



System Assessment and Validation for Emergency Responders (SAVER)

Portable Radiation Portal Monitors Focus Group Report

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System Assessment and Validation for Emergency Responders

Prepared by National Urban Security Technology Laboratory

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FOREWORD

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 commercially available equipment and systems and develops knowledge products that provide relevant equipment information to the emergency responder community. The SAVER Program mission includes:

- Conducting impartial, practitioner-relevant, operationally oriented assessments and validations of emergency response equipment
- Providing information, in the form of knowledge products, that enables decision-makers and responders to better select, procure, use, and maintain emergency response equipment.

SAVER Program knowledge products provide information on equipment that falls under the categories listed in the DHS Authorized Equipment List (AEL), focusing primarily on two main questions for the responder community: “What equipment is available?” and “How does it perform?” These knowledge products are shared nationally with the responder community, providing a life- and cost-saving asset to DHS, as well as to Federal, state, and local responders.

The SAVER Program managed and executed by the National Urban Security Technology Laboratory (NUSTL). NUSTL is responsible for all SAVER activities, including selecting and prioritizing program topics, developing SAVER knowledge products, coordinating with other organizations, and ensuring flexibility and responsiveness to first responder requirements.

NUSTL provides expertise and analysis on a wide range of key subject areas, including chemical, biological, radiological, nuclear, and explosive weapons detection; emergency response and recovery; and related equipment, instrumentation, and technologies. In support of this tasking, NUSTL developed this report to provide emergency responders with information obtained from a focus group on portable radiation portal monitors (PRPMs). PRPMs fall under AEL reference number 15SC-00-PMON, titled Monitors, Portal.

For more information on the SAVER Program or to view additional reports on PRPMs or other technologies, visit www.dhs.gov/science-and-technology/SAVER.

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1. INTRODUCTION

The System Assessment and Validation for Emergency Responders (SAVER) Program will conduct a comparative assessment of portable radiation portal monitors (PRPMs) to provide emergency responders with information that will assist with making operational and procurement decisions. As a part of the assessment process, a focus group met in March 2016, with the primary objectives of recommending evaluation criteria, product selection criteria, products, and possible scenarios for the assessment of PRPMs.

PRPMs are used by police, security, and emergency response personnel to screen people for the presence of radioactive materials. These devices may be used to screen large populations for contamination after a radiological or nuclear incident, or to screen people entering or leaving a sensitive area. The PRPMs assessment will be conducted by emergency response professionals based on the recommendations presented in this report.

Nine emergency responders from various jurisdictions participated in the focus group. The participants, whose demographics are shown in Table 1-1, all had experience using PRPMs, which facilitated meaningful and productive discussions. All of the participants acknowledged they did not have an employment or financial relationship that could create a potential conflict of interest with the work to be performed by the SAVER Program. Participants signed a nondisclosure agreement and a conflict of interest statement.

Table 1-1 Focus Group Participant Demographics

Practitioner	Years of Experience	State
Police Department, Health Physicist	35	NY
Health Department, Health Risk Control Director	31	NY
Fire Department, Battalion Chief	28	NY
Fire Department, Battalion Chief	22	NY
Emergency Management Office, Emergency Planning Consultant	22	NY
Health Department, Emergency Response Planner	20	NY
Police Department, Detective	15	NY
Police Department, Sergeant	15	NJ
Emergency Management Office, Emergency Management Planner	10	NY

2. FOCUS GROUP METHODOLOGY

The focus group opened with an overview of the SAVER Program, the PRPMs project, and the focus group goals and objectives. Once the background material was covered, a facilitator led focus group discussions on four sets of recommendations:

- Evaluation criteria recommendations – General criteria that are important to consider when making acquisition or operational decisions

- Assessment scenario recommendations – Operational scenarios in which the products should be assessed to evaluate their performance
- Product selection criteria recommendations – Criteria that identify specifications, attributes, or characteristics a product should possess to be considered for the assessment
- Product recommendations – Products and vendors that are relevant to the emergency responder community and should be candidates for inclusion in the comparative assessment.

Figure 2-1 highlights the process followed to gather these recommendations.

