RE-EVALUATION OF VENTILATION/FILTRATION SYSTEM FOR REVISED HAND-CULL STATIONS OF THE 010 CULLING SYSTEM

at

United States Postal Service
Processing and Distribution Center
Baltimore, Maryland

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Centers for Disease Control and Prevention
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SITE SURVEYED:	USPS Processing and Distribution Center, Baltimore, Maryland
SIC CODE:	4311
SURVEY DATES:	July 16, 2004
SURVEY CONDUCTED BY:	Keith Crouch, NIOSH Bryan Beamer, NIOSH
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Mention of company names or products does not constitute endorsement by the Centers for Disease Control and Prevention.

ABSTRACT

Researchers from the National Institute for Occupational Safety and Health (NIOSH) conducted an evaluation of a redesign of the Ventilation/Filtration System (VFS) developed for the United States Postal Service (USPS) mail processing equipment–the Hand-Cull stations of the 010 Culling System. The VFS was developed and installed by a private contractor hired by the USPS to reduce the potential for employee exposure to harmful substances that could be contained in mail pieces processed by the equipment. NIOSH was asked to assist the USPS in evaluating controls for this and other mail processing equipment after the 2001 terrorist attacks that used the mail as a delivery system for anthrax.

Evaluations were based on air velocity measurements and smoke release observations. Both tests were made to evaluate contaminant capture efficiency of a redesign of the VFS at the Hand-Cull stations of the 010 Culling System. The re-design of the Hand-Cull stations was carried out not only to keep the curtain out of the workers' faces but also to maximize the range of unimpeded motion.

The following recommendation and conclusion were based on the results from this report:

- It is recommended that the USPS encourage its workers to work at the Hand-Cull stations with the curtains down in order to optimize the effectiveness of the LEV to protect them from acts of bioterrorism.
- The performance of the VFS with the re-designed curtain is not appreciably different from the original configuration (114 fpm vs. 116 fpm).

INTRODUCTION

The National Institute for Occupational Safety and Health (NIOSH) is located in the Centers for Disease Control and Prevention (CDC), within the Department of Health and Human Services. NIOSH was established in 1970 by the Occupational Safety and Health Act at the same time that the Occupational Safety and Health Administration (OSHA) was established in the Department of Labor (DOL). The OSHAct legislation mandated NIOSH to conduct research and education programs separate from the standard-setting and enforcement functions conducted by OSHA. An important area of NIOSH research deals with methods for controlling occupational exposure to potential chemical and physical hazards.

The Engineering and Physical Hazards Branch (EPHB) of the Division of Applied Research and Technology (DART) has been given the lead within NIOSH to study and develop engineering controls and assess their impact on reducing occupational illness. Since 1976, EPHB (and its forerunner, the Engineering Control and Technology Branch) has conducted a large number of studies to evaluate engineering control technology based upon industry, process, or control technique. The objective of each of these studies has been to evaluate and document control techniques and to determine the effectiveness of the control techniques in reducing potential health hazards in an industry or for a specific process.

Researchers from NIOSH were requested to assist the USPS in the evaluation of contaminant controls for various mail processing equipment. These new controls are being installed to significantly reduce operator exposure to any potentially hazardous contaminants emitted from mail pieces during normal mail processing. This effort is driven by the 2001 terrorist attacks which used the mail as a delivery system for anthrax. NIOSH researchers have subsequently made several trips to postal facilities in the Washington, DC area and in Ohio to observe mail processing equipment in operation and to study the effectiveness of the newly designed controls.

The control evaluated in this report is a re-design of the VFS at the Hand-Cull stations of the 010 Culling System. This control was designed and installed by a USPS contractor to significantly reduce the potential for operator exposure to bacterial contaminants that could be contained in mail pieces processed by this equipment. This system was evaluated at the Baltimore, Maryland Processing and Distribution Center (P&DC) during a field survey that took place on July 16, 2004.

DESCRIPTION OF EQUIPMENT

The USPS 010 Culling System is comprised of 2 conveyor systems that size the collection mail brought to the P&DC into letters, flats (magazine size), and parcels. The first system is called the Dual Pass Rough Cull and the second is the Loose Mail Distribution System. The hampers of raw mail are loaded into the DPRC and LMDS. Flats and parcels are separated from the letter mail and sent to the appropriate areas of the facility for processing. The output of the LMDS sends letter mail to the next stage in its processing which is the cancellation equipment. The re-design of the VFS at the Hand-Cull stations of the 010 culling system consisted of placing cutouts in the curtain at the workers' breathing zone and

lowering the curtain between stations to try to maintain consistent total airflow between the 2 designs.

