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NIOSH HEALTH HAZARD EVALUATION REPORT

HETA 99-0068-2784
United States Postal Service
Mail Processing and Distribution Center
Orlando, Florida

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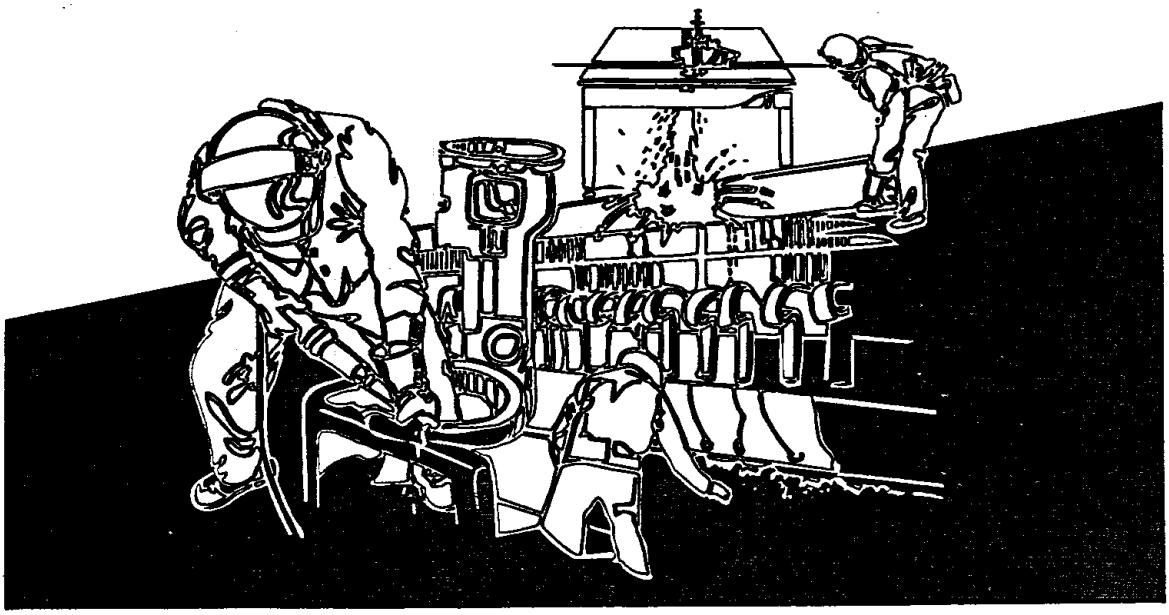

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
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PREFACE

The Respiratory Disease Hazard Evaluations and Technical Assistance Program (RDHETAP) of the National Institute for Occupational Safety and Health (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 (OSHA) 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 RDHETAP also provides, upon request, technical and consultative assistance 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. Mention of company names or products does not constitute endorsement by NIOSH.

ACKNOWLEDGMENTS AND AVAILABILITY OF REPORT

This report was prepared by of Dan Hewett, MS, CIH and Tina Gomberg, MS, of the Respiratory Disease Hazard Evaluations and Technical Assistance Program, Field Studies Branch, Division of Respiratory Disease Studies (FSB, DRDS). Field assistance was provided by Jo Stemple and Marty Pflock (FSB). Analytical support was provided by Thomas Jefferson (FSB). Desktop publishing was performed by Terry Rooney.

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Health Hazard Evaluation Report 99-0068-2784
United States Postal Service
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SUMMARY

In January 1999, the National Institute for Occupational Safety and Health (NIOSH) received a health hazard evaluation (HHE) request from employees of the United States Postal Service, Orlando to conduct an HHE at the Orlando Mail Processing and Distribution Center (OMPDC), Orlando, Florida. Employees requested an evaluation of worker exposure to paper dust, exhaust from trucks, and low oxygen levels, and an evaluation of the heating, ventilating, and air conditioning (HVAC) systems. The primary process / task associated with the paper dust exposures is machine mail sorting and the cleaning of machines by blowing paper dust from the machines (termed "blowout"). In the request, the employees listed concerns regarding inhalation exposures and the indoor environment resulting in dry throat/eyes/nose, migraines, sinus headaches, asthma, bronchitis, and pneumonia.

On March 16 - 18, 1999, NIOSH investigators performed a walkthrough survey of the worksite and met with an employee representative to discuss health issues related to worker exposure to paper dust, exhaust, and other concerns. Mail sorting machinery and HVAC systems were inspected, and records from the occupational safety and health program and from human resources were reviewed. Investigators performed quantitative area air sampling to determine inhalable dust concentrations, particle size distributions, and mite antigen concentrations. Of approximately 1093 manual clerks, small parcel and bundle sorters, flat sorting machine (FSM) clerks, optical character reader / bar code sorter (OCR/BCS) clerks, and mailhandlers, eight workers chose to participate in worker interviews with a NIOSH nurse and complete a questionnaire. The questionnaire was designed to elicit information about work history, and current upper and lower respiratory symptoms, systemic symptoms, work-relatedness of symptoms, smoking history, and past illnesses.