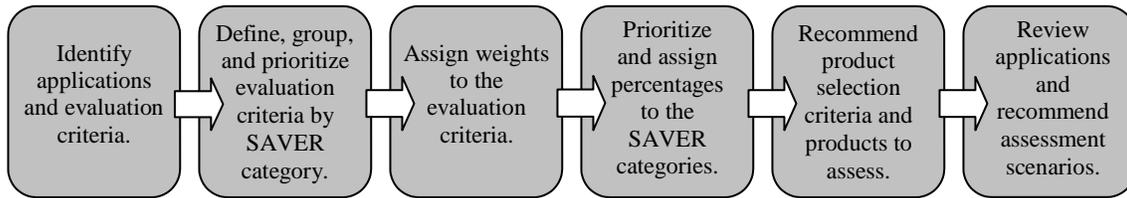


Figure 2-1 Focus Group Process

Focus group participants first identified applications in which PRPMs are commonly used. Next, the focus group participants identified and defined evaluation criteria, which were then grouped and prioritized in the SAVER categories—affordability, capability, deployability, maintainability, and usability. The SAVER categories are defined as:

- Affordability – Groups criteria related to the total cost of ownership over the life of the product. This includes purchase price, training costs, warranty costs, recurring costs, and maintenance costs
- Capability – Groups criteria related to product features or functions needed to perform one or more responder relevant tasks
- Deployability – Groups criteria related to preparing to use the product, including transport, setup, training, and operational/deployment restrictions
- Maintainability – Groups criteria related to the routine maintenance and minor repairs performed by responders, as well as included warranty terms, duration, and coverage
- Usability – Groups criteria related to ergonomics and relative ease of use when performing one or more responder relevant tasks.

Once the evaluation criteria were prioritized within the SAVER categories, focus group participants assigned a weight for each criterion’s level of importance on a 1-5 scale, where 5 is of utmost importance and 1 is of minor importance. Table 2-1 highlights the evaluation criteria weighting scale.

Table 2-1 Evaluation Criteria Weighting Scale

Weight	Definition
5	The evaluation criterion is <i>of utmost importance</i> . “I would never consider purchasing a product that does not meet my expectations of this criterion or does not have this feature.”
4	The evaluation criterion is <i>very important</i> . “I would be hesitant to purchase a product that does not meet my expectations of this criterion or does not have this feature.”
3	The evaluation criterion is <i>important</i> . “Meeting my expectations of this criterion or having this feature would strongly influence my decision to purchase this product.”
2	The evaluation criterion is <i>somewhat important</i> . “Meeting my expectations of this criterion or having this feature would slightly influence my decision to purchase this product.”
1	The evaluation criterion is <i>of minor importance</i> . “Other things being equal, meeting my expectations of this criterion or having this feature may influence my decision to purchase this product.”

After the evaluation criteria were assigned a weight, the focus group participants recommended whether the criteria should be assessed operationally or according to vendor-provided specifications. Next, considering the evaluation criteria in each category, the focus group participants ranked the SAVER categories in order of importance. Based on the ranking, a percentage was assigned to each category to represent its level of importance.

After rating the SAVER categories, focus group participants identified product selection criteria. The focus group also identified products that should be considered for the assessment. Lastly, the focus group participants reviewed the applications identified at the beginning of the focus group session and recommended operational scenarios for the assessment.

3. EVALUATION CRITERIA RECOMMENDATIONS

The focus group identified 47 evaluation criteria and concluded that all SAVER categories should be weighted equally. Table 3-1 presents the category weights, the evaluation criteria, and the evaluation criteria weights.

