Analysis of Suspicious Powders Following the Post 9/11 Anthrax Scare

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ABSTRACT

Background: Following the 9/11 terrorist attacks, SET Environmental, Inc., a Chicago-based environmental and hazardous-materials management company received a large number of suspicious powders for analysis.

Methods: Samples of powders were submitted to SET for anthrax screening and/or unknown identification (UI). Anthrax screening was performed on-site using a ruggedized analytical pathogen identification device (R.A.P.I.D.) (Idaho Technologies, Salt Lake City, UT). UI was performed at SET headquarters (Wheeling, IL) utilizing a combination of wet chemistry techniques, infrared spectroscopy, and gas chromatography/mass spectroscopy. Turnaround time was approximately 2–3 hours for either anthrax or UI.

Result: Between October 10, 2001 and October 11, 2002, 161 samples were analyzed. Of these, 57 were for anthrax screening only, 78 were for anthrax and UI, and 26 were for UI only. Sources of suspicious powders included industries (66%), U.S. Postal Service (19%), law enforcement (9%), and municipalities (7%). There were 0/135 anthrax screens that were positive.

Conclusions: There were no positive anthrax screens performed by SET in the Chicago area following the post-9/11 anthrax scare. The only potential biological or chemical warfare agent identified (cyanide) was provided by law enforcement. Rapid anthrax screening and identification of unknown substances at the scene are useful to prevent costly interruption of services and potential referral for medical evaluation.

INTRODUCTION

Public fear about becoming a victim of inhalation anthrax or other weapons of mass destruction was profound following the 9/11 terrorist attack. Following the initial reports of 22 confirmed inhalation anthrax incidents, there was a surge in calls regarding concerns over suspicious powders. For example, while the confirmed cases of anthrax were located on the east coast, the Texas Poison Center received up to 31 anthrax-related calls daily and over 500 such calls during this time period [1]. SET Environmental, Inc., a Chicago-based environmental and hazardous materials management company, received a surge in the

number of suspicious samples to analyze during this period. We describe our experience utilizing field testing techniques to assist in analysis of these calls.

METHODS

Samples of suspicious powders were submitted to SET Environmental, Inc. for anthrax screening and/or unknown identification. Samples of powders were isolated and analyzed via Fourier Transform Infrared Spectroscopy (FTIR) (KBr pellets), Attenuated Total Reflection (ATR), and micro-ATR. For smaller samples, FTIR microscope was used. For contaminated organic samples, gas

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chromatography/mass spectroscopy (GC/MS) was used. Wet chemistry was used for confirmation of results. Usually 2 methods (chromatography and spectroscopy) were used on the same sample. Anthrax screening was performed using a ruggedized advanced pathogen identification device (R.A.P.I.D) (Idaho Technologies, Salt Lake City, UT). This is a portable, air thermocycler with fluorescence monitoring capabilities. The instrument is capable of performing polymerase chain reaction (PCR)-based preprogrammed pathogen detection in under 30 minutes [2,3]. SET employed 3 emergency response project managers to perform PCR analysis using the R.A.P.I.D. All results were confirmed and/or reviewed by SET's laboratory manager (B.S.). If discrepancies were identified (i.e., false positive), the procedures were repeated. Unknown identification was performed (usually on site) utilizing a combination of wet chemistry techniques, infrared spectroscopy and gas chromatography/mass spectroscopy. Turnaround time was approximately 2–3 hours for either anthrax or unknown identification.

RESULTS

Between October 10, 2001 and October 11, 2002, 161 samples were analyzed on site. Some of these entities only requested testing for anthrax. Due to their media (i.e., extremes in pH, oxidizers present), anthrax analysis was not necessary. Of the samples that could be analyzed, 57 were for anthrax screening only, 78 were for anthrax and unknown identification, and 26 were for unknown identification only. Sources of suspicious powders included private industries (66%), U.S. Postal Service (19%), law enforcement (19%), and municipalities (7%). There were 0/135 anthrax screens which were positive. *Table 1* lists type and number of substances positively identified.

DISCUSSION

Clinical chemistry analysis for exposed patients has traditionally focused on biological (urine or serum) specimens performed in a hospital-based laboratory. Individuals acutely exposed to biological agents are likely to be asymptomatic on presentation. Therefore, utilization of emergency medical response has depended on haphazard hospital-based laboratory ordering patterns that yield either limited results, surrogate values or (in terms of cultures) take days to fully evaluate. Thus clinical reliance on hospital-based laboratories for environmental exposures is less than ideal [4]. Furthermore, laboratory capacities for mass exposures are limited and bio-safety techniques for safe handling and transport to specialized laboratories are rarely utilized [5].

Since 2001, there has been a shift within the state public-health laboratory system from testing primarily human clinical specimens to analyzing environmental specimens [6]. Between September 2005 through August 2006, more than 2000 environmental specimens were analyzed within state public-health laboratories, with almost 20% of the samples being powders [6]. Private laboratories can certainly complement this system and offer on-site evaluations along with decontamination capabilities.

Table 1: Unknown Identification

Identified Substances	Number
Detergents	16
Inorganic salts	13
Sugars	13
Cellulose	10
Plastics	10
Silica	7
Talc	5
Cyanide	4
Protein	4
Starch	4
Plaster	3
Coffee creamer	2
Clay	1
Mercuric sulfate	1
Mica	1
Mold	1
Phenolphthalein	1
Phosphoric acid	1
Polyaryl sulfonate	1
Potassium chlorate	1
Propylamine	1
Saffron	1
Salicylic acid	1
Silver nitrate	1

With polymerase chain reaction (PCR) technology screening on the site of occurrence of environmental (soil, powder) samples, triage and therapy can be directed towards those individuals who actually receive exposure while reassurance can be given to those not exposed [7]. The R.A.P.I.D. assay has been utilized by the armed forces since the first Gulf war (8). Gene amplification assays (i.e. PCR) target microbial plant DNA or RNA and do not require viable organisms. They require about two hours of sample preparation time and appear to exhibit greater sensitivity than immunoassays (which target agent-specific antibodies or antigens) [9, 10]. The negative on-site test results allowed for reopening of the sites and return to normal business within hours. Industrial downtime can be minimized while general citizen activities are less disrupted. It should be noted that the cyanide samples were obtained from four suspicious caches of powder found by the police in the Chicago subway tunnels. The intent of the offenders was to blow up the cyanide in the tunnel.

Real-time PCR testing is available in public-health laboratories in all states although specific reagents, workforce shortages,

and lack of federal standardized guidelines all contribute to lack of laboratory preparedness [6,10].

CONCLUSION

There were no positive anthrax screens performed by SET in the Chicago area following the post-9/11 anthrax scare. The only potential biological or chemical warfare agent identified (cyanide) was provided by law enforcement. Rapid anthrax screening and identification of unknown substances at the scene are useful to prevent costly interruption of services and potential referral for medical evaluation.

The authors, Chad Tameling and Bijan Saeedi, are both employees of SET Environmental, Inc. They responded to these incidents and performed the assays but had no financial gain or notoriety based on the results of the assay.

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