PRELIMINARY TESTING OF THE MODIFIED MAIL PASS AND BIOHAZARD DETECTION SYSTEM FOR THE VENTILATION AND FILTRATION SYSTEM OF THE AUTOMATED FACER CANCELLER SYSTEM

At

Siemens Postal Automation Facility
Arlington, TX

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SITE SURVEYED:	Siemens Postal Automation Facility Arlington, TX
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The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the National Institute for Occupational Safety and Health.

ABSTRACT

Researchers from the National Institute for Occupational Safety and Health (NIOSH) conducted a preliminary evaluation of the local exhaust ventilation at the delivery bins and a qualitative evaluation of the contaminant capture capabilities of the Biohazard Detection System (BDS) and Ventilation/Filtration System (VFS) for the Advanced Facer Canceller System (AFCS). This evaluation was made on September 26, 2006 at Siemens in Arlington, TX. The AFCS was being modified for the United States Postal Service (USPS) by Siemens to meet USPS requirements and where possible reduce the potential for employee exposure to harmful substances that could be contained in mail processed by the equipment. The ventilation system for the AFCS was designed to be used with a Biohazard Detection System (BDS) that samples and analyzes air from the AFCS to determine if a biohazard is present. NIOSH has been evaluating Ventilation / Filtration Systems (VFS) for the USPS as a part of the USPS Emergency Preparedness Plan since January 2002.

Evaluations were based on air velocity measurements and smoke release observations. Since the evaluation was only a preliminary test and Siemens was in the process of making additional modifications to the equipment, a full evaluation including sulfur hexafluoride (SF_6) as a tracer gas was not yet performed. The smoke release experiments showed that generally there is good capture by the VFS. Some interference by room air currents were noticed during smoke releases at the delivery bins. Capture of the smoke improved when temporary baffles were constructed to limit interference with room air currents. Smoke releases into the post flats extractor enclosure showed some smoke escaping when the BDS was exhausting into the enclosure. However, the enclosure performed well after the BDS exhaust was removed and the port was sealed. Air velocity measurements at all evaluated locations were above 100 ft/min.

Based on the results in this report, the following recommendations are made to further improve the control of potential contaminants by the AFCS ventilation and filtration system:

- There are areas at the letter delivery bins where contaminant might escape into the ambient atmosphere due to air currents in the general room air. This was shown by smoke release observations. Capture at this area was improved by adding temporary baffles. It is recommended that permanent baffles be installed.
- Smoke release observations showed poor capture in the area where the BDS exhausts into the post flats extractor enclosure. It is recommended that the BDS exhaust be relocated to exhaust manifold one to improve containment at the post flats extractor enclosure.
- All other evaluated areas appeared to be either well enclosed or adequately contained according to the smoke release and air velocity testing performed during this evaluation.

INTRODUCTION

The National Institute for Occupational Safety and Health (NIOSH) is located in the Centers for Disease Control and Prevention, within the Department of Health and Human Services. NIOSH was established in 1970 by the Occupational Safety and Health Act (OSHAct) at the same time that the Occupational Safety and Health Administration (OSHA) was established in the Department of Labor. 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 develop, evaluate, and document the performance of control techniques in reducing potential health hazards in an industry or for a specific process.

Since 2002, NIOSH has been evaluating controls that have been put in place by contractors hired by the United States Postal Service (USPS) to control the release of contaminants into the work area of postal employees. This report describes the partial evaluation of preliminary changes of the Ventilation/Filtration System (VFS) and the Biohazard Detection System (BDS) for the Advanced Facer Canceller System (AFCS) at the Siemens Postal Automation Facility.

BACKGROUND

Researchers from NIOSH were requested to assist the USPS and Siemens AG in the evaluation of additional modifications to controls for various types of mail processing equipment. These controls are being installed to meet current USPS requirements and where possible reduce operator exposure to any potentially hazardous contaminants emitted from mail during normal mail processing. This work is part of the continuing effort to evaluate and improve control technology installed on mail processing equipment since the terrorist attacks in the fall of 2001.

The controls evaluated in this report are the VFS and BDS for modifications made to the Advanced Facer Canceller System (AFCS) at the Siemens Postal Automation Facility in Arlington, Texas. The AFCS is being modified by Siemens to meet current USPS requirements and where possible reduce the potential for operator exposure to contaminants that could be contained in mail processed by this equipment. Changes to the equipment included a modification of the mail pass, the addition of pockets, changes to the feeder, and better enclosure of the equipment. Siemens estimated that 90% of the system remained unchanged from the previous AFCS configuration. This test served as a preliminary confirmation test to provide Siemens and the USPS with partial test data before additional changes to the equipment are made.

