



**Homeland
Security**

Science and Technology

U.S. Department of Homeland Security



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 responder 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.

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Summary

Radiation Detection Backpacks

(AEL reference number 07RD-01-PDGA)

Radiation detection backpacks are designed for executing covert searches of gamma-emitting (and in some cases neutron-emitting) radioactive materials. As implied, the unit's detector and associated electronics are contained in a backpack, allowing the operator to perform inconspicuous searches in public areas. These devices are especially useful in situations where radiation search surveys of large crowds or high-profile events are performed.

To provide responders with information on currently available radiation detection backpacks, National Security Technologies LLC conducted an assessment of these devices for the System Assessment and Validation for Emergency Responders (SAVER) Program in October 2010. Detailed findings are provided in the *Radiation Detection Backpacks Assessment Report*, which is available by request at <https://www.rkb.us/saver>.

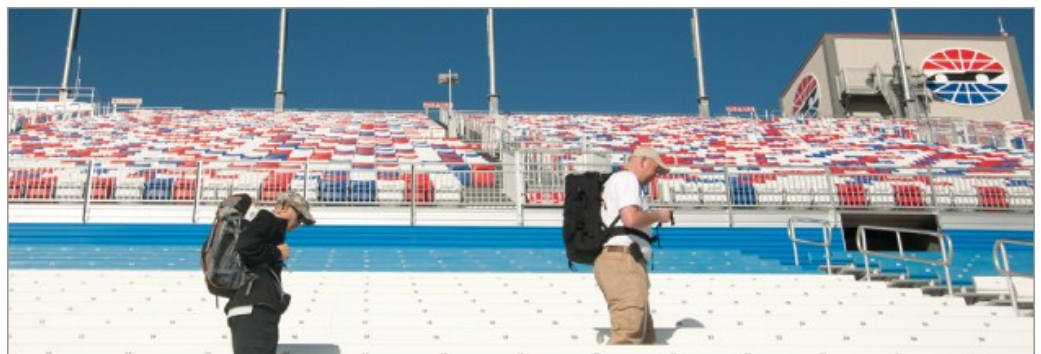
Assessment Methodology

Prior to the assessment, nine emergency responders were chosen from various jurisdictions to participate in a focus group. Each participant had experience with radiation detection and measurement instruments. The group identified evaluation criteria and recommended product selection criteria and possible scenarios for 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.

Based on focus group recommendations, market research, and availability, the following radiation detection backpacks were selected for assessment:

- PackEye, Thermo Scientific[®];
- Guardian Predator[®], NuSAFE[®]; and
- RADPACK, Sensor Technology Engineering Inc.



Ten responders served as evaluators for this assessment. All evaluators had at least 3 years of experience in disciplines including law enforcement, federal radiation control, and counterterrorism.

During the assessment, evaluators rated the radiation detection backpacks 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 systems served as the basis for the operational assessment. During the operational assessment, evaluators performed search operations similar to those performed at large venues, such as sporting events, and conducted wide-area/land-based and wide-area/water-based searches. The water search was conducted to test the practicality of using equipment in and around water.

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.

Assessment Results

Evaluators were able to successfully complete the assessment tasks using each of the radiation detection backpacks, all of which performed well in the land- and water-based scenarios. Table 1 displays the composite assessment scores as well as the category scores for each radiation detection backpack. Higher scores indicate a more favorable rating by evaluators. The advantages and disadvantages of each system, as identified by evaluators, are listed in table 2. To view how each radiation detection backpack scored against the evaluation criteria assigned to the SAVER categories, see table 3. For specifications, see table 4.

The evaluators felt that when making purchasing decisions regarding radiation detection backpacks, there cannot be a one-size-fits-all approach. The capabilities needed for the mission of the purchasing agency must be considered. For example, search missions that center on special nuclear material with a workforce of non-radiation workers may be best served by a system similar to the RADPACK. In contrast, agencies with a more comprehensive mission for all forms of radioactive materials, such as hazardous materials teams, may need to consider whether they need spectral capabilities like those offered by the Guardian Predator or the ability to know if the material is man-made, a capability offered by systems like the PackEye.

