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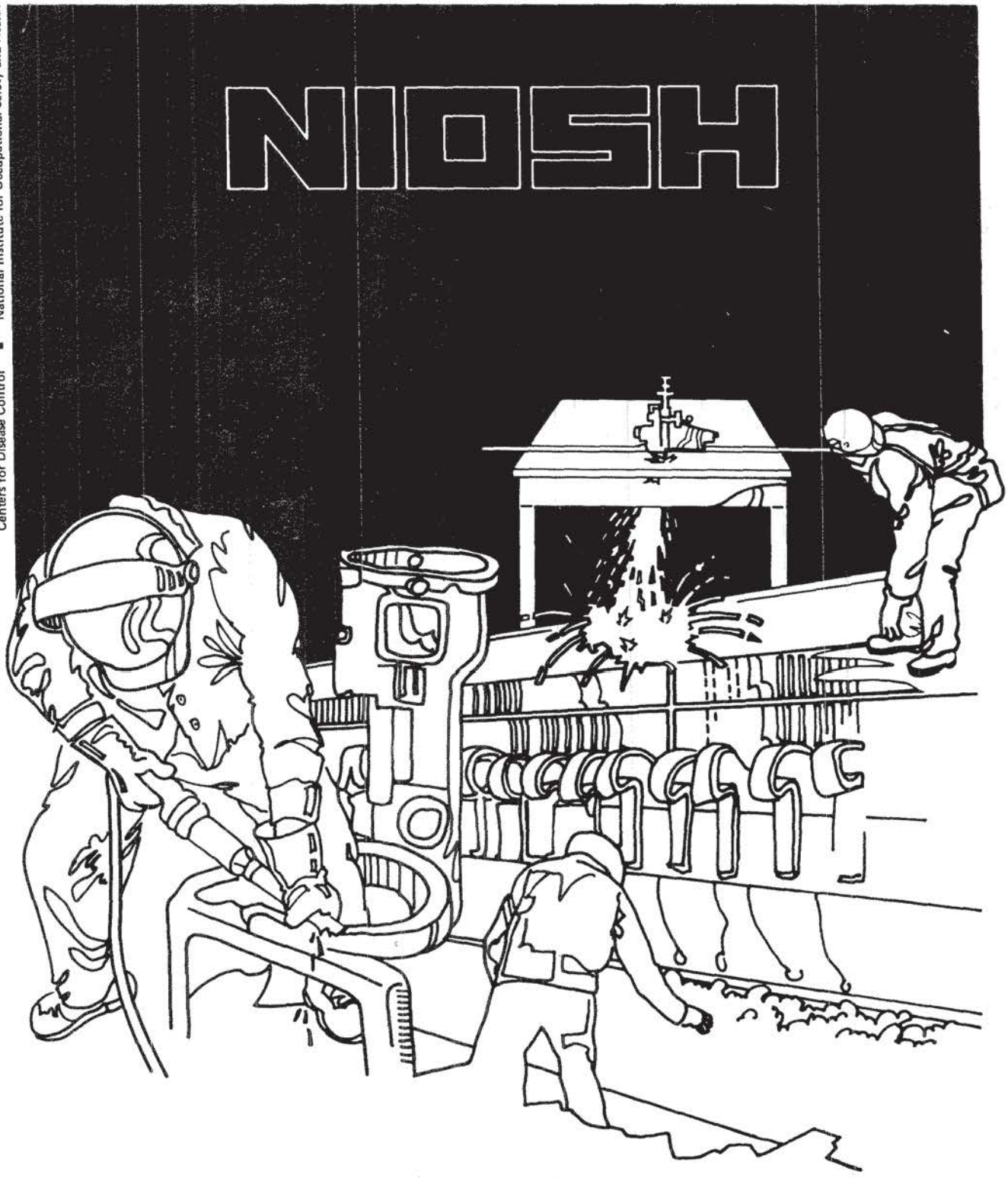

