



Investigation on the Dispersal Patterns of Contaminants in Letters

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Abstract

The assessment of how far contaminants may have spread when contaminated letters are handled and opened is an important first step in the response to such incidents. Such information assists first responders in identifying potentially exposed individuals and determining the need for environmental decontamination. In this investigation, envelopes were experimentally contaminated with a fluorescent tracer powder, opened, and the dispersion pattern of the contaminant detected. Results of the testing demonstrated that the contaminant can be spread both on the immediate and surrounding area, on the person, on fomites and into the air-handling system.

Introduction

The public health response to bioterrorism incidents involving possibly contaminated letters includes the identification of potentially exposed individuals and an assessment of the need for environmental decontamination.

How far could contaminants from handling and opening such letters spread? Should decontamination be limited to fomites in the immediate area (e.g., desks, chairs, floors, clothing, personal effects), or should it also encompass a much wider area within a common ventilation system? Can cross-contamination of remote areas occur through persons entering and exiting the immediately contaminated area?

The answers to these questions and the disper-

sion patterns of contaminants from handling and opening such letters are not known. Such information would enable responders to better define potentially contaminated areas and persons, and guide their decision-making in implementing an appropriate response. This report summarizes the findings of an investigation into the dispersion patterns from envelopes experimentally contaminated with a fluorescent tracer powder. The investigation was designed as a preliminary study and does not present rigorous quantitative data on the spread of contaminants.

Materials and Methods

Envelope testing was carried out at the Forensic Identification Laboratory, Ottawa-Carleton Regional Police Services (OCRPS) (Figure 1). Directional airflow, temperature, and humidity were measured in the room prior to and at the end of the experiment. The contaminant used was Redwop Fingerprint Powder (Brilliant Red). All six tests were performed during the experiment over the course of 8 hours.

Six envelopes were each preloaded with 3.4 g of powder and opened either by hand or with a standard letter opener as described in Table 1. Contamination was detected (qualitatively—no quantitative measurements were performed) in the immediate and surrounding areas (i.e., table, chair, floor), on the subject, and on the exhaust HVAC grilles using a UV light source. Background contamination in the laboratory was removed, and no visible powder was detected using the UV light source prior to com-

