



*System Assessment and Validation for Emergency Responders (SAVER)*

# Portable Colorimetric Tubes for Chemical Vapor Detection Market Survey Report

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**Homeland  
Security**

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System Assessment and Validation for Emergency Responders

*Prepared by National Security Technologies, LLC*

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## FOREWORD

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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; and
- 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 is supported by a network of Technical Agents who perform assessment and validation activities. As a SAVER Program Technical Agent, National Security Technologies, LLC (NSTec) has been tasked to provide expertise and analysis on key subject areas, including chemical, biological, radiological, nuclear, and explosives (CBRNE) detection, countermeasures, and test and evaluation, among others. In support of this tasking, NSTec developed this report to provide emergency responders with information gathered during a market survey of commercially available portable colorimetric tubes (PCTs) for chemical vapor detection. These fall under AEL reference number 07CD-01-KCTC titled Chemical Detection Colorimetric Tape/Tube/Chip Kit.

Visit the SAVER website on First Responder.gov (<http://www.firstresponder.gov/SAVER>) for more information on the SAVER Program or to view additional reports on PCTs for chemical vapor detection and other technologies.

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## 1. INTRODUCTION

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Portable colorimetric tubes (PCTs) for chemical vapor detection are used by emergency responders to detect chemicals in the air and determine their concentration. PCTs detect chemicals in the air by drawing a specific amount of air containing the target chemical through a tube containing a material that reacts with the targeted chemical. The material in the quantitative detection tubes changes color and allows for a chemical concentration to be measured. Tubes are specific to targeted chemicals. PCTs can be used for situational awareness, for health and safety, to identify and quantify chemicals from spills or illicit activities, and to detect and confirm the presence of chemicals that could adversely affect the public, emergency responders, or impact response actions. PCTs may also be used in conjunction with other chemical detection technologies, such as photoionization detectors (PIDs), which continuously monitor the environment for chemicals but are not capable of chemical identification. For example, a PID may indicate that an unknown chemical is present in the air. PCTs could then be used to identify the chemical. Once the chemical is known, the PID could be used to monitor the concentration as well as its persistence.

PCTs are simple to operate, require minimal training, and can detect and quantify chemicals in the percent to parts-per-billion (ppb) range. Accuracy is dependent on the specific chemical being measured, the concentration range of the chemical, and environmental conditions, but generally ranges from plus or minus 10 to 25 percent of the concentration reading. To provide emergency responders with information on PCTs, the System Assessment and Validation for Emergency Responders (SAVER) Program conducted a market survey.

This market survey report is based on information gathered from December 2013 to February 2014 from vendors, Internet research, industry publications, an emergency responder focus group conducted February 11-12, 2014, and a government issued Request for Information (RFI) that was posted on the Federal Business Opportunities website. For inclusion in this report, the PCTs and associated pumps had to meet the following criteria:

- Use gas sampling and color-change chemistry with matrix-filled tubes to perform rapid short-term chemical detection;
- Are portable and capable of handheld field operation; and
- Are intrinsically safe.

Due diligence was performed to develop a report that is representative of products in the marketplace.

## 2. PCT OVERVIEW

PCTs use chemical and enzymatic reactions to identify and quantify over 300 different gases, vapors, or aerosols in the air. PCTs rely on a chemical reaction that results in a color change, as shown in the difference between the top and bottom tubes in Figure 2-1. Once the reaction is complete, the concentration of a chemical is read on the tube. Generally, PCTs are chemical-specific, but there are some cases in which a given chemical-specific tube may be sensitive to more than one chemical. These cross sensitivities are noted on data sheets provided by the manufacturers.



**Figure 2-1. Unexposed and Exposed Tubes Showing Markings in ppm**

*Image courtesy of Draeger*

PCTs consist of sealed-glass sampling tubes, generally about 4-inches long and about ¼ inch in diameter (depending on the manufacturer). The sampling tubes are used in combination with a holder and pump for the chosen tube. The tube contains a solid granular material that has been impregnated with a reagent specific to the chemical to be detected and quantified. To use a PCT, the two sealed ends of a tube are opened, one end is connected to a pump, and a known volume of air is drawn through the tube. Pumps can be powered or manual. Tubes require a specific volume of air to be sampled for concentration determination. If the target chemical vapor is present in the air drawn through the tube, the reagents react to form a color or stain. The top tube in Figure 2-1 shows the tube before a measurement, while the bottom tube shows the color change. The chemical concentration is determined by the distance that the color change advances in the tube, this distance is usually read using a scale marked on the side of the tube with readings in either parts-per-million (ppm) and/or percentages, some other methods are also used. The reading is an estimate of the chemical vapor concentration in the air that was drawn through the tube. The color change normally occurs within 2 minutes, but depending on the chemical and reagent, it can require either more or less time.