METHODS

Since 2002, the methodology used by NIOSH to evaluate the capture efficiency of the airflows in and around mail processing equipment has typically included tracer gas, smoke release observations and capture velocities. Since this evaluation was only a preliminary confirmation test and additional modifications to the equipment are planned, only smoke release and capture velocity methods were performed. A full evaluation including tracer gas methodology is planned after additional modifications to the AFCS are made. Mail was not running during this test since the equipment did not have all belts installed to operate with test mail. The test was conducted with clean filters in the VFS and adjustments were not made to simulate dirty filter condition. The BDS was not available during the time of the testing; therefore Siemens used a pump and metered the flow to simulate the 400 Lpm airflows at the BDS exhaust.

SMOKE RELEASE

Apparatus

A smoke machine (Mini Fogger, Model F-800, Chauvet USA, Hollywood, Florida) generated smoke allowing air movement in and around the system to be visualized.

Procedures

By releasing smoke at points in and around the delivery bins, post flats extractor enclosure, and BDS hood with the VFS operating, the path of the smoke, and thus any airborne material potentially 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

An anemometer was used to measure air speeds at the mail pockets, BDS hood, and near the enclosures on the AFCS (Velocicalc® Plus Anemometer, Model 8388, TSI Incorporated, 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 exhaust openings around the system. Air velocity measurements were made at each of the twelve delivery bin locations and at the upstream and downstream faces of the BDS. Each air velocity reported is the average of three instantaneous velocities taken over 10 seconds.

RESULTS

AIR VELOCITY MEASUREMENTS

Air velocity measurements taken at the delivery bins are shown in Table 1. All average velocity measurements at the delivery bin locations were greater than 100 ft/min. Average airflow measurements of room currents in the room at a location near the delivery bins were approximately 50 ft/min.

Air velocity measurements taken with the BDS exhaust simulated at 400 lpm were between 40 and 60 ft/min at the upstream face of the BDS hood. Air velocity measurements at the downstream face of the BDS hood were measured between 10 and 50 ft/min. It should be noted that the VFS air handling system was designed to have low capture velocities at the hood faces so as not to interfere with the proper function of the BDS for the AFCS.

SMOKE RELEASE OBSERVATIONS

Inside the BDS hood with exhaust simulated at 400 lpm:

- At all locations inside the BDS hood, most of the smoke appeared to be directed toward the intake to the BDS, although some smoke was captured by the VFS.
- At the downstream face, most of the smoke was captured by the BDS hood up to approximately one inch downstream of the hood where the majority of the smoke was captured by the VFS.
- At the upstream face of the BDS hood, smoke was entrained into the BDS hood within approximately two inches upstream of the hood.

Smoke release at the mail pockets:

- At the lower row of bins, smoke generally entered the VFS; however room air currents interfered to some extent with the smoke capture at the top row of bins.
- Temporary cardboard baffles were constructed to reduce the effect of room currents and additional smoke tests near the top row showed better capture by the VFS.

Smoke release at the post flats extractor enclosure:

- Significant smoke escaped through cracks in the post flats extractor enclosure while the BDS was exhausting into the enclosure. The escape was likely due to the increase in pressure and the high turbulent airflows introduced by the BDS exhaust.
- It is recommended that the BDS exhaust be relocated to exhaust manifold one and that the port be plugged in the post flats extractor enclosure.

CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are made as a result of the confirmation test of the preliminary modifications to the AFCS of the BDS/VFS air handling systems at the Siemens Postal Automation Facility in Arlington, Texas:

- There are areas at the letter delivery bins where contaminant might escape into the ambient atmosphere due to air currents in the general room air. This was shown by smoke release observations. Capture at this area was improved by adding temporary baffles. It is recommended that permanent baffles be installed.
- Smoke release observations showed poor capture in the area where the BDS exhausts into the post flats extractor enclosure. The BDS exhaust should be relocated to exhaust manifold one to improve containment at the post flats extractor enclosure.
- All other evaluated areas appeared to be either well enclosed or adequately contained according to the smoke release and air velocity testing performed during this evaluation.

Table 1: Air Velocity Measurements at the Delivery Bins

Lower Row Number	*Velocity (ft/min)*	*Upper Row Number*	*Velocity (ft/min)*
1	124	7	112
2	111	8	125
3	114	9	115
4	118	10	118
5	128	11	119
6	110	12	110