A total of 21 area airborne particle size-selective samples and 30 area airborne inhalable particulate samples were collected and analyzed to characterize dust concentrations and particle size distributions. Six area airborne particulate samples were collected and analyzed for mite antigen.

The exposure limit recommended by the American Conference of Governmental Industrial Hygienists (ACGIH) for inhalable particulates not otherwise classified (PNOC) was not exceeded.

Engineering controls observed at the loading dock were considered effective in addressing the issue of exposure to vehicle exhaust. No oxygen-depleting conditions were observed at the plant, and symptoms of oxygen depletion were not evident. Overall, the HVAC systems were in good mechanical condition. In

terms of assessing ventilation, there are no minimum outdoor air flow guidelines specifically for the light industrial environment.

On the basis of environmental data and information gathered from employee interviews, NIOSH investigators did not find clear evidence that employee symptoms were caused by exposure to mite antigen or paper dust. The results of the environmental dust sampling helped to characterize the concentration of dust and size distribution of dust in the plant and office environment but cannot address the health concerns with certainty.

The published literature on paper dust provides little, if any, guidance on the likely effects of post office paper dust since: 1) the exposures occurred in paper-making plants where the nature of the exposure was likely to be very different to that in mail handling facilities, and 2) the dust levels in paper-making plants were considerably higher than seen in this facility.

From this and other on-site evaluations of postal facilities, we conclude that paper dust blowout involves relatively short-term, elevated particulate concentrations in the areas immediately surrounding blowout. Most of the particulate settles quickly and is in the inhalable range (less than 100 microns in aerodynamic diameter). Blowout aerosolizes contaminants that otherwise would not be inhaled, including paper dust containing chemicals associated with paper manufacturing or recycling, microbiological components of the dust, and perhaps rubber sheared from machine belts. If performed carelessly, blowout can aerosolize floor dusts and paper dust. Conclusions regarding the link between dust exposures and health effects are limited since the dust is a mixed dust and not simply paper dust. Given that most of the mass of particulate aerosolized due to blowout will likely deposit in the upper respiratory tract (URT), aggravation of symptoms in this area would be plausible due to exposure to blowout dust. The aggregate questionnaire data suggests work-relatedness, and the association of symptoms with blowout suggests aerosolized particulate as an etiologic factor. Symptoms appear to be mostly irritative in nature, with some workers experiencing relief from symptoms after leaving the work place. Allergy, or the increased susceptibility to irritants that is often associated with allergy, can be a predisposing factor for many individuals.

Keywords: SIC 7331 (Mailing service), Paper Dust, HVAC, Mail Handling, Mail Processing, Mail Sorting, Bulk Dust, Particle Size, Dust Mite, Inhalable Dust, PNOR, PNOC

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INTRODUCTION

On January 7, 1999 the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation (HHE) from employees at the United States Postal Service, Orlando Mail Processing and Distribution Center (OMPDC), Orlando, Florida (hereafter referred to as the "plant"). The plant receives, sorts, and prepares mail for delivery.

The request listed adverse health effects which included dry throat/eyes/nose, migraines, sinus headaches, asthma, bronchitis, and pneumonia. High paper dust concentrations; exhaust fumes from trucks; inadequate heating, ventilating, and air conditioning (HVAC); and low oxygen levels were listed as factors in the work environment believed to contribute to health hazards. It was stated that about 700 workers are possibly exposed, including mail processors, mailhandlers, and clerks. The primary process / task associated with the paper dust exposures is machine mail sorting and the cleaning of machines by blowing paper dust from the machines.

In response to this request, NIOSH investigators (industrial hygienist, nurse, engineer, and technician) performed a walkthrough survey on March 16 - 18, 1999. Mail sorting machinery and HVAC systems were inspected, and records from the occupational safety and health program and from human resources were reviewed. Interviews were conducted among employees who wished to be interviewed. Quantitative area air sampling was performed to determine inhalable dust concentrations, particle size distributions, and mite antigen concentrations.

The purpose of this report is to provide observations from the site visit, report the results of the environmental and medical assessment, and offer conclusions and recommendations based on observations, worker interviews, and measurement results. Some of the recommendations are drawn from our experience in addressing similar HHE requests at plants in Omaha, Nebraska and Tampa, Florida. This is the final report of this NIOSH safety and health evaluation.

BACKGROUND

The plant is located in an industrial park near the Orlando International Airport, Orlando, Florida. The building is a single story steel frame and concrete structure constructed in 1980. The building contains loading docks, mail sorting machinery, administrative offices, a post office, and conveyors for transporting packages and trays filled with letters. The plant receives, sorts, and ships packages and letters. The plant is a large, open bay with a 25 foot ceiling and is designed for mail processing. The plant and office floor plan is shown in Figure 1. The plant floor contains a cafeteria, restrooms, maintenance areas, offices, ceiling-suspended conveyors, and HVAC ducts and diffusers. Mezzanines about 15 feet above the plant floor house several HVAC systems that ventilate the plant floor.