At the time of evaluation, the VFS for the 010 Culling System consisted of 2 separate air-handling/filtration units that provided exhaust for various locations of possible contaminant release. Air-handling Unit # 1 processed about 19,000 cubic feet per minute (cfm) which represented dirty filter conditions for the VFS. Air-Handling Unit # 2 processed about the same flow rate and serviced the primary areas of the DPRC. Each of these air-handling units was fitted with three stages of filtration composed of a pre-filter, a MERV 14 filter and a High Efficiency Particulate Air (HEPA) filter. Figure 1 is an overview of the 010 Loose Mail Culling System.

METHODS

SMOKE RELEASE

Apparatus
A smoke machine (Mini Fogger, Model F-800, Chauvet USA, 3000 North 29th Court, Hollywood, Florida, 33020) was used to visualize air movement in and around these systems.

Procedures
By releasing smoke at points in and around the Hand-Cull station with the VFS operating, the path of the smoke, and thus any airborne material released at that point, could be determined. If the smoke was captured quickly and directly by the VFS, it was a good indication of acceptable control design and performance. If the smoke was slow to be captured when released at a certain point, or took a circuitous route to the air intake for the exhaust, the VFS design was considered marginal at that point.

CAPTURE VELOCITY

Apparatus
A hot wire anemometer was used to measure air speeds at the Hand-Cull stations of the 010 Culling System (Velocicalc® Plus Anemometer, Model 8388, TSI Incorporated, P.O. Box 64394, St. Paul, Minnesota, 55164).

Procedures
To measure the velocities achieved by the control at critical points, the anemometer was held perpendicular to the flow direction at those points. Velocities were recorded at the Hand-Cull station of the 010 Culling System at sampling sites shown in figures 2 and 3.

RESULTS

Smoke

Smoke release observations indicated that for all configurations at each Hand-Cull station, smoke was eventually (within 3 seconds) entrained into the VFS. However, for configurations when the front panels were flipped up out of the way (B, D), smoke took more time (about 5 seconds) to become entrained into the ductwork of the LEV.

Air Velocity

Contaminant capture velocities, measured at the positions located on the diagrams in figure 2, for configurations A and C (re-design vs. original design/curtains down) were not significantly different and were all in excess of 100 fpm. However, contaminant capture velocities for configurations B and D (re-design vs. original design/curtains flipped up), were marginal and none exceeded 87 fpm.

RECOMMENDATIONS/ CONCLUSIONS

At the time of the survey, it was noted that workers frequently flip the curtains up so that there is no curtain on the front side of the VFS at the Hand-Cull stations. Therefore, testing was done on both curtain designs with the curtains up and down to characterize any significant differences in VFS performance. It is recommended that the USPS encourage its workers to work at the Hand-Cull stations with the curtains down in order to optimize the effectiveness of the LEV to protect them from acts of bioterrorism. The performance of the VFS with the re-designed curtain is not appreciably different from the original configuration (114 fpm vs. 116 fpm).

