Homeland Security
Science and Technology

Summary

U.S. Department of Homeland Security
SAVER
System Assessment and Validation for Emergency Responders

The U.S. Department of Homeland Security (DHS) established the System Assessment and Validation for Emergency Responders (SAVER) Program to assist emergency responders making procurement decisions.

Located within the Science and Technology Directorate (S&T) of DHS, the SAVER Program conducts objective assessments and validations on commercial equipment and systems, and provides those results along with other relevant equipment information to the emergency response community in an operationally useful form. SAVER provides information on equipment that falls within the categories listed in the DHS Authorized Equipment List (AEL).

The SAVER Program is supported by a network of technical agents who perform assessment and validation activities. Further, SAVER focuses primarily on two main questions for the emergency responder community: "What equipment is available?" and "How does it perform?"

For more information on this and other technologies, contact the SAVER Program Support Office.

RKB/SAVER Telephone: 877-336-2752
E-mail: saver@dhs.gov
Website: https://www.rkb.us/saver

Handheld Radiation Survey Meters

(AEL reference number 07RD-01-HHSM)

Handheld radiation survey meters (HHRSMs) are portable instruments that measure the activity or the exposure rate from radioactive material; they are used where radioactivity is suspected to be present in order to locate or to assess the intensity of the radioactivity. HHRSMs may be used to screen packages, delineate the extent to which an area is contaminated, or confirm radiation detected by another type of instrument. HHRSMs may be capable of measuring different types of radiation such as gamma rays or beta and alpha particles and generally measure higher radiation levels, but they do not function as radionuclide identifiers, personal radiation detectors, or dosimeters.

In order to provide emergency responders with information on currently available HHRSMs, the National Urban Security Technology Laboratory (NUSTL) conducted a comparative assessment of HHRSMs for the System Assessment and Validation for Emergency Responders (SAVER) Program in October 2010. Detailed findings are provided in the *Handheld Radiation Survey Meter Assessment Report*, which is available by request at https://www.rkb.us/saver.

Assessment Methodology

Prior to the assessment, seven emergency responders were chosen from various jurisdictions to participate in a focus group. Participants possessed strong backgrounds in law enforcement, fire service, emergency preparedness, hazardous materials (HAZMAT), and environmental protection. The group identified evaluation criteria, selected instruments for the assessment, and discussed operational environments for the assessment.

After identifying evaluation criteria, the focus group assigned each criterion to one of five SAVER categories, and then assigned a weight for its level of importance. Once the criteria were weighted, the five SAVER categories were assigned a percentage value to represent the level of each category's

importance relative to the other categories. The focus group concluded that all categories were of equal importance.

Based on focus group recommendations, the following HHRSMs were selected for assessment:

- Radiagem™ 4000 Personal Portable Dose Rate and Survey Meter (Radiagem 4000), Canberra;
- 2241-3RK Emergency Response Kit (2241-3RK), Ludlum;
- FH 40 G/GL Multi-Purpose Survey Meter (FH 40 G/GL), Thermo Scientific; and
- Radiation Alert Inspector/Inspector EXP (Inspector/Inspector EXP), SE International.

Six responders served as evaluators for this assessment. All evaluators had at least 7 years of experience in emergency response disciplines including HAZMAT, search and rescue, radiological protection, fire services, law enforcement, and emergency medicine.

SAVER Category Definitions
Affordability groups criteria related to life-cycle costs of a piece of equipment or system.
Capability groups criteria related to the power, capacity, or features available for a piece of equipment or system to perform or assist the responder in performing one or more relevant tasks.
Deployability groups criteria related to the movement, installation, or implementation of a piece of equipment or system by responders at the site of its intended use.
Maintainability groups criteria related to the maintenance and restoration of a piece of equipment or system to operational condition by responders.
Usability groups criteria related to the quality of the responders' experience with the operational employment of a piece of equipment or system. This includes the relative ease of use, efficiency, and overall satisfaction of the responders with the equipment or system.