Health Hazard Evaluation Report

HETA 81-347-956
CINCINNATI BULK MAIL CENTER
CINCINNATI, OHIO

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

HETA 81-347-956
September 1981
Cincinnati Bulk Mail Center
Cincinnati, Ohio

NIOSH INVESTIGATOR:
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I. SUMMARY

On June 1, 1981 the National Institute for Occupational Safety and Health (NIOSH) received a request for technical assistance from management at the United States Postal Service, Cincinnati Bulk Mail Center (BMC) to investigate exposures to nuisance dust of employees working in the plant. On June 22, 1981, NIOSH was called by management to request that an evaluation of inbound dock employee exposure to unknown air contamination in trailer trucks containing sale catalogs be included on the original request.

NIOSH conducted a site visit on June 16, 17 and 22, 1981 to carry out an industrial hygiene evaluation. Twelve personal samples for respirable particulates, four area samples for respirable and total particulates, four area samples for organics, and one bulk sample of the sale catalogs were collected and submitted for analysis. Information was collected on work practices, and plant ventilation. Medical questionnaires were administered to two dock employees who were exposed in the catalog trucks. Ventilation measurements were made on the dust control system.

Analysis of personal and area samples showed that respirable particulate concentrations ranged from 0.06 to 0.26 milligram per cubic meter of air mg/M^3, and area total particulate concentrations were 0.06 to 0.29 mg/M^3, respectively. All exposures were significantly below both recommended criteria and OSHA standards. However, ventilation measurement showed that the dust control system in the sack shake out area was operating well below design specifications.

Medical questionnaires administered to two dock employees who worked inside the catalog trucks indicated symptoms that are typically caused by overexposure to organic vapors. Analysis of area organic samples taken inside the catalog truck showed that toluene and xylene were the major contaminants present. Other contaminants are reported as total hydrocarbons and include alkanes, cycloalkanes and olefins ranging from C_7-C_{11} and molecular weight 120 aromatics. Toluene levels ranged from 18 to 22 mg/M^3. Xylene levels ranged from 24 to 29 mg/M^3. Total hydrocarbon levels ranged from 26 to 29 mg/M^3. However, total hydrocarbon values should be considered approximations, since mineral spirits was used as a standard for quantitation.

Based on the environmental data collected during the NIOSH survey there was no health hazard at the Cincinnati Bulk Mail Center due to atmospheric particulate concentration. Health problems experienced by dock employees while unloading catalogs were determined to be caused by exposure to toluene, xylene, and minor amounts of other hydrocarbons which volatilized from the printing ink on the catalogs. Recommendations in the body of this report should serve to eliminate problems being experienced by the workers due to these organic exposure.

KEYWORDS: SIC 3579, Mailing Machines, Cincinnati Bulk Mail Center, particulates, toluene, xylene,.

II. INTRODUCTION/STATEMENT OF REQUEST

On June 1, 1981 the National Institute for Occupational Safety and Health (NIOSH) received a request for technical assistance from management at the United States Postal Service, Cincinnati Bulk Mail Center (BMC) to investigate exposures to nuisance dust of employees working in the BMC. On June 22, 1981, NIOSH was called by management to request that an evaluation of inbound dock employee exposure to unknown air contamination in trailer trucks containing sale catalogs be included on the original request.

Management reported that they had received numerous complaints and claims that the Cincinnati BMC has high levels of airborne dust which was causing lung problems to employees working at Cincinnati BMC. Two inbound dock workers became ill while working inside a truck trailer unloading sale catalogs. The symptoms they experienced were nausea, dizziness, and headache, which are characteristic of those typically caused by overexposure to organic vapors.

Interim environmental sampling results were submitted to the Postal Service in a letter dated July 10, 1981.