Table 3-1 Evaluation Criteria

SAVER CATEGORIES				
Affordability	Capability	Deployability	Maintainability	Usability
Overall Weight 20%	Overall Weight 20%	Overall Weight 20%	Overall Weight 20%	Overall Weight 20%
Evaluation Criteria				
Warranty Weight: 5	Emergency Event Throughput Weight: 5	Wheelchair Accessibility Weight: 5	Water Resistance Weight: 5	User-Friendly Controls Weight: 5
Availability of Parts Weight: 4	Vertical(Head-to-Toe) Coverage Weight: 5	Innovative Redesign Weight: 5	Durability Weight: 5	Alarms/Alarm Configurability Weight: 4
Standard Equipment Parts Weight: 4	Ability to Meet Appropriate Detection Standards Weight: 4	Weight Weight: 4	Stability Weight: 5	Adjustable Count Time Weight: 4
Modularity Weight: 4	Shielding/Crosstalk Reduction Weight: 4	Storage Volume Weight: 4	Ease of Calibration Weight: 5	Data Logging Capability Weight: 3
Maintenance Cost Weight: 4	Source Localization Ability Weight: 4	Wheeled Carrying Case Quality Weight: 4	System Diagnosis or Self-Check Weight: 5	Moveable Display Weight: 3
Initial Cost Weight: 3	Background Subtraction and Reset Weight: 3	Ease of Setup and Disassembly Weight: 4	Decontaminability Weight: 4	Person Identification Weight: 3
Repair Cost Weight: 3	Networking Capability Weight: 3	Labelling or Color-Coding for Easy Assembly Weight: 4	Calibration Standards/ Operational Checks Weight: 4	Software Configurability Weight: 3
Upgrade/Add-On Cost Weight: 3	Wireless Capability Weight: 3	Temperature and Relative Humidity Range Weight: 4	Ruggedness Weight: 4	Camera Weight: 2
Training Cost Weight: 2	Background Configurability Weight: 2	Battery Options and Battery Life Weight: 3		Remote Alarm Weight: 2
	Non-Emergency Throughput Weight: 2	Networking of Power Cords Weight: 3		
		Ability to Eliminate Carrying Case Weight: 3		

5.1 Affordability

Nine Affordability criteria were identified and defined by the focus group.

Warranty refers to the amount of time in which the vendor promises to repair or replace equipment that is not functioning properly, and the terms of such agreement.

Availability of Parts refers to the availability of parts from the vendor to replace worn-out or defective parts on the PRPM. (Note: focus group members were particularly concerned that vendors will not support older equipment with parts availability).

Standard Equipment Parts refers to the practice of incorporating standard commercial-off-the-shelf parts in the design of the product so that they are easily replaceable. Examples include D-cell batteries and High-Definition Multimedia Interface (HDMI) cables.

Modularity refers to the ability to easily add, remove, and replace components of the system such as detectors, displays, or control panels. (Note: focus group members stated that it would be ideal to have a base model available for purchase with the potential of adding options to enhance the system based on organizational needs).

Maintenance Cost refers to the accumulated costs associated with keeping the purchased equipment at operational status, including calibration, software upgrades, and technician travel for maintenance purposes. (Note: focus group members would like a low-cost maintenance contract to cover these costs).

Initial Cost refers to the up-front purchasing cost of the system and all necessary accessories.

Repair Cost refers to the accumulated costs associated with making repairs to the equipment, including replacement parts, labor, technician travel, and shipping to a repair facility.

Upgrade/Add-On Cost refers to the accumulated costs associated with making improvements, upgrades, or adding features and capabilities to the equipment.

Training Cost refers to the accumulated costs associated with training operators to use the equipment, including on-site training, off-site training, manuals, tutorials, etc.

5.2 Capability

Ten Capability criteria were identified and defined by the focus group.

Emergency Event Throughput refers to the number of persons per unit time that can be scanned for the presence of radiation during emergency response contamination screening. (Note: focus group members stated that quick flow is essential for these events).

Vertical (Head-to-Toe) Coverage refers to the ability of the PRPM to detect radiation from the top to the bottom of the portal. (Note: focus group members stated that for some products the detectors do not go to the ground, so feet cannot be screened. One agency currently uses masking tape to make people step over. This is not ideal, especially for the elderly and infirm. Responders would prefer a head-to-toe detection system or use of a ramp that can be stepped over while still allowing wheel chairs to pass through).

Ability to Meet Appropriate Detection Standards refers to the ability to meet detection standards appropriate for PRPMs. (Note: focus group members agreed that FEMA-REP-21 is the most important standard for PRPMs to meet, but it would be a bonus to meet standards from

the National Fire Protection Association and well-known guidance from the Conference of Radiation Control Program Directors).

Shielding/Crosstalk Reduction refers to the use of shielding, collimation, or software algorithms that reduce the possibility that a radiation source or contaminated person in another screening lane will alarm a PRPM. (Note: focus group members suggested networking the portals and using coincidence counting to find possible instances of crosstalk).

Source Localization Ability refers to the ability to determine information about the location of a source that passes through the portal. For example, if there are two detectors on each vertical panel, the PRPM could indicate whether the source is high or low and whether it is toward the left or right.