During the assessment, evaluators rated the HHRSMs based on evaluation criteria established by the focus group. The assessment was separated into two phases: the specification assessment and the operational assessment. Evaluators assessed the systems based on vendor-provided information during the specification assessment. Hands-on experience with the instruments during frisking and evacuation scenarios served as the basis for the operational assessment.

Assessment Results

Table 1 displays the composite assessment scores as well as the category scores for each HHRSM. Higher scores indicate a higher rating by evaluators. The advantages and disadvantages of each HHRSM, as identified by evaluators, are listed in table 2. To view how each HHRSM scored against the evaluation criteria assigned to the SAVER categories, see table 3. For instrument specifications, see table 4.

According to evaluator comments, lightweight HHRSMs with a long battery life and a wide measurement range meet their needs. Evaluators stated that they prefer a more noticeable alarm for radiation overload conditions, such as a vibration alarm or a flashing overload display.

Emergency responder agencies that may be considering the purchase of an HHRSM should review the detailed findings in the *Handheld Radiation Survey Meter Assessment Report* and carefully consider each HHRSM's overall capabilities and limitations in relation to their jurisdiction's operational needs. All reports in this series, as well as reports on other technologies, are available in the SAVER section of the Responder Knowledge Base (RKB) website, https://www.rkb.us/saver.

Table 1. Handheld Radiation Survey Meter Assessment Results

Instrument	Composite Score	Affordability (20% Weighting)	Capability (20% Weighting)	Deployability (20% Weighting)	Maintainability (20% Weighting)	Usability (20% Weighting)
Radiagem 4000	**74**	70	76	73	72	80
2241-3RK	**74**	74	73	74	74	75
FH 40 G/GL	**72**	69	75	70	68	78
Inspector/Inspector EXP	**64**	76	65	60	59	62

Table 2. Handheld Radiation Survey Meter Advantages and Disadvantages

Instrument	Advantages	Disadvantages
  **Radiagem 4000** Composite Score: 74	• Measures up to 10 rem/h • Stores data • Hot swappable probes • Waterproof[1] • 12-foot-long probe for measuring high radiation from a distance	• Lower end of measurement range is too high (10 microrem/h) • Probe cable connection does not lock • Buttons not raised or illuminated • Requires complicated button combinations and confusing menu scrolling • Screwdriver required to change batteries
 **2241-3RK** Composite Score: 74	• Wide measurement range (0 to 10 R/h) • Water resistant[1] • Simple display and settings; no need to press multiple buttons • Detailed technical manual • Backlight easy to activate	• No data storage • No internal detector • Bulky and heavier than other assessed instruments
 **FH 40 G/GL** Composite Score: 72	• Wide measurement range (1 microR/h to 10 R/h) • Stores data • Waterproof[1] • Synopsis of operating instructions on back of device; range shown on front	• Too much menu scrolling required • Can only be calibrated by manufacturer • Indicator for low battery only, not current level
 **Inspector/Inspector EXP** Composite Score: 64	• Flashing light indicates proximity to source • Lightweight • Impact-resistant rubber jacket • Lowest cost	• No data storage • Upper end of measurement range too low (100 mR/h) • No backlight • Indicator for low battery only, not current level • Not water resistant; difficult to decontaminate • Radio frequency from transmitting radio communicator interferes with reading at close range (< 1 foot)

Notes:

[1] Based on manufacturer specifications; water resistance was not tested in the assessment.

h = hour
mR = milliroentgen
R = roentgen
rem = roentgen equivalent man

Table 3. Handheld Radiation Survey Meter Criteria Ratings[1]