III. BACKGROUND

A. Description of Process and Workforce

The Cincinnati Bulk Mail Center receives various sized packages (anything shipped through the U.S. Postal System except letters) and routes them to their appropriate destination. Approximately 750 employees covering three shifts handle on the average of 49,200 sacks of mail, 149,000 parcels, and 19,272 non machinable parcels (NMP) per day. Non machinable parcels are those which because of their odd size can not be routed through the complex system of computerized belt lines and trams which carry the majority of the mail through the Center. The 750 employees at the BMC include clerical workers, machine operators, mail-handlers and maintenance workers. During the survey the Cincinnati BMC handled 57,505 sacks, 298,519 parcels and 19,160 NMP.

Six areas of the plant were evaluated during the survey. They include the sack spread, sack shake out, Pacu operation, inbound and outbound dock, and parcel sort machine processes. The sack spread operation involves the manual transfer of mail sacks from large mail crates to a tram car. The mail sacks are shook and neatly stacked onto 4' x 6' tram cars about 3 feet high. During the survey only one employee worked in sack spread for the entire day. However, the number of employees working on this operation fluctuates between 0 to 3 or 4 depending on the rate of mail being received on any one day.

In the sack shake out operation the loaded mail sacks are received via a conveyer belt. An operator manually connects the bottom of each sack to an automatic shaking machine which vibrates the sacks in an upside down position causing all the parcels to fall onto a belt line which takes them to a parcel sort machine to be sorted according to their zip code. The empty sacks are automatically dropped into a mail crate to be taken to the sack spread operation. There are four sack shack out machines each operated by three employees. During the survey only one of the machines was being used. The three employees alternate duties including attaching sacks to the shake out machine, picking out NMP, and repackaging damaged parcels.

The Pacu operation is an autmoatic process designed to dump parcels which are received in large metal crates (approximately 4' wide, 6' long and 6' deep) onto a conveyer belt to be transferred to the parcel sort machine. The Pacu operator stands at the Pacu control panel keeping watch over the system. The operator is also responsible for hand picking all NMP's off the belt line. These NMP's are sent to a special area to be handled.

The Cincinnati BMC has 106 docks, 32 are inbound and 72 are outbound. The dock workers manually unload sacks and parcels from the trailer trucks onto a conveyer belt to be routed through the system. The outbound process works much the same way as inbound. Parcels and sacks arrive on a belt at the appropriate dock where the dock workers manually load them into the trailer to be shipped out. The number of docks in use on any particular day depends on the mail load.

The parcel sort machine is a computerized system where parcels are received onto a large holding chute. An employee hand picks the parcels from the chute and positions them on the conveyer belt in a manner so that the zip code can easily be seen. As the parcel moves past the operator, he or she reads and punches the zip code of each parcel into the computer which subsequently controls the conveyer belt causing each parcel to fall into a specific slot on a master conveyer belt which will take it to the appropriate destination. There are four parcel-sort machines at the Cincinnati BMC. The number in use at any given time depends on the mail load for that day.

B. Environmental Controls

Each of the four sack shake machines has its own dust collecting system consisting of a 48" x 10" air intake port, a fan, and a dust collecting bag which is emptied once a month. Each fan has a 1,500 cubic feet per minute (cfm) capacity. Other areas surveyed in the plant relied on the general ventilation system for dust control which consists of 36 air handling units equipped with filters and 36 return air fans. Each air handling unit supplies 18,000 cfm recirculation air and 3,200 cfm make-up air for a total of 763,200 cfm to the 359,424 square foot BMC facility.

NIOSH approved dust respirators are provided for any employee who wants to use them at the BMC.

Air circulation devices are being installed in the dock areas to move air into the trailers that employees are loading and unloading.

IV. ENVIRONMENTAL EVALUATION DESIGN AND METHODS

In order to determine if the atmospheric particulate levels at the BMC pose a health hazard to employees, 12 personal samples for respirable particulate and 2 area samples for total and respirable particulate were taken. The samples were collected on preweighed Millipore M-5 PVC filters using DuPont P-2500 personal sampling pumps operating at 1.7 liters of air per minute (lpm). Filters were set in 10 mm nylon cyclone separators to obtain respirable particulate samples. Standard gravimetric procedures were used to analyze the samples.

