



Ductless Fume Hood Applications in Suspicious Package Processing

Techniques and equipment to safely
process suspicious packages

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March 2017



Abstract

In our globalized economy, complex and sophisticated networks move packages worldwide through a variety of shipping methods and vendors. The complexity and number of shipping channels presents a significant security concern because of the expanding capability to disguise dangerous substances (including bombs) in normal postal packages. Vendors that ship and deliver packages to consumers and businesses have the responsibility to ensure the safety of their employees and those who receive packages. Proper screening procedures and equipment can remove a large number of potentially dangerous packages from the mail. However, as the volume of shipping increases, specialized techniques and equipment should be considered to ensure the safety of package screeners who handle and examine parcels.

Air Science has developed the Purair SafeSEARCH, a specialized ductless fume hood that can help protect technicians from potentially harmful fumes and particulates during routine package examination. The Purair SafeSEARCH can be installed in mailrooms, airports, bus terminals, and vendor receiving bays. It provides a host of benefits including carbon and/or HEPA filtration, easy installation, and no additional ductwork requirements for the facility. Organizations can provide an additional layer of protection for mail personnel and customers by combining industry best practices mail handling procedures with the SafeSEARCH hood in any size operation.



Introduction

On September 18, 2001, seven days after the deadly terrorist attacks in New York and Washington DC, letters laced with deadly anthrax spores were mailed to several media outlets and congressional offices. Five people died from inhaling anthrax contained in the letters and 17 others were infected after they were exposed¹. While this was not the first time the U.S. Postal Service (USPS) was exploited to carry dangerous mail, these events ushered in a new wave of biological and chemical threats to the mail and package handling industry.

The problem

USPS, UPS, FedEx and other commercial carriers publish restrictions on prohibitions about what can be shipped. However, the reality is that no one can fully guarantee packages do not contain harmful substances. Additionally, with the proliferation of mail order pharmaceutical distribution, even shipments containing legal medications and other chemical and biological substances can present a hazard if packaging is compromised.

In 2015, the Drug Enforcement Agency (DEA) issued a nationwide alert for the drug fentanyl as a threat to health and public safety.² Fentanyl is an odorless, tasteless synthetic opiate painkiller. It is legal; however, it has become a drug of choice for those addicted to opioids because it is 50 times more potent than heroin.

Following the accidental exposure to fentanyl of several law enforcement officials in 2016, DEA Agents warned that fentanyl is being sold on the dark web and shipped via UPS or FedEx. The drug is often packaged in boxes disguised as containing other items such as toner cartridges.³ Even slight exposure can be harmful or deadly which presents an obvious challenge for shippers, postal workers, delivery personnel and mail handling staff.

In another incident, two detention officers in Madison County, Georgia were exposed to the substance MDMA (methylenedioxy-methamphetamine), known by the street name "Ecstasy," while opening inmate mail. After handling two envelopes the officers' hands began tingling and felt numb. One officer accidentally touched his face, cheek and mouth area which then became numb. Both officers were sent to the hospital for treatment.⁴

These incidents highlight the growing challenge of protecting all those who handle mail and packages. In organizations of any size, mail and packages are sorted, processed, and screened usually by hand. Unfortunately, visual screening procedures for incoming mail and packages are not foolproof.

The threat is not limited to the United States. The Royal Canadian Mounted Police (RCMP) issued a report in 2013 detailing a range of criminal activity being conducted through the Canadian postal system. The RCMP reported guns, grenades, dangerous chemicals and, in one case, even a rocket launcher was shipped via the postal service.⁵ In 2017, a letter bomb exploded at the Paris office of the International Monetary Fund, slightly injuring one person.⁶