Some manufacturers provide tube holders that can connect multiple tubes (as pre-selected kits) to one pump, allowing for the detection and quantification of several chemicals at the same time (Figure 2-2). Multi-layer tubes (Figure 2-3) for qualitative identification of unknowns (i.e., to determine the presence of multiple chemicals but not the concentration) are available from a few manufacturers. The multi-layer tubes shown are used in pairs. Both tubes are exposed and the patterns resulting in specific regions are used to determine which chemical(s) may be present. Once an unknown chemical has been identified using the multi-layer tubes, the relevant chemical-specific tube(s) can be selected for quantitative measurements.



**Figure 2-2. Multi-tube Sampler Showing Five Tubes in the Holder**

*Image courtesy of Draeger*



Multi-stage tubes are tube sets that include a pre-treatment, or primary reaction tube, in addition to the detector tube. The pre-treatment tube scrubs the sample air of potentially interfering gases or moisture.

A post-treatment tube may also be used to remove gases generated in the first tube that may corrode the pump.

Colorimetric technology provides an accepted and proven means of measuring chemicals in the air, but there are some limitations and disadvantages to using this technology. Sampling covers only a small area over short time periods. Therefore, the point samples

measured by the PCTs can give higher or lower readings as concentrations in an area vary with time, which is common with gases and vapors. Because a correct reading depends on an accurate volume of air being drawn through the tube, improper sampling pump operation can result in erroneous concentration readings. Readings are also subject to interpretation as the border of the color change may not be clearly defined. Because PCTs are relatively inexpensive, tube kits can be prepositioned near areas that have potential chemical hazards. While tubes are generally inexpensive, they typically have calibrated shelf lives of only 2 to 3 years. While tubes will react to chemicals past their calibrated shelf life, the color change may not accurately indicate the chemical concentration. Calibrated shelf life is specific to the target chemical for the tube. Because of shelf life limitations, an inventory-monitoring program is required to ensure tubes have not expired and are replaced at regular intervals. Expired tubes can be used for hands-on training.

Generally, PCTs cannot provide continuous monitoring. An exception, provided by some manufacturers, uses a programmable gas-sampling pump. This approach can provide a time-averaged result over the sampling period. Time weighted average (TWA) monitoring of airborne contaminants can also be done with colorimetric dosimeter tubes. These tubes rely on diffusion (i.e., do not use pumps). Dosimeter tubes monitor TWA gas concentrations for specific area monitoring or they can be worn by responders for exposure monitoring. These “long-term” colorimetric tubes for chemical vapor detection are not addressed in this report, which focuses on “short-term” colorimetric tubes.

## 2.1 Current Technologies

PCT technology for quantifying concentrations of chemical vapors has been commercially available for many years. Tubes from different manufacturers are similar, though not exactly the same. Manufacturers recommend that tube holders and pumps are matched with tubes of the correct diameter from the same manufacturer. Recent advances include additional chemicals that can be detected, the availability of new pumps, development of multi-tube samplers (discussed above and shown in Figure 2-2), tubes with barcodes that can be read by programmable pumps for simpler fielding and chemical quantification, and multi-layer tubes for the simultaneous qualitative or semi-quantitative detection of the presence of multiple chemicals (discussed above and shown in Figure 2-3).



**Figure 2-3. Multi-layer Tubes Used to Determine the Chemical(s) Present**

*Image courtesy of Sensidyne*

Tubes for quantitative measurements can be read using several methods. The methods depend on the target chemical and on the manufacturer. A given manufacturer may employ different reading methods depending on the target chemical. The common methods are:

- Direct-Reading Scale Tubes – the color stain varies in length proportionally to the amount of gas being measured, and concentration is read directly from a scale marked on each tube (rather than a paper chart). The vast majority of colorimetric tubes are this type.
- Chart-Comparison Tubes – similar to the direct-reading scale tubes, but in order to obtain concentration, stain length must be compared to a printed concentration chart enclosed in each tube box.
- Color-Comparison Tubes – the intensity of color change, rather than the length of the stain, is compared to a standard color chart. Only a few tubes are still of this type.