Initial efforts to evaluate the exposure situation inside the trailer trucks loaded with sale catalogs went into determining what type of contamination could possibly exist. This was accomplished through a literature review and by administering medical questionnaires to affected employees and correspondence with their attending physician.

Four area charcoal tube samples for organic vapors were collected inside of a sealed trailer containing Sears sale catalogs using DuPont P-4000 sampling pumps operating at 0.5 lpm. A bulk sample consisting of one sale catalog was submitted for analysis along with the charcoal tube samples.

The charcoal tube samples were analyzed by desorbing in 1 mL of carbon disulfide and injecting into a gas chromatograph using a flame ionization detector.

A portion of the bulk sample was placed in a 50 mL vial, capped and heated in an oven at approximately 80°C for two days in an effort to simulate the condition inside the catalog trailer. A head space sample was taken with a gas syringe and analyzed under the same conditions as the charcoal tube samples.

V. EVALUATION CRITERIA

OSHA standards and recommended criteria, are levels of toxic substances which it is believed that nearly all workers may be repeatedly exposed to without adverse effects for a 40-hour work week in an occupational lifetime.

Nuisance dusts have been associated with very little adverse health effects on the lungs and do not produce significant organic disease, or toxic effects when exposures are kept under reasonable control. Extremely high concentrations may cause mechanical irritation to the eyes, ears, and nasal passages, and can dangerously reduce visibility. Indirectly irritation can result from the rigorous skin cleansing procedure necessary for their removal. The American Conference of Governmental Industrial Hygienists (ACGIH) recommended exposure limit is 10 milligrams per cubic meter of air for total particulates and 5 mg/M^3 for respirable particulates. The current OSHA standard is 15 mg/M^3 for total particulate and 5 mg/M^3 for respirable particulate. These criteria and standards are all based on 8-hour time-weighted averages (TWA).

Exposure to toluene and xylene have similar health effects. They have both been associated with irritation of the eyes, respiratory tract, and skin. Prolonged contact with the liquids may cause removal of natural liquid from the skin, resulting in dry fissured dermatitis. Acute exposure can result in central nervous system (CNS) depression which is typical of most organic vapors. Symptoms associated with CNS depression include headache, dizziness, fatigue, muscular weakness, drowsiness, incoordination, and skin paresthesias. NIOSH recommends an exposure limit for toluene of 375 mg/M^3 (8-hour TWA) and 750 mg/M^3 (10-minute ceiling). The OSHA standard for toluene is 750 mg/M^3 (8-hour TWA), 1125 mg/M^3 (15-minute ceiling) and 1875 mg/M^3 (10-minute ceiling). NIOSH recommended that the OSHA standard be reduced to 375 mg/M^3 as a result of a complete review of investigations into the narcotic effects of toluene. NIOSH believes that this reduction in the standard would prevent muscular weakness, incoordination, and mental confusion in exposed workers. NIOSH recommended criteria for xylene is 435 mg/M^3 (10-hour TWA), and 870 mg/M^3 (10-minute ceiling). The OSHA standard for xylene is 435 mg/M^3 (10-hour TWA).

VI. RESULTS AND CONCLUSIONS

Personal and area samples for respirable particulate ranged from 0.02 mg/M^3 to 0.26 mg/M^3. These sample results are all significantly below ACGIH recommended criteria (5 mg/M^3 respirable and 10 mg/M^3 total), and the OSHA standard (5 mg/M^3 respirable and 15mg/M^3 total). Analysis of total and respirable particulate showed that respirable is approximately 30% of the total particulate.