Figure 1: Schematic representation of the Ventilation and Filtration System

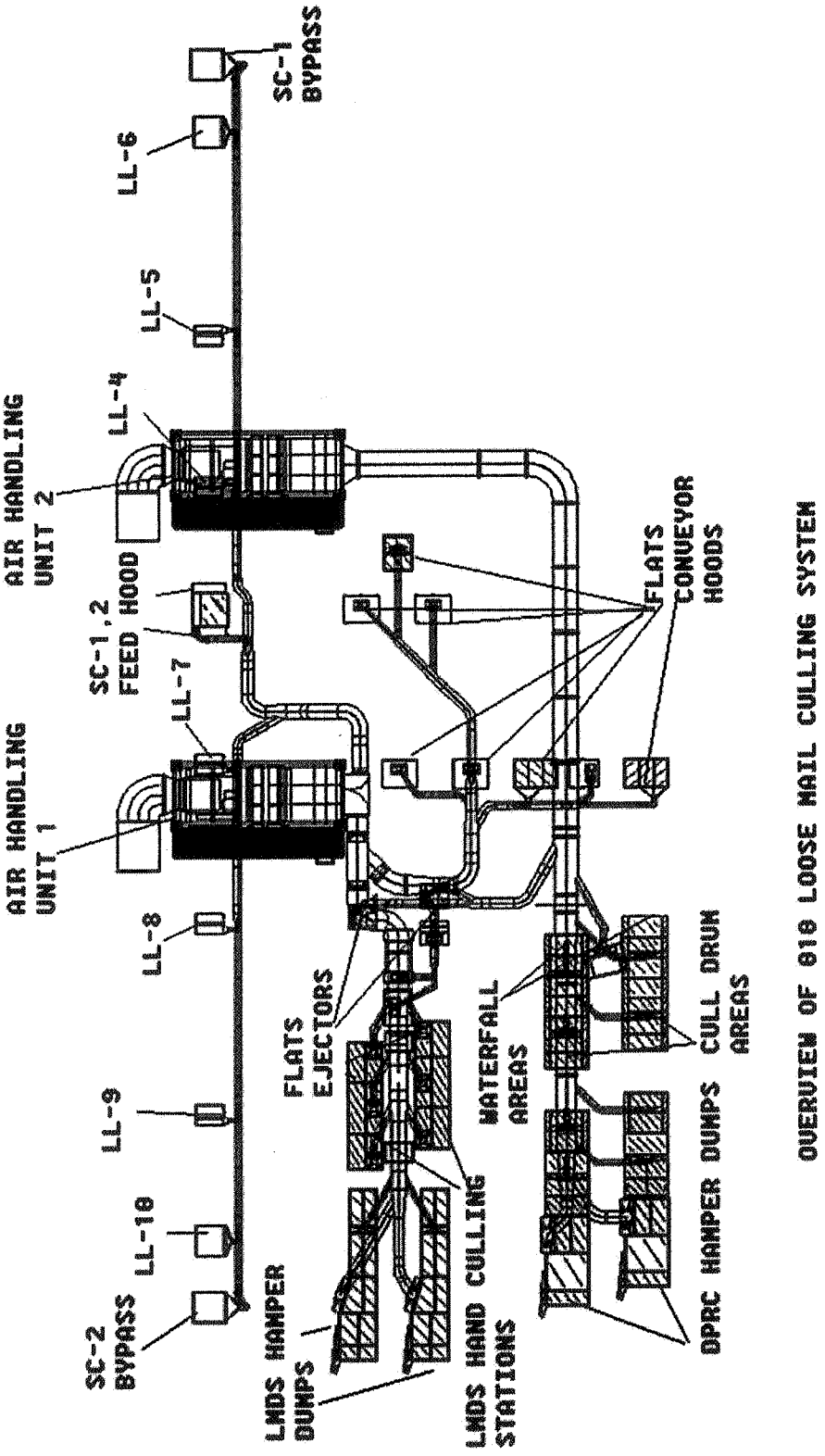

Figure 2: Location of testing points for modified curtain (configurations A & B)

(For configuration B, the entire front panel was effectively removed by being flipped up out of the way)