The plant has approximately 1093 workers throughout three work shifts referred to as Tour 1 (363 workers), 11:00 p.m. - 7:00 a.m.; Tour 2 (271 workers), 7:00 a.m. - 3:00 p.m.; and Tour 3 (459 workers), 3:00 p.m. - 11:00 p.m. The plant primarily employs mailhandlers, mail processing machine operators, parcel post distributors, express mail service clerks, air mail records processors, distribution clerks, optical character reader/bar code sorter (OCR/BCS) operators, mail processors, flat sorting machine (FSM) operators, and maintenance workers. Major categories of workers and the number in each group (all tours) are as follows: manual clerks (482), small parcel and bundle sorters (40), FSM clerks (166), OCR/BCS clerks (141), and mailhandlers (264).

The larger HVAC system air handlers are single-zone, constant volume heating and cooling-coil equipped units. Outdoor and return air is filtered by roll-type filters or framed filters composed of spun synthetic material of relatively low efficiency (about

30% efficiency, dust spot testing method). Maintenance workers have annual and semi-annual maintenance schedules for HVAC systems and chillers.

Maintenance workers clean readers and sorters to keep paper dust from inhibiting the flow of mail through the machines and clean paper dust from optics to prevent malfunctions. Maintenance work is conducted during all tours; however, most maintenance is performed on Tour 2 (7:00 a.m. to 3:30 p.m.) when lower mail volume allows greater access to mail sorters / readers for routine cleaning. Sorter and reader cleaning (hereafter referred to as "blowout") procedures require workers to open machine panels and vacuum as many interior and exterior surfaces as possible before reversing the flow of the vacuum cleaner to use the blown air to push paper dust out of the machines. Blowouts last about 20 minutes and are generally scheduled once every 24 hours of machine operation. According to maintenance personnel, compressed air is used for blowouts on a limited basis since it can be harmful to machine bearings. Compressed air is used at a maximum of 30 pounds per square inch (psi) or less to prevent skin injury from the airstream. Maintenance workers perform either full machine blowout or a partial blowout, which is primarily used if it is necessary to keep the machine optics clean in-between full blowouts. Workers performing blowouts wear goggles and a filtering facepiece respirator.

Some particulate is collected by air filtration units intended for dust control. These small stand-alone units are equipped with low efficiency roll-type filter media. A few of these units are suspended from the ceiling.

METHODS

Environmental

Inspections were carried out in the loading dock to determine the probability that outdoor air from the loading dock would mix with the conditioned indoor air of the plant. Inspections were made to find a plausible cause for decreased oxygen levels.

Since mite antigen had been a component of airborne dust at a similar facility in Tampa, Florida, mite antigen analysis of dust samples in the Orlando plant was of interest. The symptoms associated with mite antigen include nasal and ocular itching, rhinorrhea, sneezing, shortness of breath, wheezing, and productive cough. Mite antigen exposure was explored as a cause for certain health effects reported in the Orlando plant, including sinus headaches and asthma.

Particulate samples were collected to determine if dust concentrations on the plant floor were elevated compared to particulate in the office area of the plant. Particle size-selective sampling was performed since the fraction of inhaled aerosol depositing in different regions of the respiratory tract can be used to help assess the severity of exposure. The quantity of particles depositing in certain regions of the respiratory tract may help explain why health effects are largely concentrated where a majority of particle deposition occurs. Typically, particles are "inhalable" if they deposit anywhere in the respiratory tract from the nasal passages to the lowest (deepest) lung (the "pulmonary" region). The "thoracic" fraction (about 10 micrometers or less in aerodynamic diameter) deposit below the nose and mouth, in the lower region consisting mainly of the trachea and conducting bronchi and bronchioles. The "respirable" fraction are those particles collected in the lowest region; particles not captured in the nose, mouth, or thoracic region.

In addition, air handlers were inspected to determine if outdoor air was entering the ventilation systems and to assess if the systems might be dispersing some contaminant originating in some part of the plant or within the air handlers themselves.

Particulate and mite antigen samples were collected from nine locations in the plant (see locations 1 - 9, Figure 1) and one location in the office area (location 10, Figure 1). Sampling stations were near and far

om blowout operations. Sampling occurred during lowout. Blowouts occur primarily in locations 1, 2, , 5, and 8 (see Figure 1).

)n March 17, 1999, NIOSH investigators reviewed IVAC maintenance records and inspected 15 IVAC systems which service the plant and offices. The inspections consisted of a brief visual ssessment of filter seating, linkages, dampers and ctuators, dust and insect accumulation, condensate lrainage, mold or slime contamination, chemical storage within air handler rooms, and outdoor air ntake positions and screening.

