



**Homeland  
Security**

Science and Technology

# Summary

**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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## Portable Intravenous (IV) Infusion Pumps

(AEL reference number 09ME-06-PUMP)

Intravenous (IV) infusion pumps are used during medical response operations to deliver accurate rates of IV fluids or medication through plastic tubing, which is connected to an IV catheter that is inserted into a patient's vein. These devices allow medical personnel to set the amount of fluids or medication to be delivered over a specified time frame. Portable pumps are used for pre-hospital emergency response or during ground and air transport.

In order to provide responders with information on currently available portable IV infusion pumps, Science Applications International Corporation conducted a comparative assessment of these pumps for the System Assessment and Validation for Emergency Responders (SAVER) Program in May 2012. Detailed findings are provided in the *Portable Intravenous (IV) Infusion Pumps Assessment Report*, which is available by request at <https://www.rkb.us/saver>.

### Assessment Methodology

Prior to the assessment, eight paramedics with at least 10 years of experience were chosen from various jurisdictions to participate in a focus group. 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—affordability, capability, deployability, maintainability, and usability—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 system availability, the following pumps were selected for assessment:

- Sigma Spectrum, Baxter Healthcare Corporation;
- MTP<sup>®</sup> Transport Model 1001, Medical Technology Products;
- MedSystem III<sup>®</sup> Infusion Pump, CareFusion Corporation; and
- Plum A+<sup>®</sup> Infusion System, Hospira Corporation.



Eight paramedics served as evaluators for this assessment. All evaluators had at least 10 years of experience with emergency medical response and drug/fluid administration.

During the assessment, evaluators rated the pumps 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 using the pumps in scenarios designed to simulate medical response operations served as the basis for the operational assessment. Mannequins were used during the scenarios to simulate adult patients.

## Assessment Results

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

An analysis of evaluator comments and scores revealed the following common observations concerning the assessed portable IV infusion pumps:

- Evaluators expressed a strong preference for compact, lightweight, and/or mountable portable IV pumps that can be easily deployed.
- Evaluators placed a high value on portable IV pumps that are intuitive and easy to use.
- Evaluators preferred portable IV pumps that include safety features such as audio and visual alarms, prompts, security lockout features, and drug libraries that prevent user error when infusing medications.
- Evaluators expressed a strong preference for portable IV pumps that are reasonably priced and have low operational costs.
- Evaluators placed a high value on portable IV pumps that are capable of operating in a wide range of environments.
- Evaluators preferred portable IV pumps that can be easily cleaned.
- Evaluators expressed a strong preference for portable IV pumps that include a warranty.
- Evaluators placed a high value on portable IV pumps that include training with the initial purchase of the equipment.
- Evaluators preferred portable IV pumps that feature display screens that are easy to see.
- Evaluators expressed a strong preference for portable IV pumps that feature adjustable pole mounts.

Responder agencies that may be considering the purchase of a portable IV infusion pump should review the detailed findings in the *Portable Intravenous (IV) Infusion Pumps Assessment Report* and carefully consider each pump'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>.

SAVER Category Definitions
<b>Affordability</b> groups criteria related to life-cycle costs of a piece of equipment or system.
<b>Capability</b> 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.
<b>Deployability</b> 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.
<b>Maintainability</b> groups criteria related to the maintenance and restoration of a piece of equipment or system to operational condition by responders.
<b>Usability</b> 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.

**Table 1. Portable IV Infusion Pump Assessment Results**

<b>Product</b>	<b>Composite Score</b>	<b>Affordability (20% Weighting)</b>	<b>Capability (35% Weighting)</b>	<b>Deployability (10% Weighting)</b>	<b>Maintainability (10% Weighting)</b>	<b>Usability (25% Weighting)</b>
Sigma Spectrum	4.0	3.8	4.0	4.7	3.8	4.2
MTP®	3.9	4.2	3.9	4.3	3.8	3.5
MedSystem III®	3.1	2.6	3.5	3.1	2.6	3.0
Plum A+®	3.1	2.2	3.4	3.2	2.6	3.5