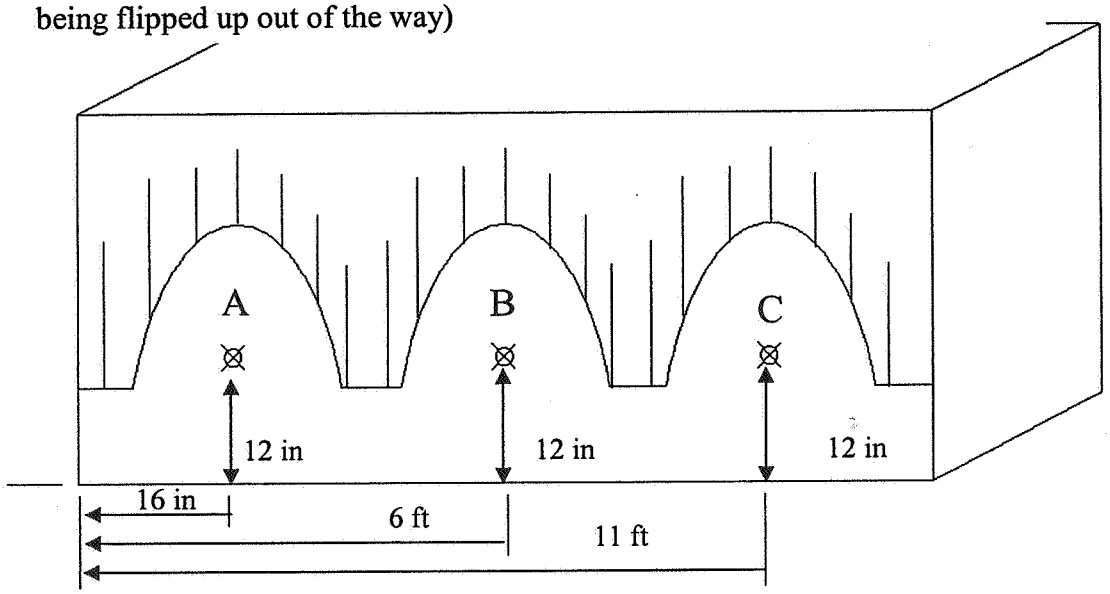

Figure 3: Location of testing points for unmodified curtain (configurations C & D)

(For configuration D, the entire front panel was effectively removed by being flipped up out of the way)

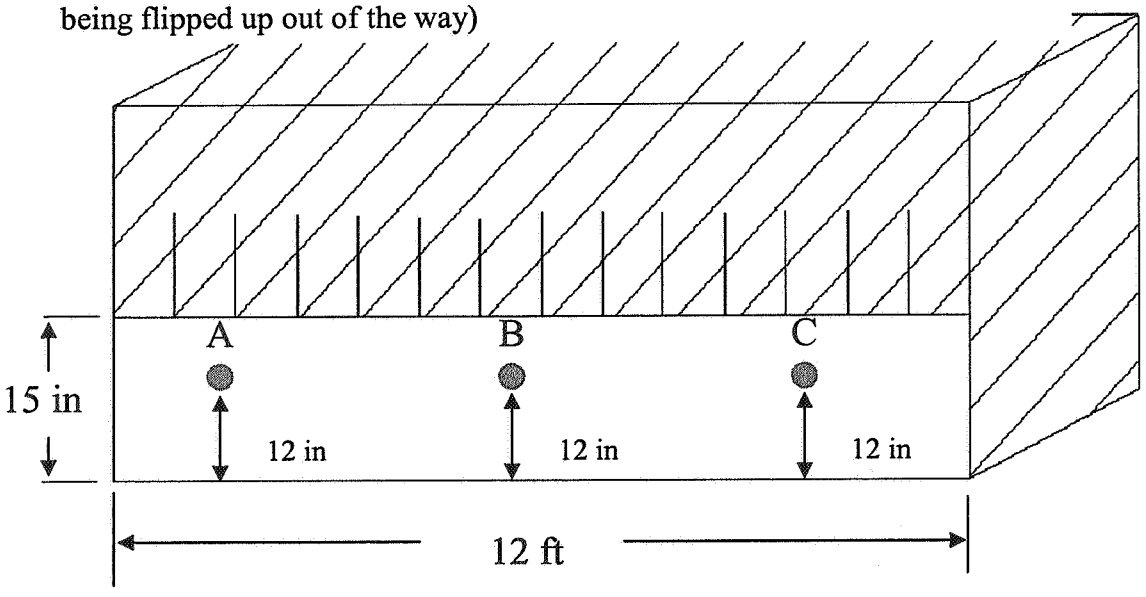

Table 1. Air Velocity Data.

AREA	CONTAMINANT CAPTURE VELOCITY (VALUES OF TRIALS IN FEET PER MINUTE)	GRAND AVERAGE
CONFIGURATION A, HAND-CULL STATION A	103, 121, 110	111
CONFIGURATION A, HAND-CULL STATION B	124, 139, 123	129
CONFIGURATION A, HAND-CULL STATION C	103, 93, 106	101
CONFIGURATION B, HAND-CULL STATION A	81, 101, 71	84
CONFIGURATION B, HAND-CULL STATION B	90, 96, 60	82
CONFIGURATION B, HAND-CULL STATION C	51, 49, 55	52

Table 2. Air Velocity Data.

AREA	CONTAMINANT CAPTURE VELOCITY (VALUES OF TRIALS IN FEET PER MINUTE)	GRAND AVERAGE
CONFIGURATION C, HAND-CULL STATION A	133, 106, 125	121
CONFIGURATION C, HAND-CULL STATION B	125, 111, 118	118
CONFIGURATION C, HAND-CULL STATION C	112, 106, 110	109
CONFIGURATION D, HAND-CULL STATION A	79, 73, 77	76
CONFIGURATION D, HAND-CULL STATION B	61, 51, 59	57
CONFIGURATION D, HAND-CULL STATION C	83, 75, 102	87