Background Subtraction and Reset refers to the ability to acquire an accurate background radiation measurement, subtract it from radiation measurements taken during portal occupancies, and reset back to acquiring background when appropriate. (Note: focus group members are concerned with the problem of obtaining an elevated background measurement due to a contaminated person being in the vicinity of the portal when backgrounds are being acquired).

Networking Capability refers to the ability to connect multiple PRPMs to a computing device (e.g., computer, tablet, smartphone, etc.) through a network configuration such as Ethernet.

Wireless Capability refers to the ability to communicate with an external computing device through a wireless interface such as Wi-Fi or Bluetooth.

Background Configurability refers to the ability to configure the system software so that the user has flexibility in how and when background measurements are acquired. (Note: focus group members suggested having the option for a preset background measurement that can be locked in until the user decides to acquire a new background. They would also like the option of having an automatically updating background).

Non-Emergency Throughput refers to the number of persons or vehicles per unit time that can be scanned for the presence of radiation during interdiction screening or non-emergency contamination screening (such as scanning employees and vehicles for contamination).

5.3 Deployability

Eleven Deployability criteria were identified and defined by the focus group.

Wheelchair Accessibility refers to the degree to which the PRPM in normal operation allows persons in wheelchairs to pass through the portal and be screened. Emergency medical service gurneys should also be accommodated.

Innovative Redesign refers to incorporating innovative new concepts into the system to make it less like a traditional portal system. (Note: suggestions from focus group members included a floor-mat detector, a foldable or telescoping portal design, and innovative ways to solve the crosstalk issue. These are suggestions mainly for the next generation of products).

Weight refers to the weight of the PRPM system including the carrying case, and the effect of the weight upon deployment for field use. (Note: focus group members want light systems that allow for single-person deployment).

Storage Volume refers to the amount of space that the PRPM and its carrying case takes when packed for storage. (Note: focus group members stated that they store their portals in trailers and schools in which space is an important issue).

Wheeled Carrying Case Quality refers to the overall quality of the carrying case for the PRPM and the degree to which it facilitates easy transportation.

Ease of Setup and Disassembly refers to the amount of time needed to assemble the PRPM, turn it on, and have it become operational; and the ease with which this can be accomplished. Also included is the time needed for disassembly and the ease with which disassembly is accomplished. (Note: focus group members stated a strong preference for not needing tools for assembly or disassembly).

Labelling or Color-Coding for Easy Assembly refers to the labelling or color-coding of parts for the purpose of easy and simple assembly. For example, a red mark on the top of the panel would match a red mark on the side panel to indicate that these parts connect in the area of the marks. Highly visible instructions on the portal would also facilitate assembly.

Temperature and Relative Humidity Range refers to the operating temperature range and operating relative humidity range as specified by the manufacturer. (Note: focus group members felt that these specifications should support outdoor use).

Battery Options and Battery Life refers to the options provided for powering the system by battery and the number of hours that each battery option powers the PRPM for. (Note: focus group members preferred the convenience of standard alkaline batteries as opposed to rechargeable batteries).

Networking of Power Cords refers to the ability to operate on alternating current power and to daisy chain the power cords from one PRPM unit to another instead of having to plug each power cord into a separate power outlet. (Note: this would facilitate operation at CRCs where many PRPM units may operate simultaneously).

Ability to Eliminate Carrying Case refers to providing a design in which the carrying case is not needed. For example, the system could have rugged components that compactly connect to a wheelbase for easy storage and transport.

5.4 Maintainability

Eight Maintainability criteria were identified and defined by the focus group.

Water Resistance refers to the ability of the PRPM to operate in rain and other wet conditions.

Durability refers to the ability to remain in good condition over a long period of time and withstand heavy usage and wear. (Note: focus group members stated that systems should meet standards for durability and that when configured for vehicle screening, the connectors should be hardened enough to drive over).

Stability refers to the PRPM being constructed to stand with firmness and not be easily moved, shaken, or toppled when bumped into or handled roughly. (Note: focus group members mentioned that PRPMs at CRCs are often bumped into and grabbed by people being screened).

Ease of Calibration refers to the ease with which the required periodic calibration of the PRPM can be performed. (Note: focus group members stated that manufacturers should provide the

option of in-field calibration in which the manufacturer travels to perform the calibration and the portals do not have to be shipped).