)n March 17 - 18, 1999, NIOSH investigators erformed quantitative area air sampling in the plant nd office areas to assess the particle size listribution and inhalable dust concentrations. Area particle size distribution samples and inhalable dust samples were collected for approximately 7.5 hours. Particle sizing was performed by 8-stage Anderson Marple 298 impactors with impaction grease coated Mylar® substrates at a calibrated flow rate of 2.0 liters per minute (L/min). Inhalable dust samples were collected by IOM samplers at a calibrated flow rate of 2.0 L/min.

From March 16 to 18, 1999, area airborne dust samples were collected for mite antigen analysis: five from the plant (locations 2, 4, 5, 6, and 8, Figure 1) and one from the office area (location 10, Figure 1). In order to collect sufficient dust mass, dust was collected continuously for approximately 60 hours with open face cassettes onto 37 millimeter (mm) polyvinyl chloride (PVC) 0.45 micrometer (μm) pore size filters attached to air pumps calibrated at 30 L/min. Dust samples were analyzed by enzyme immunoassay for the mite antigens *Dermataphagoides pteronyssinus* (Der p I) and *Dermataphagoides farinae* (Der f I).

Medical

NIOSH researchers conducted interviews with individuals who had felt they had experienced respiratory symptoms in the workplace. Interviews were facilitated by plant-wide announcements, and by union representatives who helped identify workers with respiratory complaints. Workers who were interviewed completed a questionnaire regarding their experience with respiratory symptoms associated with dust exposure. In addition to interviews, entries into the plant medical unit annual logs from 1994-1999 were reviewed.

See Appendix 1 for Evaluation Criteria.

RESULTS

Environmental

The following are the results of observations and environmental measurements that were made in an effort to determine the potential for the plant to cause adverse health effects listed by the requesters. The requesters listed insufficient ventilation, high airborne paper dust concentrations, truck exhaust, and low oxygen levels as environmental deficiencies.

Truck Exhaust

Engineering controls observed at the loading dock are likely to prevent exhaust from entering the indoor plant airspace. The controls include air curtains in the loading bay and a double set of automatically closing garage-type doors that seal the loading dock from the plant. These controls were functional at the time of the walkthrough survey. As long as these controls are functional, it is unlikely that significant exposures from vehicle exhaust will occur in the plant from the loading dock. As an added precaution, carbon monoxide (CO) sensors were installed next to the bay doors to help alert staff to hazardous concentrations of CO. In addition, truckers are required to shut off engines after backing to the dock. These controls were considered effective in addressing the issue of overexposures to vehicle exhaust.

Low Oxygen Levels

Oxygen-deficiency is often associated with confined spaces, not ventilated buildings. Typical reasons for oxygen depletion include chemical reactions where oxygen is consumed, displacement of oxygen by other gases, and adsorption of oxygen by surface chemistry.[1] No oxygen depleting conditions were observed at the plant, and symptoms of oxygen depletion were not evident.

Air Handler Inspections

The results of the HVAC inspections performed on March 17, 1999, are presented in Table 1.

Overall, the HVAC systems were in good mechanical condition. Return and supply ducts of the air handlers contained a light dust load which was considered normal and not excessively dusty. Most outdoor air dampers were functional; at least three units had dampers that were closed. Cooling coils were not in full operation at the time of the inspection therefore, an assessment of cooling coil condensate pan drainage could not be performed. Condensate drain pans in two units contained a layer of grey or black slime. Chemical pads designed to leach biocide into the drain pan water were observed. Drain pan surfaces appeared to be insulated and therefore would be challenging to properly clean and disinfect. Although a storage area was noted in the return air plenum, the materials were not considered to be an emission hazard. Air filters were in good condition.

Particle Size Distributions (Gravimetric)

Total dust concentrations collected by the sampler, and estimates of respirable and thoracic dust concentrations by location, are presented in Tables 2, 3, and 4 (see Methods for definitions).

Table 2 presents the data from Tour 3, Table 3 presents the data from Tour 1, and Table 4 presents data from Tour 2 [see Figure 1 for sample locations (1 - 10)]. The average of the plant measurements is listed as well as concentrations measured in the office locations (all in bold type).

Out of 30 samples (10 per shift), 21 had collected a sufficient amount of dust to allow particle size distribution calculations. In the plant, the tour average concentration of respirable dust ranged from 0.02 to 0.03 mg/m^3. The tour average concentration of thoracic dust was between 0.04 to 0.05 mg/m^3. The data in Tables 2 - 4 illustrate that dust concentrations in the plant were similar to the office environment.

Figure 2 contains graphs of mass fraction per diameter interval versus particle diameter to illustrate the particle size distribution by location for the 21 valid samples. The particle size distributions indicate that in most areas of the plant (samples from locations 1 - 9) mass fraction increases from about 6 to 20 μm and decreases from 20 to 50 μm. This pattern is similar to distributions measured in the office area (location 10). One exception is plant Location 9 during Tour 1 which showed a distinct increase in thoracic (about 10 to 30 μm in aerodynamic diameter) and larger inhalable aerosols (30 μm and larger). This region is close to manual casing and FSM clerks.