Figure 1
Diagram of Laboratory and Envelope-Opening Work Area

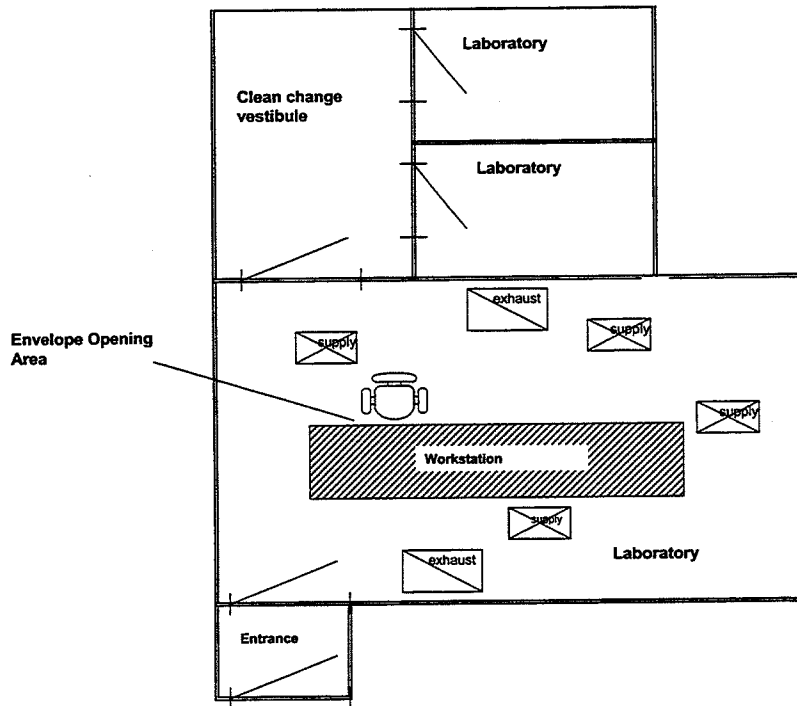


Table 1
Envelope Configuration and Method of Opening

Envelope	Size	Letter Present	Subject	Methodology
A	8½" x 11"	Yes	S. McLennan	By hand using right thumb, single letter removed and placed down on table. Subject stood up and backed away (filmed at table level).
B	8½" x 11"	Yes	M. Best	With letter opener, using right hand, towards body, letter not removed, envelope placed down on table. Subject stood up and backed away.
C	8½" x 11"	Yes	S. McLennan	With letter opener, using right hand, letter removed and placed down on table. Subject stood up and backed away.
D	9½" x 4"	Yes	S. McLennan	By hand using right thumb, letter removed and placed on table. Subject stood up and backed away.
E	9½" x 4"	No	M. Best and S. McLennan	Envelope handled in the presence of other files and papers which were in turn passed to Subject #2. Subject #2 moved 4 feet down to next work area on desk and opened file. Envelope subsequently opened by Subject #1 and brought over to Subject #2 who looked inside the envelope without touching it.
F	9½" x 4"	Yes	M. Best	With letter opener using right hand, towards body, letter not removed. Envelope placed down on table. Subject stood up and backed away.

mencement of the experiment.

Residual contamination was removed between each test and background contamination detected with UV light prior to the beginning of each test. Subjects donned clean coveralls, shoe covers, head covers, respiratory protection, and safety glasses prior to beginning each test and their background contamination levels were detected as well.

Results

The room temperature at the beginning and end of the experiment (six tests) measured 22.3°C and 22.4°C, respectively. The relative humidity at the beginning and end of the experiment measured 15.7% and 17.9%, respectively. Directional airflow in the room was away from and to the right of the chair at the table area where the letters were opened.

Letter A

Contamination was present on the subject's hands (heavy on thumb and fingers that opened envelope), arms, front chest area, back of shoulders, and feet. The table area (up to 8 feet to the right of the chair at the table), chair, floor, and table legs were all contaminated.

Letter B

Heavy contamination was present on the subject's front body, head, legs, back of the shoulders, and arms. An area across the chest was free of contamination, consistent with the positioning of the subject's arms when the letter was opened. The desk, chair, and floor were also contaminated.

Letter C

Contamination was present on the subject's hands, arms, front chest area, back of shoulders, and feet. The table area (over entire 16 feet), chair, floor, and table legs were all contaminated. Both exhaust HVAC grilles were also contaminated with powder.

Letter D

Contamination was present on the subject's hands (heavy on right thumb and finger), arms, front body, back of shoulders, head, and legs. There was minor contamination on the chair and floor.

Letter E

Contamination was present on the desk, papers, file folders, and pen prior to opening the envelope (contamination was concentrated at the corners of the envelope where it was leaking out). Some contamination was present on Subject #2's hands after receiving and opening the contaminated file folder and papers. After opening the envelope, Subject #1 and the desk were contaminated; Subject #2 standing 4 feet away was further cross-contaminated during this procedure. Subject #2 was subsequently heavily contaminated when the envelope was brought over and opened and closed by Subject #1 for Subject #2 to view inside.

Letter F

Gross contamination was present on the subject's right hand and desk below the area where the envelope was opened. Contamination was also present on the arms, front body, back of shoulders, legs, head, and glasses. The letter opener and desk were contaminated. There was minor contamination on the floor.

Conclusions

This investigation clearly demonstrates that when letters containing powdery contaminants are opened, the contaminant can be dispersed both on the immediate and surrounding area, on the person, on fomites (letter openers, files, papers, pens), and into the exhaust HVAC grilles. One of the tests also indicated that such envelopes do not necessarily have to be physically opened to generate contamination of the immediate area.

Potentially contaminated persons are not limited to those in direct contact with the envelope and/or its contents. Cross-contamination of individuals can occur through contaminated fomites, being in close proximity when such envelopes are opened, and viewing the contents of the envelope from a short distance.

The results presented give an indication of the dispersion patterns of contaminants from handling and opening letters. This preliminary study clearly demonstrates the need for further investigations and formal testing using representative contaminants.