

FIELD DEVICE USE BY FIRST RESPONDERS: ISSUES AND SOLUTIONS



During an emergency, first responders must make rapid decisions to protect their community's safety as well as their own. Should they evacuate the area? How many blocks should they evacuate? Should they don protective equipment? The answers to these questions can make the difference between health and permanent disability, or even death.

The Department of Homeland Security provides funding to first responders for purchase of biological and chemical detection kits and devices to provide fast, accurate identification of the agent. Unfortunately, many of the claims are untrue—and often, the results are neither accurate nor valid. Even more troubling, first responders are typically unaware that the kits and devices have limitations. This misperception further endangers these public servants as well as the public they strive to protect.

FALSE HOPE?

In 2008, several businesses, including Chase Bank and *The New York Times*, received threatening letters containing a white powder. First responders used a popular field device, which indicated that the powder was a non-toxic, inert chemical. Although follow-up tests at regional laboratories did not find a weapon of mass destruction, they did identify the powder as a toxic chemical that could cause illness if inhaled or ingested.

UNNECESSARY PANIC?

During a similar incident in Florida, reported to 911 at 7am, first responders got a positive result for anthrax using a field device. To double-check the initial result, responders repeated the field assay; but this time, the result was negative. Due to these conflicting results, the first responders performed the assay a third time, which resulted in a second positive. Panic ensued, at both the state and federal level, and medical intervention was provided for individuals exposed at the scene. At least one individual went to the hospital for blood work and sputum induction. Luckily, some of the original sample remained, and it was delivered to the Laboratory Response Network (LRN)¹ reference laboratory at 6pm—more than 11 hours after the incident was reported. A little over two hours later, the Jacksonville LRN reported that the sample did not contain anthrax.

URGENT NEED FOR ACTION

These two incidents undermined the public's trust in first responders and government. First responders need to take action due to pressures onsite, and deliver answers to those affected and to decision-makers. Although field devices are not validated—and as such, likely unreliable—first responders have little choice but to use them. To prevent panic and costly response due to false positives—or illness and death due to false negatives—three main steps must be taken immediately.

1. DEVELOP AND IMPLEMENT PERFORMANCE STANDARDS

- ▶ Standards to determine what field testing results warrant action
- ▶ Standards for manufacturers to assure that instruments detect analytes at the level required to assess potential human impact
- ▶ Standards to assure that instruments have adequate sensitivity, specificity and operating parameters

2. VALIDATE FIELD DEVICES (MEASURE WHETHER THE DEVICES DO WHAT THEY SAY THEY DO)

- ▶ Independent, third-party validation
- ▶ Validation under variable field conditions (vs. pristine, highly-controlled laboratory conditions)

3. DEVELOP TRAINING AND CERTIFICATION PROGRAMS FOR INDIVIDUALS USING THESE KITS AND DEVICES

- ▶ Without training, sample material may be depleted, resulting in loss of criminal evidence and the ability to conduct appropriate laboratory testing.
- ▶ First responders need to understand that all credible threats, even if they test negative, need to be sent to a laboratory for confirmation to avoid false negatives.
- ▶ Training will help responders to understand the limitations and applicability of field devices or kits, and will help them to avoid misuse and misinterpretation.
- ▶ A proficiency testing program² is needed to evaluate responders' ability to correctly use a field instrument and understand the results.
- ▶ Mandatory certification to ensure all first responders receive appropriate training, taking into account the high turnover rate in this field.

SOLUTIONS

1. Establish standardized federal guidelines for performance standardization and validation of all screening kits, assays and devices for use in the field by first responders to detect hazardous biological and chemical agents.
2. Set standard parameters for each screening kit or device. FEMA grantees should purchase from a federally-approved list of screening kit devices.
3. Involve LRN reference-level and chemical laboratories in validation studies, as appropriate.
4. Relevant organizations should partner to develop and implement a national training, certification and proficiency testing program for first responders.

² Proficiency testing (PT) is a means of evaluating performance of a device through the analysis of unknown samples. Public health laboratories in Iowa and Nebraska implemented PT programs for first responders. For information, write: Steve Treimer in IA, stephen-treimer@uiowa.edu or Dana El-Hajjar in NE, delhajja@unmc.edu.

The myriad of federally-supported committees working on various aspects of these issues has taken an unacceptably long time to provide guidance. The ultimate goal is protection of first responders as well as anyone else coming into contact with suspicious substances. Until a rigorous evaluation and validation program exists, we cannot weed out the good tools from the unreliable ones—even good tools are only useful under specific conditions (see Figure 1).

Figure 1 – Results of a Proficiency Testing Exercise in Iowa†

SAMPLE CONTEST	TEAM 1	TEAM 2*	TEAM 3*
Cerium Nitrate ~5% Yeast ~5% Methyl Methacrylate ~90%	methyl methacrylate by IR; nothing by Raman	tellurium by IR	nitrilotriacetic acid, methyl methacrylate by IR; organic compound by HazCat
Cesium Nitrate ~3% Yeast ~10% wt/wt Sulfanilamide ~85%	sulfanilamide by both IR and Raman	tellurium, tin oxide by IR	sulfanilamide by IR
Ethyl Methyl Phosphonate ~15% Yeast ~15% Penicillin ~70%	no matches	no matches	no matches

N.B. Note that different teams got different results with the same instrument.

† APHL does not necessarily endorse this program and is simply reporting the results to demonstrate the real-world limitations of these devices.

* Used no respiratory protection (mask, hood, etc).

Information on Sample Contents

- ▶ Methyl methacrylate: fairly toxic, used to make plastics, lightweight and could be disbursed in air using HVAC system
- ▶ Yeast: tests ability to detect a biological, since it contains protein
- ▶ Cerium and Cesium: not exactly toxic, but a good test for heavy metals
- ▶ Sulfanilamide: common, albeit dated, pharmaceutical
- ▶ Penicillin: common pharmaceutical, a light powder out-of-the-bottle, readily accessible
- ▶ Ethyl Methyl Phosphonate: precursor and warning sign of a WMD chemical. These compounds affect the nervous systems of all mammals to a greater or lesser degree.

The State Hygienic Laboratory at the University of Iowa sends samples in compliance with US Postal Service laws to first responders in their area to conduct proficiency testing of these teams and their field devices. Figure 1 illustrates the results of one such proficiency test and the inconsistencies and unreliable results of the devices. Many of the teams were not able to properly identify the samples, which—as explained—are not all benign.





References

Association of Public Health Laboratories, 2007. *Standardized Validation of Screening Kits and Devices for Use in the Field to Identify Hazardous Biological and Chemical Agents*. www/aphl.org/policy/Documents/Field_Devices.pdf.

US Government Accountability Office, 2008. *First Responders' Ability to Detect and Model Hazardous Releases in Urban Areas Is Significantly Limited*. www.gao.gov/highlights/d08180high.pdf.



Association of Public Health Laboratories
8515 Georgia Avenue, Suite 700
Silver Spring, MD 20910