System Diagnosis or Self-Check refers to any features that give the user information about the health of the system, indicate maintenance that is needed (such as low battery condition), or provide a test routine that can be used to test whether or not system functions are working. (Note: focus group members mentioned that failure alarms for malfunctioning sensors or other systems are particularly important).

Decontaminability refers to the ability to effectively and easily clean or decontaminate the PRPM. This can be accomplished with a design that minimizes crevices on surfaces, provides the option of using disposable sleeves for contamination protection, or some other method. (Note: focus group members are concerned that the contaminated public may touch the portal and contaminate it. Some agencies use protective sleeves provided by the manufacturers, others use their own plastic wrap. Sleeves provided by the manufacturer should allow the user to change them without taking the portal apart).

Calibration Standards/Operational Checks refers to the specification on the part of the vendor of standard sources that can be used to provide a desired PRPM radiation reading when the PRPM is properly calibrated, the availability of such calibration standards, and the presence of operational checks within the system software that can be used to verify proper calibration of the system.

Ruggedness refers to the ability to withstand rough handling, drops, bumps, collisions, vibrations, turbulence, etc.

5.5 Usability

Nine Usability criteria were identified and defined by the focus group.

User-Friendly Controls refers to having buttons, switches, and control panels that provide useful, convenient, and intuitive control and operation of the PRPM. This also includes having controls that can be operated with gloves, respirators, and other personal protection equipment.

Alarms/Alarm Configuration refers to the overall quality and performance of radiation-related alarms, the ability to configure how alarms are triggered, and the ability to turn alarm types (e.g., audible, visible, vibrate, remote, etc.) on or off. (Note: focus group members stated that the PRPM should be able to alert only responders without tipping off screened individuals to the alarm. They would also like audible alarms to have adjustable volume and visual alarms to have the following indications: green for “all clear,” yellow for “unclear” or “equipment failure,” and red for “alarm”).

Adjustable Count Time refers to the ability to set the count time (aka, measurement time) for screening people or vehicles that are stationary within the portal.

Data Logging Capability refers to the storage of useful, relevant data associated with the operation of the PRPM and the ability to offload the data quickly and easily to an external computing device. (Note: focus group members prefer that data not be stored in a proprietary format).

Moveable Display refers to having a display or control panel with display that can be easily moved or adjusted in a convenient manner to accommodate responder needs.

Person Identification refers to the ability to record and log data from a device such as a barcode reader or radio frequency identification reader that can identify the individual passing through the portal. (Note: responders at the focus group who plan operations at CRCs would like to be able to match the names and registration information of screened people to the data records from the PRPM. A convenient method of doing this would be to assign them badges with barcode labels or similar readable identification tags and have the PRPM automatically read this information and store it along with the radiation data records for that person).

Software Configurability refers to how much and how easily PRPM operation can be adapted to responder needs based on software settings and parameters. (Note: focus group members stated that once settings are configured, they should be password protected so that field operators cannot change them).

Camera refers to having a built-in camera to associate a photo or video stream with an alarm. This would be useful in the event that someone who passes through the portal sets off an alarm and flees.

Remote Alarm refers to the capability to send an alarm discreetly to a remote operator who is using a handheld unit such as a tablet or smartphone.

4. EVALUATION CRITERIA ASSESSMENT RECOMMENDATIONS

The focus group provided recommendations on whether the evaluation criteria should be assessed operationally or according to vendor-provided specifications. In an operational assessment, evaluators assess criteria based on their hands-on experience using the product. In a specification assessment, evaluators assess criteria based on product information provided by the vendor. In some cases, criteria may be assessed operationally and according to vendor-provided specifications.

Table 4-1 presents the focus group's assessment recommendations for the evaluation criteria. Criteria without an indication for "operational" or "specification" will likely not be assessed because the feature is unavailable or the assessment would be too difficult.