Questionnaires administered to employees who experienced illness after working inside trailers loaded with sale catalogs and information obtained from their attending physician revealed symptoms including weakness, dizziness, headache and nausea. The employees working in the truck began experiencing these symptoms after approximately 30 minutes

of exposure. These symptoms are a typical result of exposure to organic vapor. Odors inside the trailer were described as a strong printer ink or wood varnish smell. The Catalog trailer had no ventilation openings, was sealed almost a month before it arrived at the Cincinnati BMC, and was subjected to extreme heat during this period of time. These conditions probably caused organics to vaporize from the printer's ink on the new catalogs.

Analysis of the charcoal tube samples taken inside of a sealed catalog trailer showed that toluene and xylene were the major contaminants with minor amounts of alkanes, cycloalkanes, and olefin ranging from C_7 - C_{11}. Total hydrocarbons were quantitated using mineral spirits as the standard for quantitation and are listed in Table II. Total hydrocarbons include all hydrocarbons except toluene and xylene. Since mineral spirits patterns did not match the samples hydrocarbon pattern exactly, reported levels should be considered approximations. Toluene sample concentrations ranged from 18 to 22 mg/M^3 which is significantly below NIOSH recommended criteria (315 mg/M^3 TWA) and the OSHA standard (750 mg/M^3 TWA). Xylene concentrations ranged from 24 to 29 mg/M^3. These values are well below NIOSH recommended criteria and the OSHA standards, which are both 435 mg/M^3 TWA. Total hydrocarbon concentrations ranged from 26 to 29 mg/M^3. Analysis of the bulk sample (a Sears catalog) showed that toluene and xylene were the major volatile components matching the charcoal tube air samples taken inside the catalog trailer, thus confirming that the catalogs were the source of the organic vapor air concentrations inside the trailer.

Since the standard and criteria are based on 8 to 10 hour TWA's and the samples taken are short-term 100 liter area samples, the validity of the comparison between standards and actual measured values are questionable. This point along with the fact that total hydrocarbon concentrations in this report are approximations, could explain the reason that these measured organic concentrations are much lower than those normally associated with exposures resulting in symptoms such as those reported by exposed employees. Another possibility is that trailer #1 in which employees became ill while working actually contained higher concentrations of organic vapor than trailer #2 in which sampling was conducted, even though trailer #2 was immediately resealed after being opened, contained the same kind of catalogs, and the same odor as trailer #1. Also, the fact that trailer #1 was sealed for a longer period of time before being opened at the Cincinnati BMC could attribute to a possible organic vapor concentration difference.

It is also possible that measure value are reasonably representive of actual levels in trailer #1 and that the two employees who became ill while working inside trailer #1 were abnormally sensitive to organic vapor exposure. Therefore, they might experience symptoms at low levels such as those measured inside trailer #2.

Any of these factors or combination of them could account for the discrepancy between symptoms experienced and low organic vapor levels measured.

Results of ventilation measurement made on the sack shake out dust collecting system ranged from 180 to 530 cfm and are listed in Table III. These values are all considerably less than the design specification of 1,500 cfm for each unit. These units are running below design capacity probably because the dust collecting bags are not being emptied often enough.

VII. RECOMMENDATIONS

The following recommendations should reduce employee exposure to organic vapor and eliminate symptoms like those experienced by the two dock employees.

1. Ship all newly printed material in trailers which have ventilation ports.

2. If trailers containing newly printed materials are received that are sealed air tight, they should be allowed to air out over night before being unloaded, especially during the hot summer months.

3. The dust collecting systems on the sack shake out machines should be cleaned out on a regular basis and properly maintained so that they operate at design specifications.

VIII. REFERENCES

1. Occupational Safety and Health Standards for General Industry. U.S. Department of Labor (OSHA) Sec. 1910.1000 (1980).

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6. Encyclopedia of Chemical Technology, Vol. 7, Interscience Encyclopedia Inc. 1951.

IX. AUTHORSHIP/ACKNOWLEDGEMENTS

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X. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this Determination Report are currently available upon request from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days the report will be available through the National Technical Information Service (NTIS), 5258 Port Royal Road, Springfield, Virginia 22151. Information regarding its availability through NTIS can be obtained from the NIOSH Publications Office at the Cincinnati address.

