Partnering and Consumer Orientation: Techniques That Move Occupational Safety and Health Research into Practice

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Partnering and Consumer Orientation: Techniques that Move Occupational Safety and Health Research into Practice

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ABSTRACT

First responders, remediation workers, and other personnel frequently encounter clandestine methamphetamine (meth) labs or previous meth lab sites while performing their everyday jobs. National Institute for Occupational Safety and Health (NIOSH) researchers developed a real-time method for detecting methamphetamine on surfaces for use by these workers. This case study describes how a federal agency developed and field-tested this innovative technology and collaborated with a private sector partner to commercialize and market the technology and the impact these actions had on its transfer and adoption.

Introduction

Illegal methamphetamine (meth) labs pose well-known threats to public health, safety, and security in the United States. In 2005, over 12,000 incidents (includes labs, "dumpsites," or "chemical and glassware" seizures) in the United States involved methamphetamine labs. Between 1996 and 1999, the CDC reported 155 emergency services personnel were injured in meth lab investigations. For police officers assigned to seize illegal labs, there are significant occupational risks of exposures to toxic materials when they enter buildings or structures that are contaminated with chemical wastes and methamphetamine from illegal production.

Prior to 2006, first responders used time-consuming and expensive analytical methods to determine the degree of contamination and potential exposure risks when responding to clandestine meth labs. Lacking a rapid and accurate field-based method, many first responders were exposed to methamphetamine and other residual contaminants, placing them at risk for serious health problems, including respiratory distress and cardiac arrhythmia.

Developing the Product

Field investigations conducted with city law enforcement agencies and a global research center revealed the critical need for real-time "meth" surface detection methods. Real-time methods would enable first responders to accurately sample and determine meth concentrations and allow decisions to be made regarding personal protective equipment. To gain a better understanding of the problem, NIOSH researchers joined a police drug task force in raids of clandestine labs. NIOSH researchers discovered that surface contamination from methamphetamine residues presented far more of an occupational safety and health risk than airborne contamination. Researchers also found that surface wipe samples were effective in collecting surface contamination, but analysis took days to weeks to get results.

Drawing on expertise with the development and commercialization of a wipe sampling colorimetric detection method for lead (Pb), NIOSH researchers designed two novel detection methods for detecting surface contamination from meth. Both methods collect a surface sample using a cotton swab or gauze pad. The methods differ in their sensitivity and detection techniques. For the colorimetric method, the surface is wiped by the gauze pad and then the pad is sprayed with a "developing" solution. If meth is present, a blue color immediately develops. The immunochemical method works similarly to a home pregnancy test. The surface to be tested is wiped with the swab or gauze pad and then the pad is placed in a vial containing a saline-based extraction solution. After shaking the vial, three drops of the solution are dropped onto the immunochemical test strip. If methamphetamine is present, a single red line forms. If the surface is not contaminated, two red lines appear.

NIOSH researchers standardized sampling procedures for both methods. Then, the use of the sampling methods by nonlaboratory NIOSH staff and other volunteers was tested to determine the accuracy and sensitivity of the methods in a laboratory setting. After internally validating the methods, NIOSH partnered with the Greater Cincinnati Hazardous Materials Unit, Hamilton County (Ohio) Health District and Kentucky and Ohio law enforcement agencies to conduct field testing of the two wipe methods. By partnering with potential external stakeholders, NIOSH was able to achieve two primary goals. The first

goal was to develop a level of awareness in HAZMAT personnel, health department sanitarians, and law enforcement personnel that methamphetamine surface contamination was a potentially significant route of exposure. The second goal was to validate the methods in the field and, with input from partners, develop protocols for the use and interpretation of the tests.

NIOSH researchers, together with their partners, visited more than a dozen suspected methamphetamine laboratories. Sites visited included mobile labs and labs in abandoned properties, residences, and motel rooms. Some locations were visited immediately after discovery by law enforcement and others were visited to confirm that methamphetamine contamination did exist in suspect properties. Figure 1 illustrates NIOSH researchers sampling methamphetamine levels on one of the field trials at a former clandestine lab to assess possible exposures that may occur during demolition. In all of these field trials, NIOSH researchers saw greater than 95% agreement between the lateral flow immunochemical assays (LFIA) and laboratory-based, liquid chromatography mass spectroscopy (LC-MS) methods. In some cases, the LFIA detected methamphetamine below levels of detection for laboratory-based analytical methods.