Table 4-1 Evaluation Criteria Assessment Recommendations

Category	Criteria	Operational	Specification
Affordability	Warranty		✓
	Availability of		✓
	Standard Equipment	✓	
	Modularity	✓	
	Maintenance		✓
	Initial		✓
	Repair Cost		✓
	Upgrade/Add-On		✓
	Training		✓
Capability	Emergency Event	✓	
	Vertical (Head-to-Toe)	✓	
	Ability to Meet Appropriate	✓	✓
	Shielding/Crosstalk	✓	
	Source Localization	✓	
	Background Subtraction and	✓	
	Networking	✓	✓
	Wireless	✓	✓
	Background	✓	
	Non-Emergency	✓	
Deployability	Wheelchair	✓	
	Innovative Redesign		
	Weight	✓	✓
	Storage	✓	✓
	Wheeled Carrying Case	✓	
	Ease of Setup and	✓	
	Labelling or Color-Coding for Easy	✓	
	Temperature and Relative Humidity		✓
	Battery Operations and	✓	✓
	Networking of Power	✓	
	Ability to Eliminate Carrying Case		
Maintainability	Water		✓
	Durability		✓
	Stability	✓	
	Ease of		✓
	System Diagnosis or Self-	✓	
	Decontaminability	✓	
	Calibration Standards/Operational	✓	✓
	Ruggedness		
Usability	User-Friendly	✓	
	Alarms/Alarm	✓	
	Adjustable Count	✓	
	Data Logging	✓	✓
	Moveable	✓	
	Person Identification		
	Software Configurability	✓	
	Camera		
	Remote Alarm	✓	

3. ASSESSMENT SCENARIO RECOMMENDATIONS

The focus group identified emergency response, post-emergency, routine inspection, and vehicle screening as the applications in which they use PRPMs. Based on these applications, the focus group recommended five scenarios in which products could be assessed using the evaluation criteria recommended for an operational assessment (Table 4-1).

5.6 Post-Emergency Scenario

PRPMs are set up in an area that simulates a CRC and are used to screen people that may have been exposed to and contaminated with radioactive material. In this scenario, the PRMPs should be configured for high throughput.

5.7 Emergency Response Scenario

PRPMs are used to screen emergency responders for contamination during an event in which they might have been exposed to radioactive material. In this scenario, the PRPMs should be configured in stop-and-count mode with adjustable count time.

5.8 Routine Inspection Scenario

PRPMs are used to screen individuals entering a major sporting event and operators screen for illicit radioactive sources.

5.9 Vehicle Screening for Illicit Sources

PRPMs that are capable of scanning vehicles are set up on a roadway checkpoint and used to scan vehicles for illicit radioactive sources

5.10 Vehicle Screening for Contamination

If it is possible to simulate a contaminated vehicle, a scenario for scanning for contaminated vehicles should be included.

5.11 Additional Assessment Scenario Recommendations

The focus group also provided the following suggestions for conducting tests associated with the scenarios described in Sections 5.1 through 5.5:

- Test the PRPMs with a variety of different radionuclides including cesium-137, cobalt-60, silicon-32, at least one medical source such as iodine-131, and one low-energy source such as americium-241
- Compare the operation of the PRPMs as vehicle monitors with the BubbleTech RadBump. The RadBump is a rugged speed bump that detects radiation when cars drive over it. This type of test would fit more as a SAVER On-Demand report than as part of a comparative assessment.
- Compare the operation of the PRPMs as vehicle monitors with a “poor-man’s portal monitor” made up of backpack radiation detectors. Again, this would be more suitable as a SAVER On-Demand report.

6. PRODUCT RECOMMENDATIONS

The focus group recommended that all five PRPMs commercially available on the market should be assessed. Table 6-1 presents the products recommended for assessment. It should be noted that the Canberra MiniSentry was included in the *Portable Radiation Portal Monitors Market Survey Report* (March 2015), but this product has been discontinued by the vendor.

Table 6-1 Product Recommendations

Vendor	Product
Laurus Systems Inc.	TPM-903B
Ludlum Measurements Inc.	52-1-1 Personal Portal Monitor
Rapiscan Systems	TSA PM704
US Nuclear Corporation	Portable Personnel and Vehicle Monitor (PPVM)
WB Johnson Instruments	AM-801

Due to the small number of products available, the focus group declined to recommend product selection criteria.

7. FUTURE ACTIONS

The focus group recommendations will be used to guide the development of a PRPM assessment plan and the selection of products to evaluate in the assessment. Once the assessment is complete, the results will be available on www.dhs.gov/science-and-technology/SAVER.

8. ACKNOWLEDGEMENTS

The National Urban Security Technology Laboratory thanks the focus group participants for their valuable time and expertise. Their insights and recommendations will guide the planning and execution of the PRPM assessment as well as future SAVER projects. Appreciation is also extended to the home jurisdictions of the participants for allowing them to participate in the focus group.