**Table 2. Portable IV Infusion Pump Advantages and Disadvantages**

<b>Product</b>	<b>Advantages</b>	<b>Disadvantages</b>
<b>Sigma Spectrum</b> Composite Score: 4.0	<ul style="list-style-type: none"> <li>• Small, portable size</li> <li>• Easy to use</li> <li>• Safety features</li> <li>• Inexpensive system</li> <li>• Reasonable cost of operation</li> <li>• Training included; biomedical training available</li> <li>• Infusion sets (common Baxter brand)</li> <li>• Easy-to-see screen</li> <li>• Wireless capabilities</li> <li>• Easy wireless battery exchange</li> </ul>	<ul style="list-style-type: none"> <li>• Cost of wireless battery module</li> </ul>
<b>MTP®</b> Composite Score: 3.9	<ul style="list-style-type: none"> <li>• Durable, all-weather system</li> <li>• 25-year life expectancy</li> <li>• Simple to use</li> <li>• Quiet operation</li> <li>• Quick disconnect</li> <li>• Inexpensive battery replacement</li> <li>• Interchangeable MTP parts</li> <li>• Free onsite training</li> <li>• Small, lightweight, and portable</li> <li>• Adjustable clamp (horizontal and vertical)</li> <li>• Easy to clean</li> </ul>	<ul style="list-style-type: none"> <li>• Knob on pole mount clamp not secure</li> <li>• Cannot see digital screen in bright sunlight</li> <li>• Unit runs without tubing; no alarm to indicate problem</li> </ul>
<b>MedSystem III®</b> Composite Score: 3.1	<ul style="list-style-type: none"> <li>• Three chambers for infusions</li> <li>• Small size; lightweight for three pumps</li> <li>• Removable rotating pole clamp</li> <li>• Torque feature on pole clamp</li> </ul>	<ul style="list-style-type: none"> <li>• Easy contamination of unused chambers</li> <li>• Not user friendly or intuitive to use</li> <li>• Difficult to insert cartridge of infusion sets</li> <li>• Cluttered, difficult-to-read display screen</li> <li>• Expensive (if purchasing as an individual pump rather than three pumps)</li> <li>• Poor location of handle (inverts pump)</li> </ul>
<b>Plum A+®</b> Composite Score: 3.1	<ul style="list-style-type: none"> <li>• 33 different alarms with helpful prompts</li> <li>• Security lockout feature</li> <li>• Durable intravenous (IV) pole clamp/mounting bracket</li> <li>• Quick reference guide attached to pump</li> <li>• Inexpensive system</li> <li>• Easy connection of drip set</li> </ul>	<ul style="list-style-type: none"> <li>• Loud operation</li> <li>• Direct viewing required to see display screen</li> <li>• Short tubing length between cassette and drip chamber</li> <li>• Expensive IV sets</li> <li>• Lack of manufacturer information</li> <li>• Heavy system</li> <li>• Poor cartridge placement leads to kink in tubing</li> <li>• Difficult to prime cassette</li> <li>• 90-day warranty on battery</li> </ul>

**Table 3. Portable IV Infusion Pump Criteria Ratings<sup>1</sup>**

	KEY			
	Least Favorable	→		Most Favorable
	Sigma Spectrum	MTP®	MedSystem III®	Plum A+®
<b>Affordability</b>				
Accessory costs				
Value for cost				
Replacement part costs				
Maintenance costs				
Training costs				
<b>Capability</b>				
Power supply				
Drug or fluid administration				
Safety features				
Durability				
Ability to be decontaminated				
Drug library <sup>2</sup>		Not applicable		
Personal computer interface <sup>2</sup>		Not applicable		
<b>Deployability</b>				
Ease of transport				
Ease of site setup				
<b>Maintainability</b>				
Serviceability				
Warranty				
Decontamination process				
Software updates <sup>2</sup>		Not applicable		
<b>Usability</b>				
Ease of use				
Easy-to-read display				
User-friendly controls				
Help prompts				
Presets				

Note:

- <sup>1</sup> Averaged criteria ratings for each assessed product are graphically represented by colored and shaded circles. Highest ratings are represented by full green circles.
- <sup>2</sup> The MTP does not have these features; as such, these criteria were not assessed and were not factored into the product's final scores.

**Table 4. Portable IV Infusion Pump Specifications<sup>1</sup>**

Specifications	Sigma Spectrum	MTP®	MedSystem III®	Plum A+®
Power source	Lithium ion, AC, or DC	Sealed lead acid, AC, or DC	Nickel-cadmium or AC	Sealed lead acid or AC
Run time	8.0 hours (standard battery) 4.0 hours (wireless module)	8.0 hours	6.0 hours	6.0 hours
Recharge time	12.0 hours (standard battery) 16.0 hours (wireless module)	24.0 hours	Information not available	6.0 hours
Weight	1.6 lbs (standard battery) 2.4 lbs (wireless module)	4.0 lbs	5.1 lbs	9.5 lbs
Dimensions	5.8 x 4.2 x 2.5 in. (standard battery) 6.3 x 4.2 x 2.5 in. (wireless module)	4.0 x 4.0 x 7.0 in.	7.9 x 6.0 x 2.1 in.	8.0 x 8.0 x 6.0 in.
Volume range	0.1 to 9,999 mL	1.0 to 999 mL	0.1 to 9,999 mL	0.1 to 99.9 mL
Flow rate	0.5 to 99.9 mL/hour	0.1 to 499.9 mL/hour	0.1 to 999 mL/hour	0.1 to 999 mL/hour

Notes:

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

AC = alternating current  
 DC = direct current  
 lbs = pounds  
 in. = inches  
 mL = milliliters