FIGURE 1

NIOSH Researchers Sampling Methamphetamine Levels on One of the Field Trials at a Former Clandestine Lab to Assess Possible Exposures that May Occur during Demolition

The development of the methods enabled field-based decisions to be made regarding extent of contamination and types of protective equipment required so responders can make risk-based decisions without delays waiting for laboratory analyses.

Production and Distribution

The next step was to move to full commercialization and make the technology into a product readily accessible to first responders who needed the ability to detect meth real-time in the field and use that information to make risk-based decisions. NIOSH, as a federal agency, needed the help of a commercial partner to commercialize the product and make it affordable and accessible to first responders around the nation. Coincidently, Scientific Kit Company (SKC), Inc. approached NIOSH about the possibility of developing such a technology and expressed its interest in taking such a product to the market. Having previously worked with SKC to license and commercialize another NIOSH surface detection technology, NIOSH trusted SKC's intentions and believed that the company was highly motivated to take the technology to the commercial marketplace. After research proved that the methods could be developed, NIOSH refined and tested the newly developed technology. NIOSH presented results of the lab and field research to SKC representatives, the presentation included a practical demonstration of the methods.

The SKC representatives were so taken by the demonstration and convinced of the invention's market potential that SKC enthusiastically pursued licensing the invention. In a matter of weeks, the Centers for Disease Control and Prevention (CDC) Technology Transfer Office negotiated terms between SKC and CDC granting SKC a license to market the inventions. Once the licensing agreement for the two technologies was executed, NIOSH continued to collaborate with SKC on packaging and further validation of the methods. In 2006, SKC released the two products at the American Industrial Hygiene Conference and Exposition. The two NIOSH-invented technologies were commercialized and are currently sold under the brand names MethAlert™ (colorimetric method) and Meth-Chek™ (immunochemical method). In the first 3 months on the commercial market, more than $10,000 worth of product was sold by SKC.

Adopting Science into Work Practices

Working with a proven partner helped NIOSH move the technology from initial conception, to initial (beta) versions developed in the laboratory, and finally to fully commercialized products. The time from initial conception to commercial products

was only one year. Through partnership with SKC, NIOSH succeeded in developing and commercializing a technology initially intended for first responders but also was able to identify new markets and potential users for this technology.

While first responders were the intended users for meth surface detection methods, marketing results from SKC showed that real estate agents, property owners, property renovation companies, and the general public were purchasing the technology. This suggested that the occupational safety and health-derived methods expanded beyond the needs of the worker to meet the needs of the general public. As hazards of methamphetamine exposures continue to be reported in scientific literature and in the media, a wider and broader adoption of the methods is expected. Long-term impact includes continued prevention of exposures to infants, children, and adults through hazard identification and risk mitigation.

MethChek™ is marketed to be used to detect methamphetamine surface contamination at levels required by various state and local regulations. SKC retails many different versions of the MethChek™ kit that differ in number of test and sensitivity. Allowing users to address the different limits for each locality, kits are sold that are designed to detect trace amounts (50 ng), 0.1, and 0.5 $\mu g/100\,cm^2$. In late 2007, California released a draft of a health-based target remediation standard of 1.5 $\mu g/100\,cm^2$. In response to this change, NIOSH researchers worked with SKC to develop a new California-only kit to meet customer requests. This kit was introduced in February 2008.

NIOSH researchers partnered with the Hamilton County (Ohio) Health District and other agencies to expand on the uses and applications of MethAlert™ and MethChek™. Aside from compliance with state and local surface limits, the Hamilton County Health District employees used the tests to analyze the potential of cross-contamination by surface methamphetamine to workers involved in the demolition of a former laboratory. In addition, they used the test to assess cross-contamination from surfaces to items brought into a former methamphetamine laboratory in a residence. The test allowed them to make decisions to discard, decontaminate, or release personal property to residents occupying a former methamphetamine lab.

NIOSH researchers are also conducting outreach activities targeting first responders, remediation workers, and real estate agents across the nation. They are demonstrating the hands-on application of the methods and the use of personal protection; providing education on how to determine risks of re-occupancy for a residence; and instructing on how to create a decontamination plan. In their outreach, researchers are also expanding their awareness of behavioral

determinants of target audience members, such as the benefits and barriers to use of the real-time methods.

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