KEY Least Favorable → Most Favorable				
	Radiagem 4000	2241-3RK	FH 40 G/GL	Inspector/Inspector EXP
Affordability				
Operational costs	◕	◕	◕	◕
Initial price	◕	◕	◕	◕
Repair costs	◑	◕	◑	◕
Warranty	◑	◑	◑	◑
Shipping costs	◕	◕	◕	◕
Customer service	Not assessed	Not assessed	Not assessed	Not assessed
Capability				
Radiological performance	◕	●	◕	◕
Non-radiological performance	◕	◕	◕	◕
Data storage	◕	◔	◕	◔
Standards conformance	◕	◕	◕	◕
Intrinsically safe	○	○	○	○
Deployability				
System durability	◑	◕	◑	◕
Environmental	◕	◕	◕	◑
Probe	●	◕	◑	◑
Battery replacement	◔	◑	◕	○
Weight	◕	◑	◕	◕
Equipment storage/transport	◕	◕	◕	◑
Maintainability				
Serviceability	◑	◑	◑	◔
Calibration	◕	◕	◕	◕
Power (battery types)	◕	●	◕	●
Usability				
Display interface	◕	◕	◕	◑
Probe use	◕	◑	◕	◑
Alarms/audible options	◕	◕	◕	◑
Form factor	◑	◕	◕	◕
Software/controls/data handling	◑	◑	◕	◑

Note:

[1] Averaged criteria ratings for each assessed product are graphically represented by colored and shaded circles. Highest ratings are represented by full green circles.

Table 4. Handheld Radiation Survey Meter Specifications[1]

Specifications	Radiagem 4000	2241-3RK[2]	FH 40 G/GL	Inspector/Inspector EXP
Cost				
Cost range	$1,000 (base unit) $2,000 to $2,500 (with SAB-100 probe) $4,500 to $5,000 (with Tele-STTC)	$2,500 to $3,000 (kit)	$2,000 to $2,500 (FH 40 GL) $2,500 to $3,000 (FH 40 G)	$500 to $1,000
Radiological				
Measurement range[3]	10 microrem/h to 10 rem/h	0 to 10 R/h [4]	1 microR/h to 10 R/h (FH 40 GL) 1 microR/h to 100 R/h (FH 40 G)	1 microR/h to 0.1 R/h
Internal detector	Energy-compensated Geiger Mueller	None	Proportional counter	Geiger Mueller (Inspector)
External probes	Alpha, beta, gamma	Alpha, beta, gamma	Alpha, beta, gamma	Alpha, beta, gamma (Inspector EXP)
Data storage	Yes	No	Yes	No
Electrical				
Battery type (life) (alkaline batteries)	Two AA (80 h)	Two D (200 h)	Two AA (250 h)	One 9V (2,160 h)
Mechanical				
Dimensions base unit, no probes	5.9 x 3.3 x 1.8 in.	8.5 x 3.5 x 6.5 in.	7.7 x 2.9 x 1.7 in.	5.5 x 3.3 x 1.2 in.
Weight	0.7 lbs (base unit) 2.2 lbs (with SAB-100 probe) 3.1 lbs (with Tele-STTC)	3.5 lbs (base unit) 4.5 lbs (with 44-9 pancake probe) 4.5 lbs (with 44-2 gamma scintillator)	0.9 lbs (base unit)	0.7 lbs (base unit) (Inspector) 1.3 lbs (with probe) (Inspector EXP)
Environmental				
Waterproof	Yes (immersion to 1 meter)	No (water resistant)	Yes (immersion to 1 meter)	No
Operating temperature range	14˚ to 122˚F	-4˚ to 122˚F	-22˚ to 131˚F	14˚ to 122˚F

Notes:

1 Information was provided by manufacturers and has not been independently verified by the SAVER Program.

2 The 2241-3RK contains a 2241-3 ratemeter, 44-9 alpha beta Geiger Mueller pancake probe, 44-2 high sensitivity gamma scintillator, watertight case, and cesium-137 check source.

3 Three of the instruments measure radiation exposure (charge created per unit mass of air per unit of time) in units of roentgen per hour (R/h). One instrument measures radiation dose rate (energy absorption rate) in units of roentgen equivalent man per hour (rem/h). While the distinction between R and rem is generally not significant for survey meter applications, both units are used to maintain consistency with manufacturer specifications.

4 While technically no instrument is capable of measuring an infinitely small exposure, one company quoted the lower measurement range of "0."

F = Fahrenheit
h = hour(s)
in. = inches
lbs = pounds
R = roentgen
rem = roentgen equivalent man
V = volt