



Preparedness Directorate
Office of Grants and Training

Summary



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?"

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Commercial Radiation Pagers and Survey Meters Performance Assessment

The threat of a nuclear or radiological terrorist attack resulted in the U.S. Department of Homeland Security (DHS) deploying large quantities of radiation detectors throughout the emergency responder community. However, emergency responders' specific needs were not always met by standard health physics instrumentation used in radiation facilities. Several American National Standards Institute (ANSI) standards were approved to evaluate capabilities of detection equipment. Establishing technical capability is a critical step, but it is equally important to emergency responders that the instruments are easy to operate and can withstand the rugged situations they encounter.

The Commercial Radiation Pagers and Survey Meters Performance Assessment was conducted to achieve the following objectives:

- Perform a scenario-driven field assessment of radiation detectors (pagers and survey meters) to evaluate preoperational requirements, durability, usability, and operational capabilities when used by emergency responders with and without personal protective equipment (PPE).



Mini-Radiac manufactured by Canberra Industries.

- Publish and distribute insights gained from responder assessments to assist communities in determining the types of radiation detectors necessary to improve local preparedness in responding to WMD incidents and other radiological response activities.

Several radiation pagers and survey meters were purchased by National Security Technologies (NSTec) based on criteria identified by emergency responders. The equipment purchased was limited to those without neutron capabilities to limit and constrain the selection process.

National Security Technologies (NSTec), as a Technical Agent for the SAVER Program, conducted the Commercial Radiation Pagers and Survey Meters Performance Assessment to provide impartial, practitioner-relevant, and operationally oriented assessments of detectors used by emergency responders. The assessment was carried out by the Remote Sensing Laboratory (RSL) at the Nevada Test Site (NTS) using volunteer, active emergency responders who rely on this equipment to perform their duties.

This is a summary of the contents of the Commercial Radiation Pagers and Survey Meters Performance Assessment report. The complete report should be viewed for the full discussion and recommendations and can be found on the SAVER Web site (<https://saver.fema.gov>).

Radiation Detectors

The radiation pagers and survey meters that were included in the assessment were selected based on the primary criteria established by a focus group consisting of emergency responders with experience using radiation pagers and survey meters. You can see this criteria in the full report on the SAVER Web site. Three radiation pagers and three survey meters were selected for assessment.

Radiation Pagers

- Mini-Radiac manufactured by Canberra Industries.
- PM1703MA manufactured by Polimaster Inc.
- PM1401MA manufactured by Polimaster Inc.

Survey Meters

- Model 19A manufactured by Ludlum Measurements Inc.
- FH40GL manufactured by Thermo Electron Corporation.
- KV-100 manufactured by Science Applications International Corporation.



PM1703MA manufactured by Polimaster Inc.



PM1401MA manufactured by Polimaster Inc.

Assessment Results

Opinions were collected from the emergency responders on usability in the field of three different models of radiation pagers and three different models of survey meters under conditions that may be encountered by emergency responders in actual scenarios. The instruments were evaluated using the following assessment categories: usability, deployability, maintainability, capability, and a composite score. Overall, all of the survey meters and radiation pagers rated fairly close to each other, with weighted scores ranging between 80.3 and 83.6 for the radiation pagers and 79.0 and 84.0 for the survey meters. These results are shown in Table 1 and Table 2, respectively. Figures 1 and 2, the SAVER QuickLook charts, provide a graphical representation of the results. The QuickLook charts for the radiation pager and survey meter assessment are available on the SAVER Web site.

Evaluators' Comments

Evaluators compared the features of the individual radiation pagers and survey meters and evaluated both common and unique components of each system. During

the assessment, each evaluator scored all three radiation pagers and all three survey meters and provided positive and negative observations and opinions based on the four SAVER categories: capability, usability, deployability, and maintainability. Examples of the evaluators' comments are included below.

Radiation Pagers

Mini-Radiac

The evaluators liked the rugged design, the large display screen, that the instrument had been extensively field tested, and that it only required four standard AAA batteries. However, the evaluators felt the Mini-Radiac's response to radiation changes was too slow, the control buttons were too small, the pager was difficult to operate wearing heavy-duty gloves, and it was larger and heavier than most pagers.

Model PM1703MA

The evaluators felt the PM1703MA was easy to set up and use, and the display window made readout easy. They also liked that it was designed like a communications pager and

| Radiation Pagers | Composite | Capability | Deployability | Maintainability | Usability |
|------------------|-----------|------------|---------------|-----------------|-----------|
| Model PM1703MA | 83.6 | 78.0 | 88.8 | 86.4 | 81.2 |
| Mini-Radiac | 81.8 | 75.0 | 87.7 | 82.1 | 82.3 |
| PM1401MA | 80.3 | 86.0 | 83.1 | 77.9 | 74.1 |

Table 1: Overall category scores for radiation pagers.