- 1 "Timeline: How The Anthrax Terror Unfolded," npr.org, last modified February 15, 2011, <http://www.npr.org/2011/02/15/93170200/timeline-how-the-anthrax-terror-unfolded>.
- 2 "DEA Warning to Police and Public: Fentanyl Exposure Kills Roll Call Video Advises Law Enforcement to Exercise Extreme Caution," Drug Enforcement Agency, last modified June 10, 2016, <https://www.dea.gov/divisions/hq/2016/hq061016.shtml>.
- 3 Robinson, Lisa "Officials issue new warning about fentanyl - Synthetic opioid posing problems for law enforcement," wbalrtv.com, last modified Oct 20, 2016, <http://www.wbalrtv.com/article/officials-issue-new-warning-about-fentanyl/6964930>.
- 4 "Officers exposed to drug in inmate mail," madisonjournaltoday.com, last modified February 27, 2017, <http://www.madisonjournaltoday.com/archives/8906-Officers-exposed-to-drug-in-inmate-mail.html>.
- 5 Bronskill, Jim, Criminals using Canada Post to transport illicit goods — including a rocket launcher — RCMP report says," nationalpost.com, last modified January 25, 2013, <http://news.nationalpost.com/news/canada/criminals-using-canada-post-to-transport-illicit-goods-including-a-rocket-launcher-rcmp-report-says>.
- 6 Charlton, Angela & Paphitis, Nicholas, "Letter bomb explodes at Paris IMF's office; Greek ties seen," abcnews.com, last modified March 16, 2017, <http://abcnews.go.com/International/wireStory/letter-bomb-explodes-france-office-imf-injuring-46167493>.

Solutions

Best Practices

The Department of Homeland Security (DHS) has issued guidelines for best practices in mail handling and screening. In these guidelines, DHS notes that threats come in many forms including chemical, biological, radiological/nuclear and explosives (CBRNE). The guidelines suggests organizations realistically assess their internal and external threat level based on several factors including:

- physical proximity to large populations,
- potential controversy on the part of the organization or individuals within the organization,
- the visibility to the public of the organization's mail handling center,
- the size and mail volume an organization receives, and
- the number of visitors coming in and out of the organization on a daily basis.⁷

USPS provides additional guidance on this subject. They suggest a key method to minimize risk to employees and the public is to centralize mail handling in a single location, and if possible, physically separate mail handling from the hub of an organization. Additionally, providing specialized training for mail handlers to spot potential problems increases both efficiency and safety.

Equipment to protect technicians during processing

There are four primary types of organizational mail handling configurations including off-site screening facilities or remote delivery sites, isolated on-site facilities, primary office locations with a secure mail facility and single room mail centers. Commercial carriers also have a variety of processing and handling options. Under each condition, DHS provides a series of minimum mail screening facility design recommendations. Some of these recommendations include:

- X-ray screening room with blast containment
- Separate HVAC system
- Negative pressure screening rooms or equipment
- Separate inbound and outbound mail processing rooms or areas
- Secure facilities or processing areas

For high risk facilities, USPS suggests additional layers of protection. These include:

- Bomb-detection equipment or a K-9 unit
- X-ray of all incoming mail with additional storage in containers until testing is concluded
- Using a "safe air" room for mail processing with monthly swab testing of the mail handling area
- Filtered exhaust hoods installed in areas where dust is generated (e.g., areas with high-speed, mail-sorting machinery)
- Installing air curtains in areas where large amounts of mail are processed
- Installing filters in the building's HVAC systems to capture aerosolized spores (if feasible)⁸

Additionally, the Centers for Disease Control (CDC), suggests all mail technicians use an appropriate level of personal protective equipment (PPE) depending on the level of risk. For mail center personnel in a low to medium risk facility the CDC recommends wearing a smock or similar covering, a NIOSH approved FFR, and Nitrile gloves. In cases where mail volume and risk is very low, handlers should use gloves, masks, smocks and protective glasses.

7 "Best Practices for Mail Screening and Handling Processes: A Guide for the Public and Private Sectors" Department of Homeland Security, last modified September 27, 2012, <https://www.dhs.gov/sites/default/files/publications/isc-mail-handling-screening-nonfouo-sept-2012-508.pdf>.

8 "Who Protects Your Mail? A guide to Mail Center Security," United States Postal Service, accessed March 17, 2017, https://postalinspectors.uspis.gov/radDocs/pubs/Pub166_01-13_PRINT.pdf.

How to spot a suspicious package

Properly trained mail center staff can help spot suspicious items protecting themselves and the wider organization. Along with training, standardized procedures add another layer of protection. A few precautions can save lives and injury. For example, if a letter or package looks suspicious, isolate it immediately and don't handle it any further. Don't open, taste or smell any of the contents and activate your emergency response procedure immediately.