There are two types of pumps that are commonly used with PCTs: hand pumps and stand-alone (or automated) powered pumps. There are two common types of hand pumps, piston and bellows, that draw a known quantity of air with each stroke, so accurate operation consists of counting a pre-determined number of full strokes. If the strokes are miscounted or are not full strokes, erroneous concentration readings can result. Many of the hand pumps can be operated with one hand and have stroke counters. Powered pumps draw air at a known rate for a pre-determined time period and are less prone to errors in the sampling procedures. Some powered pumps are designed to be used with the bellows pumps designed for hand operation (i.e., the bellows pump is inserted into the powered pump for operation), while others are stand-alone pumps.

Manufacturer systems are differentiated by the number of tubes available for different chemicals and applications, system and pump size, reaction time, required air volume, flow rate, and the number and types of pumps and accessories that are available. These differences (e.g., small variances in size or required air volume) may not be important in all operational scenarios. There are several PCT manufacturers, but users are advised to pair pumps and tubes manufactured by the same company because of size, volume, and flow rate requirements. Manufacturers' tubes and systems may have the capability to detect significantly more chemicals than the number of chemical-specific tubes available. Tubes can detect multiple chemicals at once or be for specific concentration ranges. A manufacturer may market several tubes for a single targeted chemical. For example, five different tubes may be available for ammonia, each designed for a different concentration range.

PCT pump purchase considerations may include intrinsic safety (only intrinsically safe pumps are presented in this report), the availability of manual and powered pumps, air sampling rates and volumes, the number of detector tubes that can be used at the same time, the chemicals that can be detected by a given system, accommodation of specialized tubes such as multi-layer tubes for simultaneous detection of the presence of a number of chemicals, and available accessories, such as multi-tube samplers that can quantify the concentration of a small number of chemicals at the same time. For purchasing ease, many manufacturers have preconfigured kits with tubes preselected for the chemicals likely to be present in specific scenarios (e.g., methamphetamine laboratories or industrial settings).

## 2.2 Applications

Situations suitable for colorimetric tube use include, but are not limited to, the following:

- Hazardous materials (HazMat) incidents;
- Industrial leaks/accidents;
- Agricultural or farming volatile organic compounds (VOC) detection;
- Confined space detection;
- Methamphetamine laboratory detection; and
- Fire service incidents.

PCTs are also used to independently confirm qualitative detections and provide a concentration estimate, or to determine what specific chemical(s) might be present based on a non-specific measurement such as a PID. Results can influence response actions and mitigation decisions.

## 2.3 Standards/Regulations

The American National Standards Institute (ANSI)/International Safety Equipment Association (ISEA) standard 102-1990 (R2003), *American National Standard for Gas Detector Tube Units-Short Term Type for Toxic Gas and Vapors in Working Environments* applies to PCTs, pumps, and components. This standard, "...sets forth the minimum performance requirements for gas detector tube units and components, which are used to determine the concentration of toxic gases and vapors in working environments."

Manufacturers may choose to submit their equipment to the Safety Equipment Institute (SEI) <http://www.seinet.org> for third party ANSI certification testing. ANSI, along with other organizations, has accredited SEI as a certification organization to test safety equipment, including colorimetric tube kits.

## 3. PRODUCT INFORMATION—VENDOR PROVIDED

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This report discusses tubes and pumps separately. Generally tubes from a given manufacturer can be used with all of that manufacturer's pumps. The PCT pumps included in this market survey have a suggested retail price range of \$180 for a simple hand pump to \$1,825 for an automated programmable pump. Tubes have a wide price range depending on the target chemical, the type of tube (single chemical or multi-layer), and the size and type of order. Some manufacturers allow purchase of single tubes, but most package tubes in lots of 10 or more. Some manufacturers provide tube sets preselected for specific scenarios (e.g., methamphetamine laboratories). Manufacturers also provide complete kits, including pumps, accessories, carrying cases, and tubes designed for specific scenarios. In some instances the tubes included in these pre-packaged kits can be custom selected for specific chemicals by the user. Kits can include manual or powered pumps, or both.

Product information presented in this section was obtained directly from an RFI, manufacturers, vendors, and their websites. The information has not been independently verified by the SAVER Program. Product data have been separated into two categories, detection tubes presented in Table 3-1, and pumps presented in Table 3-2.

