy mode, readings within range		
In non-occupancy mode, system alarm		
In non-occupancy mode, readings within range		

Comments: _____

_____

_____

_____

Completed by: _____ Date: _____

Reviewed by: _____ Date: _____

Section 9.1 Vibration
Test Data and Report

Instrument:
Model: Serial Number:
Date Performed: Test Location:

Requirement: The monitor shall function normally when exposed to vibrations associated with equipment installed in non-weather protected locations of up to 0.5 gn over a frequency range from 10 Hz to 150 Hz. The physical condition of the monitor should not be affected by exposure (e.g., solder joints shall hold; nuts and bolts shall not come loose).

Note: Comments are required when the requirement is not verified.

Temperature: _____ °C   Humidity: _____ %   Pressure: _____ in Hg.

Test Equipment:

Gamma Background Reading: _____ (add units)   Neutron Background Reading: _____ (add units)

Gamma Source Data:

Neutron Source Data:

Test Data

Readings within acceptance range with sources present

	Pre-Test				Post Test	
	Gamma	Neutron			Gamma	Neutron
1			(add units)	1			(add units)
2				2		
3				3		
4				4		
5				5		
6				6		
7				7		
8				8		
9				9		
10				10		
Mean	#DIV/0!	#DIV/0!		Mean	#DIV/0!	#DIV/0!
STD	#DIV/0!	#DIV/0!		STD	#DIV/0!	#DIV/0!
CV	#DIV/0!	#DIV/0!		CV	#DIV/0!	#DIV/0!

Acceptance Range - Gamma				Acceptance Range - Neutron		
#DIV/0!	to	#DIV/0!	(add units)	#DIV/0!	to	#DIV/0!	(add units)
-15%		+15%		-15%		+15%

Alarms with no source present

Gamma Alarms		
	Yes	No
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Number of alarms		

Neutron Alarms		
	Yes	No
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Number of alarms		

Test Report	Yes	No
Did the system alarm during the test?		
Where the post-test readings within range?		
Where there any mechanical damage and/or loose components?		

Comments:

Completed by: _____ Date: _____

Reviewed by: _____ Date: _____

Section 9.2 Microphonics/Impact
Test Data and Report

Instrument:

Model: **Serial Number:**

Date Performed: **Test Location:**

Requirement: The monitor shall be unaffected by microphonic conditions such as those that may occur from low-intensity sharp contacts at energies of up to 1.0 J. 1.0 J is equivalent to a mass of 1 kg moving at 1.4 m/s over a distance of 0.1 m.

Note: Comments are required when the requirement is not verified.

Test Equipment:

Gamma Background Reading: _____ (add units)   **Neutron Background Reading:** _____ (add units)

Temperature: _____ °C   **Humidity:** _____ %   **Pressure:** _____ in Hg.

Gamma Source Data:

Neutron Source Data:

	Pretest Response Gamma				Pretest Response Neutron			Acceptance Range - Gamma		
1		(add units)		1		(add units)		#DIV/0!	to	#DIV/0!
								low		high
2				2						
3				3						
4				4						
5				5				Acceptance Range - Neutron		
6				6				#DIV/0!	to	#DIV/0!
7				7				low		high
8				8						
9				9						
10				10						
Mean	#DIV/0!			Mean	#DIV/0!					
STD	#DIV/0!			STD	#DIV/0!					
COV	#DIV/0!			COV	#DIV/0!					

Test Data - Occupancy Mode

Without Sources

Impact Number	Side No. 1		Side No. 2		Side No. 3	
	Record if monitor alarm during the test (Yes/No)					
	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron
1						
2						
3						
No. of alarms						

Impact Number	Side No. 4		Side No. 5		Side No. 6	
	Record if monitor alarm during the test (Yes/No)					
	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron
1						
2						
3						
No. of alarms						

With Sources

Impact Number	Side No. 1		Side No. 2		Side No. 3	
	Response After Each Impact					
	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron
1						
2						
3						
No. of alarms						

Impact Number	Side No. 4		Side No. 5		Side No. 6	
	Response After Each Impact					
	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron
1						
2						
3						
No. of alarms						

Non-Occupancy Mode

Test Equipment: _____

Gamma Background Reading: _____ (add units)　　　　**Neutron Background Reading:** _____ (add units)

Temperature: _____ °C　　**Humidity:** _____ %　　**Pressure:** _____ in Hg.