Inhalable Dust Concentrations

Inhalable dust (up to 100 μm) concentrations collected from areas 1 - 10 are presented in Table 5. Concentrations are based on 8-hour time-weighted average (TWA) exposures in milligrams of dust per cubic meter of air (mg/m^3). Exposures during sampled periods were judged to be representative of exposures during unsampled periods. Dust concentrations determined over the course of Tours 3, 1, and 2 did not exceed the American Conference of Governmental Industrial Hygienists (ACGIH) exposure limit (10 mg/m^3) for inhalable particulates not otherwise classified (PNOC, see Appendix 1). The average of the plant measurements (by tour) is listed as well as concentrations measured in the office locations (all in bold type). Tour average inhalable dust concentrations in the plant ranged from 0.56 to 0.86 mg/m^3. The data in Table 5

illustrates that inhalable dust concentrations were similar to those measured in the office environment.

Airborne Microbial Sampling

No airborne mite antigen (Der p I or Der f I) were detected above the limit of detection (0.021 micrograms (μg)/sample Der p I; 0.009 μg/sample Der f I) in any of the five plant and one office locations.

Medical

Worker Interviews

During the site visit, a small number of workers participated in a 30-minute questionnaire (see Appendix 2). Out of a work force of approximately 1075 mail handlers, clerks, maintenance, and other workers, eight workers were administered the questionnaire. This population represented less than 1.0% of the total work force and was not randomly selected. Therefore, the sample cannot be considered representative of the work force as a whole.

The questionnaire was administered by a single interviewer. It was designed to elicit information about current upper and lower respiratory symptoms, systemic symptoms, work-relatedness of symptoms, smoking history, and past illnesses. Questions about department, job, and machine assignments were open-ended.

The ages of the eight respondents ranged from 45 to 62, with a mean age of 55 years. Six were male. One of the eight respondents was a current smoker; six respondents had smoked for at least a year during their lifetimes. All of them worked in the production area in the center of the plant. Respondents performed various job tasks such as mail handler, electronics technician, mail sorter, manual casing/sorting, letter distribution clerk, and mail processor.

Workers were questioned with regard to the presence of symptoms occurring more than once a week during working hours at the plant. Two of the respondents reported being completely asymptomatic, while a third respondent reported no upper or lower respiratory complaints and only rarely experiencing "flu-like" symptoms (which they attributed to contracting influenza). Three workers reported that they experienced nasal symptoms (irritated, stuffy, or runny nose), and one reported irritated eyes. Two reported irritated throat and cough; one reported productive cough. Five reported flu-like symptoms (fevers, aches, tiredness) with varying degrees of frequency, three reported wheezing, two were bothered by tightness in the chest, and two reported that they were short of breath more than once a week either while at work or home. In total, four respondents reported one or more of the chest symptoms: wheezing, chest tightness, or shortness of breath.

One respondent felt that symptoms were worse at work. This worker felt better on days off. When returning to work, symptoms worsened. A second respondent felt better after work. The third respondent had a cough which worsened after work, and as the week progressed. However, symptoms lessened after days off or when on vacation. All eight respondents felt their symptoms worsened during blowout.

One of the respondents reported physician-diagnosed asthma with onset three years after starting work at the plant. Two respondents had bronchitis, hay-fever/nasal allergies, and sinus trouble. One reported bronchitis, and one reported sinus trouble.

Quality of life questions were asked to determine if generalized feelings of dissatisfaction might influence perception of symptoms by severity or number of symptoms. Six of the respondents rated their quality of life as very satisfactory, the highest rating.

Orlando Medical Unit Reports

The medical unit annual logs from 1994 to 1999 were reviewed for respiratory symptom-related

visits. These were found under the category "Non-Occupational Illness- Respiratory (Allergy/Coryza)" and totaled by year for each tour of duty. Additionally, the sub-category "Headache" was included in the totals. The respiratory symptom-related medical unit visits were divided by the total number of medical unit visits per year. Table 6 presents these data for each year and tour of duty. The data provides a rough description of the respiratory symptom-related visits as compared to the total number of visits.

The medical unit data showed respiratory symptom-related visits were 29% of the total for fiscal year (FY) 1994, 23% for FY 1995, 17% for FY 1996, 16% for FY 1997, and 21% for the first six months of FY 1999 (9/98 - 3/99). The percentage for FY 1998 was 10%; data were only available for Tours 1 and 2.

The data in Table 6 were collected as a indicator of overall respiratory complaints and to assess the variation in the number of complaints from tour to tour, and year to year. Of note is the appearance of a general decline in respiratory-related medical unit visits from 1994 through 1997, and then the appearance of an increase in the first six-months of 1999.

Accident and Illness Reports

The District Office also performed a search of the Human Resources Information System for occupational illness cases where a CA-2 (Federal Employee's Notice of Occupational Disease and Claim for Compensation) was submitted to the Office of Workers' Compensation Programs. The data was searchable from October 1, 1996, through April 13, 1997. The Central Florida District, covering 40 postal facilities, had 793 injury and occupational illness (CA-2) cases during that period. A search for case codes found one classified under "disease of the lung" and two under "respiratory agents."