Features in the matrix presented in Table 3-1 are defined as follows, listed in column order:

- **Number of Target Chemicals Available** refers to the number of different chemicals targeted for detection by a manufacturer’s tubes.
- **Multi-tube Sampler Available** refers to the availability of a pump accessory that allows for multiple tubes to be exposed simultaneously.
- **Multi-layer Tubes Available** refers to the availability of tubes that are designed to detect and identify the presence of more than eight chemicals in a single tube.
- **Application Specific Kits** refers to the availability of preconfigured detection kits for specific scenarios.

**Table 3-1. Product Comparison Matrix Chemical Tubes**

Manufacturer	Number of Target Chemicals Available	Multi-tube Sampler Available	Multi-layer Tubes Available	Application Specific Kits Available
Draeger	>200	✓		✓
Gastec	>300	✓	✓	✓
Kitagawa <sup>1</sup>	>200		✓	✓
RAE <sup>®</sup> Systems Inc. <sup>2</sup>	>300			
Uniphos <sup>3</sup>	>170			✓
Notes: <sup>1</sup> North American distributors of Kitagawa gas detector tubes include Sensidyne LP and Kitagawa America LLC. <sup>2</sup> In April 2013, Honeywell acquired RAE Systems Inc. <sup>3</sup> Uniphos recently acquired MSA <sup>™</sup> . Tubes with MSA’s specifications and technology are now produced by Uniphos and sold domestically by Ion Science LLC. ✓—manufacturer provides corresponding feature Blank cell—product is not equipped with corresponding feature				

Information presented in this table is based on data gathered from December 2013 to February 2014.

Pump features in the matrix presented in Table 3-2 are defined as follows, listed in column order:

- **Pump Type** refers to the type of pump. Bellows and piston types require manual operation unless paired with a battery powered system. Powered refers to any non-manual pump.
- **Programmable Sampling** refers to the ability of powered pumps to be programmed to follow a given pumping profile over time.
- **Adjustable Stroke Volume** refers to the ability of a pump to be used for different stroke volumes, typically whether there are ways to accurately perform half as well as full strokes.

- **SEI Listing** refers to whether the pump has been submitted to and received an SEI listing.

**Table 3-2. Product Comparison Matrix Pumps and Systems**

Vendor	Product	MSRP	Pump Type	Programmable Sampling	Adjustable Stroke Volume	Weight (pounds)	SEI Listing
Draeger	Accuro <sup>®</sup> Bellows Pump	\$440	Bellows	N/A	✓	0.5	✓
	X-act <sup>®</sup> 5000	\$1,825	Battery powered	✓	✓	3.5 <sup>1</sup>	
Gastec	GV-100	\$350	Piston	N/A	✓	0.5	✓
	GV-110	\$400	Piston	N/A	✓	0.5	✓
Kitagawa <sup>2</sup>	AP-20 Sampling Pump	\$450	Piston	N/A	✓	0.65	✓
RAE <sup>®</sup> Systems	LP-1200 Piston Hand Pump	\$180	Piston	N/A	✓	0.75	
Uniphos	ASP-40	\$350	Piston	N/A	✓	<0.9	
	Kwik-draw <sup>™</sup> Basic	\$530	Bellows	N/A		<0.5	
	Kwik-draw Deluxe	\$600	Bellows	N/A		<0.5	
	Toximeter <sup>™</sup> II Automatic Detector Pump	\$1,500	Battery powered	✓		1.28	

Notes:  
<sup>1</sup>Without battery  
<sup>2</sup>Sensidyne markets the Kitagawa piston pump as the AP-20S whereas Kitagawa America sells the Kitagawa piston pump using the factory model name: AP-20. Distributor prices vary slightly.  
 MSRP—manufacturer’s suggested retail price  
 SEI—Safety Equipment Institute  
 N/A—not applicable  
 ✓—product is equipped with corresponding feature  
 Blank cell—product is not equipped with corresponding feature

Information presented in this table is based on data gathered from December 2013 to February 2014.

### 3.1 Draeger

Draeger tubes and pumps are sold in the United States by Draeger Safety Inc. designated distributors.

#### 3.1.1 Tubes and Accessories

Draeger produces over 200 different tubes for measuring over 500 different chemicals. Tubes can typically be purchased in groups of 10, or as application-specific kits that can detect a range of chemicals preselected for specific scenarios.