Other key indicators can help mail personnel spot potentially dangerous letters or packages. These include:

- envelopes or packages sealed with excessive tape
- poorly handwritten or incorrectly typed address or missing return address
- envelopes or packages addressed to non-existent departments
- powdery coatings, oily stains, discolorations or strange odors
- restrictive endorsements such as "Personal", "Confidential" or "Addressee Only"
- excessive postage or mail that is inconsistent with the types of mail normally received

Dangerous Agents

Chemical: Chemical contaminants include nerve agents, blood agents, pulmonary (choking) agents, blister agents, industrial chemicals, and irritants. These substances come in the form of a solid, gas or liquid. They can be light weight or compressed into small containers and are difficult to detect until already released. Their impact is almost always instantaneous.

Biological: Biological contaminants are any substance involving a disease organism, such as smallpox, botulinum toxin, anthrax, and ricin. Large quantities of weaponized spores can be distributed using an ordinary envelope or by being aerosolized through something like a "bomb" enclosed in a flat parcel. Because of their small size and the usually high volume of dust common in most large mail centers, biological agents can go undetected under visual inspection.

Radiological/Nuclear: These threats include any substance designed to release radiation such as a "dirty bomb" or through exposure to radioactive material. Individuals exposed to radiation can suffer both immediate and long-term effects. Radiation particles (alpha, beta, and gamma) can be detected through technological screening.

Explosive: Both letters and packages can be used to deliver bombs with new explosive material and the availability of miniature components to initiate an explosion. Military explosives such as C-4 and detonation or "det cord," ammonium nitrate, and pentaerythritol tetranitrate (PETN)-based explosives are all available. Explosives have some specific characteristics that can help detect them including visual indicators such as wires, density and unexpected electronic components. Explosive substances also emit vapors that can also be traced by canine teams or electronic sensors.

Techniques to process suspicious mail prior to dissemination

In low to medium risk operations there are generally three steps for mail processing. In higher risk organizations, these steps may be done in differing orders with higher levels of security and more intense screening techniques. For low volume and low risk organizations, the mail processing procedures may include the following:

Pre-screening: The first step in processing mail is to check mail at the point of receipt. Depending on the volume and nature of the mail processing function, the return address on each package and envelope should be checked. If it is unrecognizable or doesn't exist, mail personnel may alert the organization's security office. Other initial visual inspection includes envelopes or packages addressed to non-existent departments, or packages that have powdery coatings, oily stains, discolorations or strange odors. Each should be treated with caution and according to best practice procedures.

Individual Examination: For mail that passes through the initial step or is of sufficient volume to preclude the first step, technicians should inspect and sort mail by hand. The number of people working at or near sorting areas where aerosolized particles may be generated should be limited. Mail centers that do not have negative pressure systems should have sealable plastic bags or other suitable containment systems available to enclose and isolate suspicious envelopes. Clear bags allow first responders and other security personnel to easily examine the parcel. Further, if an envelope or package has leaked any suspicious substance during handling covering and disturbing it as little as possible is a priority.

Specialized examination: When available, incoming mail and packages should be X-rayed for determination of risk. X-ray scanning systems are the most widely used technology to detect bombs and other dangerous items in mail and packages. X-ray screening effectiveness depends on solid training and alertness of the operator. If mail clears the x-ray screening process, it can then be sent through steps one and two. If x-ray equipment is not readily available, it may be used only when a suspicious package goes through the first two steps and is not cleared.

Disposal: Depending on the circumstances, each mail processing department should develop and deploy a standardized disposal system for mail and packages unsuitable for delivery. This procedure should follow all local, state and federal laws and guidelines that govern disposal of material that may be contaminated.

Places of risk

Any location where mail travels is at risk for potential exposure to CBRNE contamination. In 2016 alone, USPS inspectors responded to more than 5,000 incidents and delivered more 154 billion pieces of mail. UPS delivered 4.9 billion packages and documents in 2016 and FedEx moved more than 12 million shipments each business day. Packages and letters are shipped over land, air and sea, making processing stations, airports, and sea ports prime areas for contamination.

As noted earlier, organizations of all sizes are also at potential risk. From law enforcement agencies to corporate mailrooms, college campuses and local nonprofits, local, state and federal offices and retail establishments receive mail daily from a wide variety of places, people and businesses.

Equipment for examination

Purair® SafeSEARCH ductless fume hoods offer advanced carbon filtration technology, providing a safe, high performance alternative to conventional ducted fume hoods for preliminary package inspection. Ductless fume hoods are stand-alone enclosures that remove fumes, vapors and particulates from air drawn into the cabinet. They are self-contained and don't require venting to the outside, which means ductwork, HVAC and construction costs are eliminated. Additionally, many units are portable and can be placed in small areas or moved from one location to the next with minimal downtime and without filter changes.

