Homeland Security

Summary

SAVER

The U.S. Department of Homeland Security, Preparedness Directorate, Office of Grants and Training (G&T) established the System Assessment and Validation for Emergency Responders (SAVER) Program to assist emergency responders in performing their duties. The mission of the SAVER Program is to

- Provide impartial, practitioner relevant, and operationally oriented assessments and validations of emergency responder equipment.
- Provide information that enables decision-makers and responders to better select, procure, use, and maintain emergency responder equipment.
- Assess and validate the performance of products within a system, as well as systems within systems.
- Provide information and feedback to the user community through a well-maintained, Web-based database.

The SAVER Program established and is supported by a network of technical agents who perform the actual 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?"

To contact the SAVER Program Support Office
Phone: 877-347-3371
E-mail: saver.odp@dhs.gov
Visit the SAVER Web site: www.dhs-saver.info

Ion Mobility Spectrometry (IMS) Chemical Detectors Analysis Report Summary

Chemical detection is an essential component of emergency response. Equipment should detect harmful chemicals, correctly identify agents, and help define the area of exposure, as well as the source. Rapid detection is essential so that responders can recognize the threat of an immediately dangerous to life and health (IDLH) atmosphere. It is also important to know the affected area and extent of contamination in order to properly contain the situation. Because emergency responders are often called upon to work in positions of close proximity to the hot zone, it is imperative that the equipment used is the most beneficial to the situation.

In order to provide emergency responders with information on ion mobility spectrometry (IMS) chemical detectors, the Center for Domestic Preparedness (CDP) conducted an assessment of four IMS chemical detectors that met the Authorized Equipment List (AEL) guidelines for IMS chemical agent detectors (see table 1).

The IMS chemical detectors analysis report assists emergency responders in their decision to acquire IMS chemical detectors based on their organizational requirements. This is a summary of the contents of the IMS report. The report should be reviewed for the full discussion and recommendations. The complete report can be found on the SAVER Web site.

APD 2000	Multi-IMS
	
• Manufacturer: Smiths Detection • Battery life: 6-8 hours, Duracell alkaline • Weight: 6 pounds including batteries • http://www.smithsdetection.com	• Manufacturer: Draeger Safety • Battery life: 10 hours, rechargeable Li-Ion • Weight: 1.68 pounds including battery • http://www.afcintl.com
ICAM	**RAID-M**
	
• Manufacturer: Smiths Detection • Battery life: Typical 14 hours continuous • Weight: 4.18 pounds • http://www.smithsdetection.com	• Manufacturer: Bruker Daltonics • Battery life: Minimum 6 hours • Weight: 4.85 pounds • http://www.lifesafetysys.com

Table 1. Selected IMS chemical detectors.

Assessment Planning

A focus group was held in order to determine criteria by which to measure IMS chemical detectors' effectiveness, the scenario used in testing, expected operational outcomes, and criteria for evaluation. Focus group participants were selected from students attending a CDP WMD HazMat Technician Course. After the training course was completed, the selected nine volunteers remained at the CDP an additional day to participate in the focus group. The participants were briefed on the SAVER equipment assessment program purpose and the technologies to be assessed. The information addressed the five SAVER categories of usability, capability, affordability, maintainability, and deployability of the equipment.

Market survey research led to the consideration of four IMS chemical detectors for assessment (see table 1). The survey process was guided by factors which significantly impact the decision-making process (i.e., unit capabilities, availability, and cost).

The scenario for this assessment was taken from the Homeland Security Council (HSC) Planning Scenarios associated with the Universal Task List (UTL). For the purposes of this assessment, the scenario used was Scenario 7, Chemical Attack - Nerve Agent, and the activities performed were consistent with operational objectives that would exist in the event a nerve agent attack actually occurred.

Assessment Results

All of the devices used in this assessment helped to achieve the overall assessment goal of evaluating components of each IMS detector within each of the five SAVER categories: usability, capability, affordability, maintainability, and deployability. Table 2 displays the results of the assessment. A synopsis of evaluators' comments for each category is also provided.

Capability

Within the SAVER capability category, several common conclusions were developed about each IMS chemical detector. For example, the manufacturers of each IMS chemical detector did not provide instructions for operating the device in extreme weather conditions or information regarding standoff distances.

Additionally, evaluators felt that during an actual event, the IMS carrying straps could hinder or slow detection activities. Evaluators recommended that future IMS chemical detectors have the capability of wireless data transmission which might allow more timely information to be relayed to the incident commander.

IMS Device	Composite	Capability Score	Usability Score	Affordability Score	Deployability Score	Maintainability Score
Multi-IMS	76.3	70.6	80.9	67.7	82.1	73.9
ICAM	70.1	59.4	72.9	71.5	81.4	72.5
APD 2000	69.0	66.5	65.7	71.5	81.4	73.9
Raid-M	66.1	62.6	66.4	59.2	75.0	70.3

Table 2. IMS assessment results.

Usability

The operator manuals did not contain information on standoff distances from the product being monitored; however, evaluator comments reflected that the operator manual for the Multi-IMS contained sufficient information for employment. Additional training was not needed to employ either the APD 2000 or ICAM. Evaluators felt that at least eight additional hours of training was needed for the RAID-M because it was a more complex detector. When the detector was placed near an evaluator's clothing, the clothing apparently prevented the instrument from detecting the simulant.