DISCUSSION

Paper Dust Exposures

There is some evidence that sinusitis can be induced or exacerbated by occupational exposures to dusts. A possible mechanism is the impaired clearance of mucous from the nasal passages as a result of swelling of the nasal mucosa secondary to allergic or irritant rhinitis.[2] One study revealed an association between an increased rate of upper respiratory symptoms and exposures to various types of non-specific occupational dusts. Interestingly, this study also showed a higher prevalence of upper respiratory symptoms in never-smokers than in current smokers.[3]

Mill workers exposed to paper dust during its production had more upper respiratory symptoms (throat irritation, nasal crusts), more cough with phlegm, and increased prevalence of asthma compared to non-exposed workers.[4] In another comparison of paper dust exposed versus non-exposed workers, there was increased risk for wheezing, breathlessness, chronic cough, and chronic phlegm.[5]

Studies of total paper dust exposures in soft paper mills indicate that adverse health effects occur where concentrations of airborne dust range from 15 to 20 mg/m^3.[4,6] One study performed in a soft paper mill in British Columbia with paper dust levels under 10 mg/m^3 showed no increase in the prevalence of lower or upper respiratory symptoms among 1932 workers.[7]

In general, studies of lower levels of total paper dust exposure (1 to 3 mg/m^3) in soft paper mills showed an increase in complaints of nasal irritation and nasal crusts, but no increase in coughing, chronic bronchitis, asthma, dyspnea, or sinusitis. There was no decline in respiratory function noted after low levels of exposure. In relatively high (> 5 mg/m^3) versus low (< 1 mg/m^3) exposure groups at one plant, the high exposure groups exhibited more upper respiratory symptoms (throat dryness, throat irritation, and nasal crusts), but no difference

between the groups in terms of cough or cough with phlegm and no increase in cross-shift change in pulmonary function was found. However, decrements in forced expiratory volume in one second (FEV_1) and forced vital capacity (FVC) were associated with at least 10 years of high-exposure work.[8] In another study, pulmonary function tests did not show any changes in lung function for workers exposed to total dust levels less than 5 mg/m^3 for greater than ten years. Though there was an increase in the prevalence of upper respiratory symptoms with dust exposure, no dose-response relationship could be found.[9] At least three studies suggest that higher levels of total paper dust exposure (> 5 mg/m^3) in pulp and paper mills seem to be associated with an increase in respiratory symptoms.[10] However, it is not clear whether or not exposures to processing chemicals or the paper dust itself is clearly the cause for certain symptoms.

Before processing, wood may contain wood preservatives, fungal spores, and terpenes. In the process of creating paper products, wood fibers are freed by digesting the fibers, a process that removes lignin and hemicellulose from the fibers. This is accomplished by the sulfite acidic process (using sulfite) or in recent decades, the sulfate alkaline process (associated with hydrogen disulfide, dimethyldisulfide, dimethylsulfide, and methylmercaptan). For printing paper, bleaching is used to increase the whiteness of the pulp to various degrees. This involves the addition of chlorine, and in recent decades, chlorine dioxide. Other methods have recently been favored in an effort to replace chlorine compounds, including the use of peroxides, oxygen, ozone, binders, enzymes, and peracetic acid. The pulp is mixed with water and certain additives which have included certain filling agents (talc, titanium dioxide, clay, aluminum hydroxide, barium sulfate), wet strength agents (polyvinylamide resins), whitening agents, retention agents, anti-foaming agents (waxes, tall oil rosin), dyes (benzedrine-based dyes, titanium dioxide), dispersing agents, coating agents (melanin resins, casein, latexes, calcium carbonate, aluminum hydroxide, barium sulfate, colophony), and slime controlling agents or "slimicides" (organic bromic compounds, methyl-bisthiocyanate, fatty acids, pentachlorophenol, isothiazolinones, mercury compounds, and ethylenediamine).[10]

The repulping and deinking of paper waste for recycling involves further chemical treatment. Mixtures of used newspapers, magazines, and waste from the production of corrugated paper may be repulped without de-inking. The paper is mixed with water in a pulper and major impurities such as staples are removed. The paper pulp is refined, and slimicides, sizing agents, flocking chemicals, fillers, and other chemicals are added to the recycled pulp and paper. Deinking newspapers and magazines involves dissolving the waste paper in water, the addition of fatty acids and other chemicals to dissolve impurities, and the addition of bleaching chemicals to restore whiteness to the paper. Common chemicals used in the repulping and deinking include fatty acid derivatives, hydrogen peroxide, sodium bisulfite, sodium hydroxide, sodium silicate, sodium dithionate, hypochlorite, polyethylenimine, (diethylenetrinitrilo) pentaacetic acid, bentonite, kaolin, and acrylamide polymers, as well as slimicides, e.g., thiazole, bromine, and copper compounds. In addition to these chemicals, the pulp fibers likely contain biological contaminants including mycotoxin and endotoxin which could be concentrated to some extent as process water is recycled.[11]