These cabinets isolate and contain chemical vapors to prevent exposure through the release of contaminants into the surrounding work area. When paired with HEPA/ULPA filters they provide an additional layer of biological safety. These features offer a simple, yet effective additional layer of protection for mail handling staff.

The Purair SafeSEARCH ductless fume hood can help provide this additional level of safety in a variety of settings. The cabinet draws air into the work area by a negative pressure flow designed to protect the user. As mentioned earlier, DHS recommends mail and package processors consider using negative-pressure cabinets and filtered exhaust hoods in areas where dust is generated and initial containment is desired.

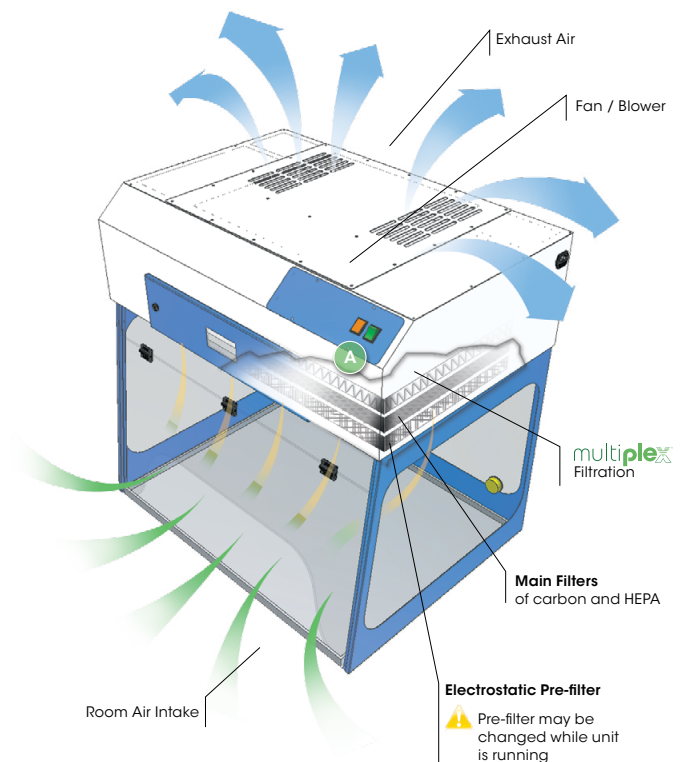
Mail handlers using the Purair SafeSEARCH ductless hood to process mail by hand will have additional protection because the cabinet airflow and face velocity protect users from incidental exposures to fumes. Clear back and side panels allow ambient light into the chamber so users can easily view contents. This is important when evaluating properly isolated suspicious envelopes or packages.

The Purair SafeSEARCH includes a Multiplex filter combination that captures chemical vapors, as well as particulates such as biological aerosols when paired with HEPA or ULPA filters.

Purair SafeSEARCH ductless fume hoods are available in 2', 3' or 4' wide cabinet sizes with internal heights of either 19" or 23.6". For larger applications, Air Science can build custom-engineered cabinets to accommodate walk-in access or roll-in carts.

Conclusions/Summary

The Purair SafeSEARCH ductless fume hood can provide an additional layer of protection for mail personnel, other employees and customers who use industry best practices for mail and package handling procedures. From organizations with single mailrooms or complex off-site mail processing centers, handlers can inspect packages in compact, portable ductless fume hoods to more safely process mail without additional risk to themselves or to the environment. Using best practice mail handling procedures, training expert personnel and providing the optimal level of protective equipment will increase the safety of mail processing operations of any size and in a variety of settings.



A. The main filter is easy to replace, no tools required. The filter clamps tightly against the filter gasket to prevent filter bypass and maintain filter integrity.

About the Author: Andre Chambre

Andy Chambre is the founder and CEO of Air Science, LLC and has been associated with the ductless fume hood industry for more than 25 years. He was formerly the US Vice President for Captair Labx and President of Astec Microflow US. He was named President of Filtco Corporation in 2003 and currently also serves as a Director of Air Science Technologies Ltd. in the UK. Mr. Chambre has written numerous articles on fume hood safety and assisted in the development of safety standards by serving on various committees such as the Canadian Standards Association subcommittee on fume hoods and the SEFA 9 Ductless Enclosures Committee.



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