Copies of this report have been sent to:

1. Cincinnati Bulk Mail Center, Cincinnati, Ohio
2. Vice President, Local Union 304
3. NIOSH, Region V
4. OSHA, Region V

For the purpose of informing the affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees, for a period of 30 calendar days.

TABLE I

PERSONAL AND AREA AIR SAMPLES FOR PARTICULATES
CINCINNATI BULK MAIL CENTER
CINCINNATI, OHIO
HETA 81-347

JOB/LOCATION	SAMPLE TIME PERSONAL SAMPLES	RESPIRABLE PARTICULATE mg/M^3
Sack Spread	8:35 AM - 3:03 PM	0.16 mg/M^3
Sack Spread	8:38 AM - 3:04 PM	0.07 mg/M^3
Sack Shake Out	8:45 AM - 3:00 PM	0.11 mg/M^3
Sack Shake Out	8:49 AM - 3:00 PM	0.8 mg/M^3
Pacu Operator	8:56 AM - 3:07 PM	0.13 mg/M^3
Inbound Dock	8:05 AM - 3:11 PM	0.19 mg/M^3
Inbound Dock	8:07 AM - 3:12 PM	0.17 mg/M^3
Inbound Dock	8:08 AM - 3:12 PM	0.26 mg/M^3
Outbound Dock	9:01 AM - 3:15 PM	0.13 mg/M^3
Outbound Dock	9:06 AM - 3:15 PM	0.18 mg/M^3
Outbound Dock	9:08 AM - 3:16 PM	0.19 mg/M^3
Parcel Sort Machine	8:19 AM - 3:20 PM	0.06 mg/M^3
	AREA SAMPLES	
Inbound Dock #5(T)*	8:55 AM - 3:24 PM	0.29 mg/M^3
Inbound Dock #5(R)**	8:55 AM - 3:24 PM	0.08 mg/M^3
Sack Spread (T)	9:30 AM - 3:25 PM	0.06 mg/M^3
Sack Spread (R)	9:30 AM - 3:25 PM	0.02 mg/M^3

*T - Total Particulate measurement done using a filter with no cyclone attached.
**R - Respirable Particulate measurement done on filter with cyclone.

ACGIH Recommended Criteria: (Time-weighted average 8-hour exposure)	10 mg/M^3 total 5 mg/M^3 respirable
OSHA Standard: (Time-weighted average 8-hour exposure)	15 mg/M^3 total 5 mg/M^3 respirable

TABLE II

AREA SAMPLES FOR ORGANICS
CINCINNATI BULK MAIL CENTER
CINCINNATI, OHIO
HETA 81-347

LOCATION	SAMPLE TIME	TOLUENE mg/M^3	XYLENE mg/M^3	TOTAL HYDROCARBONS mg/M^3
Sale Catalog Trailer				
Sample #1	8:15 AM-11:35 AM	18	24	26
Sample #2	8:15 AM-11:35 AM	22	29	29
Sample #3*	8:15 AM-11:35 AM	-	-	-
Sample #4	8:15-AM-11:35 AM	20	26	26

*The sampling pump malfunctioned for Sample #3 causing low results.

NIOSH Recommended Criteria: (Time-weighted average (TWA) 8-hour exposure)	375 mg/M^3	435 mg/M^3 (10 hour TWA)
OSHA Standard (Time-weighted average (TWA) 8-hour exposure)	750 mg/M^3	435 mg/M^3 (10 hour TWA)

TABLE III

VENTILATION MEASUREMENTS
SACK SHAKE OUT MACHINE DUST CONTROL SYSTEM
CINCINNATI BULK MAIL CENTER
CINCINNATI, OHIO
HETA 81-347

SACK SHAKE OUT MACHINE NUMBER	AIR FLOW THROUGH SYSTEM (CFM)
1	270
2	530
3	200
4	180

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