A study of paper dust exposure in Croatian paper recycling workers compared exposed (9.1 mg/m^3 total dust mean concentration) and unexposed groups. Among the exposed group, more chronic respiratory symptoms (cough, phlegm, bronchitis, shortness of breath, sinusitis, and nasal inflammation) were observed, along with lower lung function measurements [FEV_1 and maximum expiratory flow rates at 25% and the last 50% of the FVC (FEV_{25} and FEV_{50})] compared to the unexposed group. Of 101 exposed workers, 16% had positive skin prick tests to at least one of two paper extracts in contrast to zero positives for unexposed workers. Increased serum IgE levels were found in 21% of the exposed workers and in 5% of the controls. Exposures to paper dust in the

recycling plant were higher than those recommended by Croatian standards (3 mg/m^3 total dust, 1 mg/m^3 respirable dust).[12] The allergic component explored in the Croatian recycling mill study suggests an allergic potential of paper dust exposures.

No epidemiological studies have been performed to assess exposure and response to paper dust created by the mail handling and sorting process. Exposure to certain chemical components of the dust, rather than the aggregate airborne mass of the dust, could be a factor in presenting or aggravating certain symptoms in sensitized workers. For example, respiratory and cutaneous sensitization to the enzymes cellulase and xylanase used in the bleaching process have been described in the literature. After four months to six years of exposure, four workers exposed to these enzymes in a laboratory setting developed contact urticaria followed by rhinitis and asthma. All four workers developed specific antibodies against the enzymes.[13] Since the origin of the paper dust to which workers are exposed is likely to be quite variable under mail sorting conditions, it is difficult to assess the full range of chemical, and perhaps biological contaminants, that are associated with inhalation of the dust.

As determined by a literature search for references on the subject, health effects associated with exposure to paper dust generated from mail handling are not well characterized. A basis for limiting exposure to the paper dust in mail handling environments is impeded by the variability in the sources of paper dust. Because paper dust is likely to vary widely in composition, the ACGIH PNOC standard cannot be applied with certainty to all types of paper dusts. It is not certain that the OSHA PNOR standard, the cellulose content of paper, or any other substance and/or impurity is appropriate for limiting exposure to paper dust. Many types of dust exposures are without applicable exposure limits.

Orlando Post Office Processing and Distribution Center

Environmental

Based on airborne dust size distributions, most of the mass of particulate aerosolized on the plant floor will likely deposit in the upper respiratory tract. According to the inhalable mass data, no area concentrations exceeded applicable exposure limits. The size distributions of particles and the inhalable particulate concentrations did not differ appreciably between plant and office sampling locations.

The relatively low pressure used at the Orlando plant for blowout (when using vacuum cleaners operated in reverse instead of compressed air) did not appear to aerosolize as much paper dust as was observed during blowout at other facilities.

In regard to the requesters' perception that paper dust concentrations were high, it should be noted that at this point in time, the concentration of paper dust in the mail handling environment that could be defined as "high" (hazardous) has not been determined (see Appendix 1).

Paper dust has accumulated on surfaces within the plant, particularly within air ducts and the interior of air handlers. The cellulose content of paper dust provides a food source for fungi, and paper dust absorbs moisture from the air, so the accumulation of bulk paper dust will likely provide a matrix for microbial growth. The extent to which paper dust actually contributes to health effects due to microbial growth is not known. However, paper dust should be considered as a factor in investigating health complaints due to its *potential* for supporting microbial growth. No mite antigen was detected in airborne area dust samples, so the allergenic potential of the dust in terms of dust mite antigen could not be determined.

Overall, air handlers were in good mechanical condition. Most of the air handlers servicing the plant floor had outdoor air dampers that were both functional and open. The hygienic condition of the

air handlers was generally good with the exception of accumulated debris and slime layer in two air handlers. Biocide packets used in the drain pans were not effective in preventing the accumulation of microbial materials in the pans. The extent of hygienic problems in the air handlers was not considered to be significant enough to warrant further investigation by environmental sampling.

OMPDC management does not have a respiratory protection program and does not consider paper dust exposures at OMPDC to be sufficiently elevated to warrant the use of respiratory protection because paper dust exposures, even during mail sorter cleaning, are well below the PNOR standard. However, some employees have associated paper dust exposures to their own respiratory problems.

Medical

Symptom data was not obtained from a random sample of the working population. The most prevalent symptoms noted were flu-like symptoms (fevers, aches, tiredness) which affected five of the eight respondents, and one or more of the chest symptoms; wheeze, chest tightness, and shortness of breath, which affected four of the eight respondents.

It is not possible to definitively state the mechanisms underlying symptoms in these individuals. However, questionnaire data suggests work-relatedness. Association of symptoms with blowout suggests aerosolized particulate material as an etiologic factor.