Emergency responder agencies that may be considering the purchase of a radiation detection backpack should review the detailed findings in the *Radiation Detection Backpacks Assessment Report* and carefully consider each radiation detection backpack'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. Radiation Detection Backpack Assessment Results

System	Composite Score	Affordability (8% Weighting)	Capability (27% Weighting)	Deployability (25% Weighting)	Maintainability (10% Weighting)	Usability (30% Weighting)
PackEye	3.7	2.8	3.7	3.7	3.0	4.0
Guardian Predator®	3.6	3.6	3.9	3.7	3.1	3.5
RADPACK	2.6	2.8	2.0	2.5	2.5	3.1

Table 2. Radiation Detection Backpack Advantages and Disadvantages




System	Advantages	Disadvantages
 PackEye Composite Score: 3.7	<ul style="list-style-type: none"> • Rugged detection system • Just-in-time training possible for new responders • Loud alarms • Alarm for man-made nuclides 	<ul style="list-style-type: none"> • No nuclide identification available • Alarm levels cannot be altered • Calibration must be performed by manufacturer
 Guardian Predator® Composite Score: 3.6	<ul style="list-style-type: none"> • Real-time nuclide identification • Data format is easy to download and use • The graphical user interface is easy to use 	<ul style="list-style-type: none"> • Proprietary parts • Calibration must be performed by manufacturer • Global positioning system location and alarm data are not paired for mapping purposes
 RADPACK Composite Score: 2.6	<ul style="list-style-type: none"> • Rugged detection system • Just-in-time training possible for new responders • Loud alarms 	<ul style="list-style-type: none"> • No nuclide identification available • Alarm levels cannot be altered • Most maintenance must be performed by manufacturer • Neutron alarms activated easily by radio frequency interference

Table 3. Radiation Detection Backpack Criteria Ratings¹









































KEY	  		
	PackEye	Guardian Predator®	RADPACK
Least Favorable      Most Favorable			
Affordability			
Deployable cost			
Service contract			
Training costs			
Cost of parts			
Capability			
Battery life			
Radio frequency interference			
Detection over water			
Global positioning system			
Breadcrumb trail			
Data storage			
Low battery indicator			
Detector response time			
Battery life of wireless component			
Wireless			
Temperature range			
Directional detection			

Table 3. Radiation Detection Backpack Criteria Ratings¹ (Continued)

















































































































	KEY					
	Least Favorable		Most Favorable			
						
				PackEye	Guardian Predator	RADPACK
Capability (Continued)						
Water resistance						
Spectrum						
Reachback capability						
Real-time identification						
Instrument resolution						
Saturation point						
Design options						
Intrinsically safe						
Altitude sensitivity						
Deployability						
Lockout feature						
Static or dynamic setting option						
Minimal training time						
PDA not required for operation						
Charge time						
Ability to set alarms						
Waterproof case option						
Additional storage space						
Setup time						
Quick-start guide						
Maintainability						
Authorized service center						
24-hour customer service support						
CONUS-based customer support						
Universal parts						
Minimal maintenance downtime						
Battery conditioner option						
Calibration frequency						
Usability						
Weight						
Vibration sensitivity						
Alarm volume						
Vibration alarm intensity						
Hot-swap batteries						
Viewable display						
Button accessibility						
Personal protective equipment compatibility						
Ergonomics						

Table 3. Radiation Detection Backpack Criteria Ratings¹ (Continued)

KEY			
	PackEye	Guardian Predator	RADPACK
Least Favorable      Most Favorable			
Usability (Continued)			
Self testing with error alert			
Ease of user interface			
Simple software graphical user interface			
Automatic reconnect to Bluetooth			
Overall dimensions			
Quick-release option			
Usable data format			
Ruggedness			
Software compatibility			
Power options			

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. Radiation Detection Backpack Specifications¹

Specifications	PackEye	Guardian Predator [®]	RADPACK
Weight	13 pounds	< 20 pounds	14 pounds
Power options	Rechargeable nickel-metal hydride 7.2 volt (V) battery Internal battery pack and an external pack for use with disposable batteries Direct current (DC) adapter	Disposable lithium ion 9.0 V	Disposable lithium ion 2/3A 3.0 V
Battery life ²	60 to 70 hours	20 hours	14 to 40 hours
Global positioning system	Yes, optional	Yes	No
Data storage	Yes, using personal digital assistant	Yes	No
Wireless	Yes (available)	Yes (available)	No
Spectrum	No	Yes	No
Reachback capability ³	Yes	Yes	No
Lockout feature	No	Yes	No
Quick-start guide	Yes	Yes	No
System cost	\$25,000, customer supplies helium-3 \$37,000, vendor supplies helium-3	\$30,000 to \$50,000, depending upon configuration	\$34,000 to \$37,000, depending upon configuration with customer-supplied helium-3

Notes:

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

² Battery life may be less depending on use.

³ Reachback capability refers to the ability of the backpack system to send data to a data collection device or organization in real-time or near real-time for further analysis. This may include telemetry systems.