| Radiation Survey Meters | Composite | Capability | Deployability | Maintainability | Usability |
|-------------------------|-----------|------------|---------------|-----------------|-----------|
| Model 19A | 84.0 | 88.0 | 84.1 | 82.8 | 81.1 |
| FH40GL | 82.9 | 79.0 | 86.0 | 84.2 | 82.3 |
| KV -100 | 79.0 | 83.0 | 79.5 | 74.2 | 79.1 |

Table 2: Overall category scores for survey meters.

| Product | COMPOSITE | | | | | Comments |
|---|------------------|------------------|------------------|------------------|------------------|----------|
| | AFFORDABILITY | CAPABILITY | DEPLOYABILITY | MAINTAINABILITY | USABILITY | |
|  <p>Specs RKB</p> <p>Polimaster Inc. PM1703MA</p> | ★ ★ ★ ★ | ★ ★ ★ ★ | ★ ★ ★ ★ | ★ ★ ★ ★ | ★ ★ ★ ★ | \$1300 |
|  <p>Specs RKB</p> <p>Canberra Industries Mini-Radiac</p> | ★ ★ ★ ★ | ★ ★ ★ ★ | ★ ★ ★ ★ | ★ ★ ★ ★ | ★ ★ ★ ★ | \$600 |
|  <p>Specs RKB</p> <p>Polimaster Inc. PM1401MA</p> | ★ ★ ★ ★ | ★ ★ ★ ★ | ★ ★ ★ ★ | ★ ★ ★ ★ | ★ ★ ★ ★ | \$1400 |

Figure 1: SAVER QuickLook chart for radiation pagers.

used standard AA batteries. However, they felt the alarm sound level was too low to be heard and the design was not rugged enough for normal operations.

PM1401MA

The evaluators liked that the PM1401MA was designed like a communications pager, it used standard AA batteries, it was easy to set up and use, had a rugged design, and that it contained an external vibrating device. However, they felt the external vibrating device would be easy to lose and that the pager had weak alarms. They also felt the detector was more complicated than most pagers.

Radiation Survey Meters

Model 19A

The evaluators noted that the Model 19A was extremely simple to operate. The survey meter contained a three-position knob switch, scale analog readout, two standard D batteries, a rugged design, and it could be handled comfortably with one hand. The evaluators did not like the survey meter's limited dynamic range—one unit failed during the test.

| Product | | COMPOSITE | AFFORDABILITY | CAPABILITY | DEPLOYABILITY | MAINTAINABILITY | USABILITY | Comments |
|---|--|-----------|---------------|------------|---------------|-----------------|-----------|----------|
|  | Specs  Ludlum Measurements, Inc. Model 19A | ★ | ★ | ★ | ★ | ★ | ★ | \$1200 |
|  | Specs  Thermo Electron Corporation Radiation Measurement & Protection FH40GL | ★ | ★ | ★ | ★ | ★ | ★ | \$2300 |
|  | Specs  SAIC Advanced Security Products KV-100 | ★ | ★ | ★ | ★ | ★ | ★ | \$4000 |

Figure 2: SAVER QuickLook chart for survey meters.

FH40GL

The evaluators felt the survey meter was simple to operate with only four keys and that the basic operating instructions were printed on the instrument. It contained a numerical auto-ranging scale readout, used two standard AA batteries, was lightweight, had a wide dynamic range, and external probes were available. The evaluators disliked the plastic body and that the automatic backlight turns off after 30 seconds. The LCD screen was difficult to read in bright sunlight and the absence of a handle made it difficult to hold for long periods.

KV-100

The evaluators liked the simple basic operation with clearly marked keys, the numerical auto-ranging scale readout, the use of two standard D batteries, the rugged design close to military specification, the wide dynamic range, and that external probes were available. However, they felt the survey meter was too expensive, heavy, contained a LCD screen that was difficult to read in bright sunlight, the backlight only stays on for 10 seconds, the position and construction of the handle made it difficult to hold for long periods, and the high voltage needed adjustment after tests were completed.

Overall Assessment Results

Table 1 and Table 2 list the assessed radiation pagers' and survey meters' ratings, respectively, on a 100-point scale. These ratings are for the assessments conducted by the NSTec, using category weightings that were based on information reported by SMEs in a focus group. Ratings for all radiation pagers indicate the Polimaster 1703 had the highest overall ratings followed by the Canberra Mini-Radiac, and lastly the Polimaster 1401. Ratings for all radiation survey meters indicate the Ludlum Model 19A had the highest overall ratings followed by the Thermo Electron GH40GL, and lastly the SAIC KV-100.

Overall comments indicated poor quality of the operating manuals, lack of ergonomic designs for carrying and

operating the instruments, poor visibility of LCD screens, and instruments not capable of handling rugged and harsh environments are the primary concerns of the emergency responders who volunteered to participate in this assessment.

For Further Information

For complete radiation pagers and radiation survey meters assessment recommendations, visit the SAVER Web site. All of the NSTec's reports pertaining to the radiation pager and survey meter assessment can be found on the Web site, along with reports on other technology assessed as part of the SAVER Program.

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

For more information on the commercial radiation pagers and survey meters assessment project please see the SAVER Web site or contact the SAVER Program Support Office.

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