Draeger produces a number of accessories for their tubes. These include:

- Carrying cases (hard-sided and soft-sided);
- Tube opener;
- Multi-tube sampler to expose a specific set of five tubes simultaneously;
- Hot air probe;
- Extension hoses (3.3, 10, 33, 50, 100 feet);
- Motor vehicle probes; and
- iPhone app.

Application-specific kits are offered both with and without pumps, chargers, and other accessories. Available kits include: Civil Defense Simultest (CDS) sets (CDS I and V) (Figure 3-1), Hazardous Materials (HazMat) Simultest sets—(HazMat I [inorganic], HazMat II [inorganic], and HazMat III [organic])—as well as Clandestine Laboratory, Fumigation, and Container Fumigation Simultest sets. Simultest sets are simultaneous reading kits which use scenario-specific tubes and a multi-tube sampler shown attached to a pump as shown in Figure 2-2 on page 2.

#### 3.1.2 Draeger Accuro<sup>®</sup> Bellows Pump

The Draeger Accuro Bellows pump MSRP is \$440 and is shown in Figure 3-2. It is a manually operated bellows pump with a 100 milliliter (mL) stroke. It allows for one-hand operation. The pump includes an end-of-stroke indicator and an automatic stroke counter. The pump has an integrated tube-tip cutter.



**Figure 3-1. Draeger Civil Defense Simultest (CDS) Kit**

*Image courtesy of Draeger*



**Figure 3-2. Draeger Accuro Bellows Pump**

*Image courtesy of Draeger*

### 3.1.3 Draeger X-act® 5000 Pump

The Draeger X-act 5000 Pump MSRP is \$1,825 and is shown in Figure 3-3. It is a battery-powered pump that permits hands-free operation. It is programmable up to 199 strokes. It is designed to be used with Draeger short-term tubes and reads barcodes on the tubes to automatically determine the required flow rates and volumes for each specific tube. Pump components are corrosion resistant.



**Figure 3-3. Draeger X-Act 5000 Automatic Pump with Tube Inserted**

*Image courtesy of Draeger*

## 3.2 Gastec Corporation

Nextteq® is the exclusive United States wholesale distributor for Gastec tubes and pumps. Gastec products can be purchased from Nextteq designated distributors.

### 3.2.1 Tubes and Accessories

Gastec manufactures over 500 tubes for over 300 different chemicals. Tubes are typically available in lots of 10. Tube calibrated shelf lives range from 6 months to 3 years depending on the target chemical. Gastec also manufactures four different multi-layer tubes for simultaneous semi-quantitative analysis of 9 to 15 chemicals, depending on the tube.

Accessories include:

- Carrying cases (hard-sided and soft-sided);
- Tube-tip breaker/holder;
- Tube warmer;
- Sampling bag;
- iPhone app with product information (e.g., measurement) ranges, sampling times, etc.;
- Extension hoses (16 feet and 32.5 feet);
- Telescoping extension pole;
- One-hand adapter;
- Hot probe for sampling in stacks or other hot gases; and
- Pyrolyzer (converts some gases to another form that can be measured).

Available kits include Clandestine Lab, Custom Industry (customer designed), and HazMat.

### 3.2.2 GV-100 and GV-110 Manual Sampling Pumps

The GV-100 MSRP is \$350 and GV-110 MSRP is \$400. The pumps are shown in Figure 3-4 with the GV-100 on the left and the GV-110 on the right. They are manually operated piston pumps with 100 mL stroke and half stroke capability. They have integrated tube-tip cutters. Both pumps have end-of-stroke indicators. A stroke counter for up to 10 strokes is available for the GV-110 as a MSRP \$250 accessory. The pumps include a thermometer that displays ambient temperatures at 9°F intervals from 32°F to 104°F.



**Figure 3-4. Gastec GV-100 and GV-110 Piston Pumps**

*Image courtesy of Nextteq*

### 3.3 Kitagawa

Kitagawa tubes and pumps are sold by North American distributors: Sensidyne and Kitagawa America. Tubes from these distributors are compositionally identical, but packaging, tube marking systems, and part numbers may differ.

#### 3.3.1 Tubes and Accessories

Kitagawa produces over 250 different tubes for measuring over 200 chemicals. Kitagawa also manufactures two qualitative multi-layered detection tubes for up to 70 chemicals. One is for identification of a broad range of organic compounds such as gasoline, alcohols, and hydrocarbons; the other identifies inorganic compounds such as carbon monoxide, sulfur dioxide, chlorine, etc.