The ICAM display readout is small and the backlight alarm did not alarm as quickly as the audible alarm. The display and readout for the APD 2000 were difficult to read while wearing class 3 PPE; however, the information stayed on the screen for an acceptable length of time. Evaluators reported that they could not see the display on the Multi-IMS and ICAM detectors because the backlights did not remain illuminated for an adequate amount of time while performing sampling operations. Also, the backlight of the Multi-IMS detector was cited as being weak and the red light was difficult to see. The display readout for the RAID-M was difficult to read during monitoring due to the screen angle, but easy to read when held toward the responder.

To operate the buttons and switches of the APD 2000, RAID-M, and ICAM, the evaluators had to hold detectors with one hand and manipulate the buttons with the other. Comments reflected that both hands were needed to properly employ the APD 2000. Its top-heavy configuration resulted in fatigue when holding the instrument at arms length during operations. Similar wrist and arm fatigue were experienced with the RAID-M. The Multi-IMS detector was easy to hold with either hand as it was the smallest and lightest detector assessed.

Evaluators downloaded the data from the APD 2000 and the Multi-IMS detectors with no significant problems. The data cable for the RAID-M used a DB9 female serial connector that did not have a matching port on many newer laptop computers. During the assessment, female to male serial connector converters were used when connecting the RAID-M to a computer. The ICAM did not have the capability to store or transmit data.

Affordability

The ICAM was the least expensive of the assessed IMS chemical detectors. The APD 2000 and Multi-IMS detectors were reported to be competitively priced. The RAID-M was found to be the most expensive detector of those assessed, and evaluators found that purchasing additional RAID-M software libraries would make the device even more costly.

Evaluators did not comment on maintenance costs; however, they chose to address the operating costs associated with each IMS chemical detector. The APD 2000 used several modestly priced consumables such as C batteries and intake/standoff filters that may increase the costs for employing the detector. The Multi-IMS detector used a replaceable intake filter, and the batteries for the detector were reasonably priced. The ICAM operating costs were also found to be procurable since there is no software or extra accessories required for operation. Items such as software and batteries for the RAID-M would increase the costs for this detector (e.g., a spare battery costs approximately $350.00).

The upgrade costs for the Multi-IMS and RAID-M detectors involved purchasing additional libraries which allowed for the detection of more chemical agents. The APD 2000 manual did not include information on upgrade costs. Evaluators discovered there are no upgrade options for the ICAM.

The manufacturers of the ICAM, Multi-IMS, and APD 2000 detectors did not provide information on any warranty, shelf life, or spare parts. Even though the extended warranty and spare parts for the RAID-M are optional, they were found to be very expensive.

Deployability

When employing each detector, the time for installing the batteries and conducting the confidence sample test affected how long it took to get the detector ready for employment.

Stronger storage cases were needed for the APD 2000 and ICAM according to evaluators. The Thermodyne case for the RAID-M appeared to be the strongest container of the assessed detectors and the evaluators preferred it over the other cases.

Maintainability

The APD 2000 and Multi-IMS detectors seemed to be easy to decontaminate with soap and water. The straps for each detector would be difficult to properly decontaminate because the canvas-like material could absorb contaminant. Evaluators suggested the RAID-M case would be difficult to decontaminate due to the crevices on the case.

Evaluators noted that if or when calibration is required, the manufacturers recommend returning the device to them for service. This would leave jurisdictions without their detection equipment. On-site service may be available, but would entail additional costs.

Conclusion

Table 3 supplies an overview of the conclusions drawn during the assessment process. The full IMS chemical detectors analysis report can be found on the SAVER Web site along with other CDP reports dealing with the IMS chemical detectors assessment project. The QuickLook chart for the IMS assessment is also available on the SAVER Web site (see figure 1). The QuickLook chart offers responders a mechanism to select equipment items based on characteristics that are of most importance to their department. Using the QuickLook chart, responders can emphasize and de-emphasize five categories to fully refine their search for equipment items.

Characteristics	RAID-M	Multi-IMS	APD 2000	ICAM
Detects CWA	X	X	X	X
Detects radiation			X	
Display was easy to read			X	
Reasonably priced			X	X
Operate easily with both hands			X	X
Operate easily with one hand		X		
No additional training needed				X
Lightweight		X		
Durable storage case	X			
Loud audible alarm	X			
Change modes to detect agent (may require purchasing additional libraries)	X	X	X	
Buttons were easy to push with gloved hands	X	X		X
Upgrade capabilities exist	X	X	X	
Easy to operate in low light conditions	X		X	
Design was user-friendly		X	X	X
No additional software required			X	X

Table 3. IMS chemical cetectors-characteristics cummary.

SAVER is sponsored by the U.S. Department of Homeland Security, Preparedness Directorate, Office of Grants and Training.

Opinions or points of view expressed in this document are those of the authors and do not necessarily represent the view or official position of the U.S. Government.

For more information on the IMS chemical detector project, please see the SAVER Web site or contact the SAVER Program Support Office.

Product	COMPLETE	AFFORDABILITY	CAPABILITY	DEPLOYABILITY	MAINTAINABILITY	USABILITY	Features
 Specs RKB Draeger Safety Draeger	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	• Battery Life: 10 hours, rechargeable Li-Ion • Weight: 1.68 pounds including battery
 Specs RKB Smith's Detection APD2000	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	• Battery Life: 6-8 hours, Duracell alkaline • Weight: 6 pounds including batteries
 Specs RKB Smith's Detection ICAM	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	• Battery Life: Typical 14 hours continuous • Weight: 4.18
 Specs RKB Bruker Daltonics RAID-M	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	• Battery Life: Minimum 6 hours • Weight: 4.85 pounds

SAVER Program Support Office
Phone: 877-347-3371
Fax: 443-402-9489
E-mail: saver.odp@dhs.gov