Gamma Source Data: _____

Neutron Source Data: _____

	Pretest Response Gamma				Pretest Response Neutron			Acceptance Range - Gamma		
1		(add units)		1		(add units)		#DIV/0!	to	#DIV/0!
2				2				low		high
3				3						
4				4						
5				5				Acceptance Range - Neutron		
6				6				#DIV/0!	to	#DIV/0!
7				7				low		high
8				8						
9				9						
10				10						
Mean	#DIV/0!			Mean	#DIV/0!					
STD	#DIV/0!			STD	#DIV/0!					
COV	#DIV/0!			COV	#DIV/0!					

Test Data - Non-Occupancy Mode

Without Sources

Impact Number	Side No. 1		Side No. 2		Side No. 3	
	Record if monitor alarm during the test (Yes/No)					
	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron
1						
2						
3						
No. of alarms						

Impact Number	Side No. 4		Side No. 5		Side No. 6	
	Record if monitor alarm during the test (Yes/No)					
	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron
1						
2						
3						
No. of alarms						

With Sources

Impact Number	Side No. 1		Side No. 2		Side No. 3	
	Response After Each Impact					
	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron
1						
2						
3						
No. of alarms						

Impact Number	Side No. 4		Side No. 5		Side No. 6	
	Response After Each Impact					
	Gamma	Neutron	Gamma	Neutron	Gamma	Neutron
1						
2						
3						
No. of alarms						

Test Report	Yes	No
In occupancy mode, system alarm		
In occupancy mode, readings within range		
In non-occupancy mode, system alarm		
In non-occupancy mode, readings within range		

Comments:

Completed by: _____ Date: _____

Reviewed by: _____ Date: _____

Sections 10 - Documentation
Test Data and Report

Instrument:				
Model:		**Serial Number:**		
Date Performed:		**Test Location:**		

Requirements: **10. 1 Type test report**

The manufacturer shall make available, at the request of the purchaser, the report on the type tests performed to the requirements of this standard.

10.2 Report

The manufacturer shall provide the following information, as a minimum:

– Contact information for the manufacturer including name, address, telephone number, fax number, e-mail address, etc.

– Type of portal monitor, detector, and types of radiation the monitor is designed to measure

– Mounting distance between detection assemblies, as appropriate

– Power supply requirements

– Results of tests performed to this standard

– Recommended operational parameters such as: detector response, false alarm probability, alarm thresholds, operating parameters, and libraries

– Complete description of the evaluated monitor

– Enclosure specification classification

– Inclusion of any hazardous material that may require additional regulation (such as radionuclide check source)

– List of radionuclides that are identified by the monitor

– Over-range exposure rate values for gross counting and identification

10.3 Operation and maintenance manual

The manufacturer shall supply an operation and maintenance manual containing the following information to the user:

– Operating instructions and restrictions

– Module connection schematic

– Electrical connection schematic

– Spare parts list

– Troubleshooting guide

– Description and protocol for communication methods of transmitting and receiving data

Note: Only one data sheet per model is required. Comments are required when the requirement is not verified.

	Yes	No
Did the manufacturer provide a report on the type tests performed?		
Was contact information provided in the manual?		
Did the manual describe the type of monitor and detectors?		
Was the mounting distance between detection assemblies provided?		
Were the power supply requirements provided?		
Were results of test performed to this standard provided?		
Were recommended operating parameters provided?		
Was a complete description of he evaluated monitor provided?		
Were enclosure specification provided?		
Was information about any inclusion of hazardous materials provided?		
Was the list of radionuclides that are identified by the monitor provided?		
Were the over-range exposure values for gross count and identification provided?		
Were manuals with operating instructions and restrictions provided?		
Were manuals with module connection schematics provided?		
Were manuals with electrical connection schematics provided?		
Were manuals with spare parts list provided?		
Were manuals with troubleshooting guides provided?		
Did the manual provide a description and protocols for communication methods of transmitting and receiving data?		

Comments:

Completed by: _____ **Date:** _____

Reviewed by: _____ **Date:** _____