Additional Optional Accessories (by Kitagawa except where noted):

- Carrying cases (hard-sided and soft-sided);
- Rubber extension hoses (16 feet and 32.5 feet);
- Hot-air probe (cools gases before they enter the tube and permit sampling of gases at elevated temperatures such as auto exhausts or stacks);
- Extension pole;
- Telescoping extension probe to 10 feet (Sensidyne);
- One-hand pump adapter;
- Tube-tip cutter for AP-20 Sampling Pump (Sensidyne);
- Air-flow indicator kit;
- Air-flow indicator tubes;
- Pump volume-verification kit with 100 mL bubble meter;
- Sampling probe for gases in soil; and
- Boring bar for use with sampling probe for gases in soil.



Kitagawa America sells qualitative multi-layer tubes individually or as part of custom kits. Sensidyne provides multi-layer tubes as part of a set in their Deluxe HazMat III kit. Scenario-specific kits sold by both distributors under slightly different names include a Toxic Gas Measurement Set for Disaster Relief, a Toxic Gas Detector Kit, an Indoor Air Quality Test Kit, and Compressed Breathing Air Analysis Kit (to detect impurities in compressed air).

### 3.3.2 Kitagawa AP-20 Sampling Pump

The Kitagawa AP-20 Sampling Pump MSRP is \$450 and is shown in Figure 3-5. It is a manually operated piston pump with a 100 mL stroke and half-stroke ability. It has an end-of-stroke indicator but no stroke counter. The pump has an integrated tube-tip cutter and a glass-tip holder. Pump components are corrosion resistant.

The same pump (varying only by color) is sold by Kitagawa America and by Sensidyne. Sensidyne sells this pump as part of the AP-20S Gas Detection Pump Kit with lubricant, rubber tube connectors, and a carrying case. The AP-20S pump is shown in Figure 3-5.



**Figure 3-5. AP-20S Sampling Pump**

*Image courtesy of Sensidyne*

### 3.4 RAE® Systems

RAE System tubes and pumps are sold in the United States by RAE Systems and various distributors.

#### 3.4.1 Tubes and Accessories

RAE Systems produces over 300 different tubes. Tubes can be purchased in groups of 5 (if pre-treatment tubes are required) or 10. Accessories include remote sampling hoses (15 feet and 35 feet lengths).

#### 3.4.2 RAE Systems LP-1200 Piston Hand Pump

The RAE Systems LP-1200 Piston Hand Pump MSRP is \$180 and is shown in Figure 3-6. It is a manually operated piston pump with an end-of-stroke indicator and built-in stroke counter. A full stroke is 100 mL and it has a half-stroke setting. The pump includes an integrated tube-tip cutter and glass-tip holder. It has a tapered inlet to accommodate a wide range of tubes.

The LP-1200 is available as a kit, which costs about \$200 and includes the pump, 2 spare inlet filters, a spare rubber inlet, a spare plunger gasket, and a carrying case.



**Figure 3-6. RAE Systems LP-1200 Piston Pump and an Assortment of Tubes**

*Image courtesy of RAE Systems*

### 3.5 Uniphos

On January 14, 2014, Uniphos Envirotronic Pvt. Ltd. (Uniphos) purchased the colorimetric tube business from MSA. Uniphos will produce detector tubes using MSA's

specifications and technology. Uniphos tubes and pumps are distributed in the United States by Ion Science, LLC and designated distributors.

### 3.5.1 Tubes and Accessories

Uniphos produces both wide [8 millimeters (mm) which is approximately 1/3 inches] Kwik-Draw™ and narrow (6 mm or approximately 1/4 inches) Uniphos tubes.

These tubes detect over 170 chemicals.

Accessories include:

- Extension hoses (10 feet and 50 feet);
- Telescoping extension pole;
- One-hand adapter (for Kwik-Draw and ASP-40 pumps); and
- Hot probe.

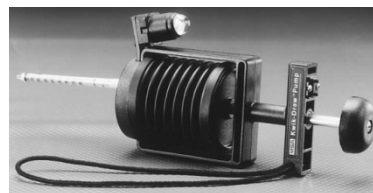
Applicable kits include HazMat, Indoor Air Quality, and Industry Action Sets (e.g., agriculture, mining, pharmaceutical, petroleum, and others) for the Kwik-Draw product line.

### 3.5.2 Kwik-Draw Basic

The Kwik-Draw MSRP is \$530. It is a manually operated 100 mL capacity bellows pumps with an integrated tube-tip cutter. It does not have an end-of-stroke indicator but includes a stroke counter. The pump is provided with a remote sampling adapter and a carrying pouch. Pump components are corrosion resistant.

### 3.5.3 Kwik-Draw Deluxe

The Kwik-Draw Deluxe MSRP is \$600 and is shown in Figure 3-7. It is a manually operated 100 mL capacity bellows pumps. It is the same as the Kwik-Draw basic pump but includes an end-of-stroke indicator. The pump is provided with a remote sampling adapter and a carrying pouch. Pump components are corrosion resistant.



**Figure 3-7. Kwik-Draw Deluxe Showing End-of-Stroke Indicator**

*Image courtesy of Ion Science*

### 3.5.4 Toximeter™ II Automatic Detector Pump

The Toximeter II MSRP is \$1,500 and is shown in Figure 3-8. It is a powered pump, programable for up to 250 strokes. Stroke volume is regulated by a temperature compensated differential pressure sensor. For increased accuracy, calibration factors can be used. The calibration factor as well as the number of pump strokes are set prior to sampling. The pump has a built in tube-tip cutter.

There are two receptacles on the pump, one at the pump inlet and the other at the outlet (for exposing tubes or collecting gas samples).



**Figure 3-8. Toximeter II Automatic Detector Pump**

*Image courtesy of Ion Science*

### 3.5.5 Uniphos™ ASP-40

The Uniphos™ ASP-40 MSRP is \$350 and is shown in Figure 3-9. It is a manually operated piston pump. A full stroke is 100 mL and it has a half-stroke setting. It has an integrated tube-tip cutter and an end of stroke indicator.



**Figure 3-9. Uniphos ASP-40 Pump**

*Images courtesy of Uniphos*

## 4. VENDOR CONTACT INFORMATION

Additional information on PCTs, pumps, and associated products included in this market survey report can be obtained from the vendors listed in Table 4-1.

**Table 4-1. Vendor Contact Information**

Vendor	Primary U.S. Vendor <sup>1</sup>	Phone Number/Website
Draeger	Draeger Safety Inc.	(800) 858-1737 <a href="http://www.draeger.com">http://www.draeger.com</a>
Gastec	Nextteq, LLC	(877) 312-2333 <a href="http://www.nextteq.com">http://www.nextteq.com</a>
Kitagawa	Sensidyne, LP	(800) 451-9444 <a href="http://www.sensidyne.com">http://www.sensidyne.com</a>
	Kitagawa America LLC	(973) 616-5410 <a href="http://www.kitagawa-america.com">http://www.kitagawa-america.com</a>
RAE® Systems Inc.	RAE Systems Inc. by Honeywell	(877) 723-2878 <a href="http://www.raesystems.com">http://www.raesystems.com</a>
Uniphos	Ion Science LLC	(877) 864-7710 <a href="http://www.ionscienceusa.com">http://www.ionscienceusa.com</a>
Notes: <sup>1</sup> Only primary U.S. vendors who responded to the Request for Information (RFI) or were in contact with a National Security Technologies, LLC representative are listed here; these vendors may be contacted to locate local distributors.		

## 5. SUMMARY

This market-survey report provides information on PCT systems, including tubes and pumps, from five manufacturers. The number of different target chemical tubes range from 170 to over 300, depending on the manufacturer. Pumps are available as both manual and powered with some having programmable options. They range in price from \$180 for a simple manual pump to \$1,825 for an automated programmable powered pump. The types of colorimetric tubes, the availability of scenario-specific kits, and accessories are also described. Pumps are listed by manufacturer with power type, weight, whether the pump volume is variable, and if the pump is programmable. A pump with a built-in tube barcode reader is also discussed.

Manual pumps are light-weight, rugged, low-cost, and simple to operate. They are well-suited to scenarios that require the identification and quantification of chemicals that might be present.

However, because of the time and effort required to take a sample (tens of strokes) they may not be suited for scenarios where a large number of measurements will be required. Powered pumps are more suited to scenarios where a large number of measurements are required or the measurements will be taken at intervals over a longer time period.

Emergency-responder agencies that consider purchasing PCT systems should carefully research each product's overall capabilities and limitations in relation to their agency's operational needs