The high frequency of systemic symptoms (headaches, fevers, achiness, fatigue, etc.) was unexpected. Although such symptoms are not specific for any particular disease process, they can be associated with inflammatory conditions such as endotoxin inhalation.

Findings From Other Post Office Plants

Recent NIOSH HHEs that have involved a site visit to assess paper dust and other exposures include the Orlando plant and plants in Omaha, Nebraska; Tampa, Florida; and San Francisco, California. Other requests that have not involved a site visit include Portland, Oregon; South Bend, Indiana; Shrewsbury, Massachusetts; Waite Park, Minnesota; and Longview, Washington. The on-site investigations have focused on HVAC and mail sorting machinery inspections, review of personnel records, review of the occupational safety and health program, interviews with employees, and environmental sampling.

The site-visit plants employ about 1000 to 3000 workers and have similar Tour schedules as Orlando. In general, most requesters mention exposures to ambient paper dust or dust generated by blowout as causing symptoms. A lack of vacuuming prior to blowout is a common complaint. The requesters noted that symptoms are sometimes linked to the heating, ventilating and air conditioning (HVAC) systems. Common symptoms among requests include nasal congestion, a "respiratory" complaint, headache, and irritated eyes (five requests) and cough, skin irritation, asthma, and sinus infection (three requests).

Medical assessments at site-visit plants have generally focused on interviews of workers who reportedly have experienced respiratory symptoms in the workplace. Interviews were facilitated by plant-wide announcements and by publicity from union representatives. The workers were interviewed by a NIOSH physician or nurse, and a questionnaire was answered (in Tampa and Orlando) to help document relative frequencies and work-relatedness of upper respiratory, lower respiratory, and systemic symptoms among the respondents. In addition, the interviews/questionnaires were conducted either on-site or by telephone. In some cases, individual medical records were reviewed. District-level accident and illness reports were reviewed at Omaha, Tampa, and Orlando.

Overall, participation for interviews was low, consisting of only 14 workers out of 897 in Omaha, 38 out of 1700 in Tampa, and 8 out of 1075 in Orlando. Thus, the overall prevalence of symptoms among the respondents cannot be considered representative of the working population. A few

generalizations can be made regarding the respondents, however. The most prevalent symptoms noted were sinus problems (irritated, runny, stuffy nose), itchy eyes, itchy/scratchy throat, and flu-like symptoms (fevers, aches, tiredness). Other, less common symptoms included headache, cough, chest tightness, shortness of breath, wheezing, and skin rash. Workers reported having asthma (11), bronchitis (24), allergies (18), and sinusitis/sinus symptoms (34). All the respondents in Orlando and Tampa thought some symptoms worsened during blowout.

The plant-level and district-level medical or accident logs did not reveal a great deal of specific information since the case categories were generalized under such headings as "Non-Occupational Illness-Respiratory (Allergy/Coryza)", "dust/foreign particle", "inhalation", "diseases of the lung", or "respiratory agents." The prevalence of these illnesses or accidents could not be attributed specifically to paper dust.

From this and other on-site evaluations of postal facilities, we conclude that paper dust blowout involves relatively short-term, elevated particulate concentrations in the areas immediately surrounding blowout. Most of the particulate settles quickly and is in the inhalable range (less than 100 microns in aerodynamic diameter). Blowout aerosolizes contaminants that otherwise would not be inhaled, including paper dust containing chemicals associated with paper manufacturing or recycling, microbiological components of the dust, and perhaps rubber sheared from machine belts. If performed carelessly, blowout can aerosolize floor dusts and paper dust. Therefore, the aerosolized dust is a mixed dust and not simply paper dust. Given that most of the mass of particulate aerosolized due to blowout will likely deposit in the upper respiratory tract (URT), aggravation of symptoms in this area would be plausible due to exposure to blowout dust. We have found mite antigen in the plant environment, but only in the relatively humid environment of Florida.

The NIOSH field studies have not definitively found the cause(s) for the underlying symptoms of workers. However, the questionnaire data from the NIOSH HHEs suggests work-relatedness, and the association of symptoms with blowout suggests aerosolized particulate as an etiologic factor. Symptoms appear to be mostly irritative in nature, with some workers experiencing relief from symptoms after leaving the work place. Allergy, or the increased susceptibility to irritants that is often associated with allergy, can be a predisposing factor for many individuals.

OSHA Respiratory Protection Directives

According to an OSHA interpretation letter on dust exposure of postal employees dated September 25, 1990, "certain individuals who are allergic to non-specific dusts should be allowed to wear protective dust masks." If a worker's private physician "prescribes a dust mask", then "a letter from his/her private physician explaining the individual's susceptibility should be placed on file in the Health Unit." According to the interpretation letter, "OSHA policy is not to cite an employer for lack of a respiratory protection program unless there is a potential for employee overexposure or an adverse health condition occurs due to the respirator. Therefore, the use of disposable dust masks to limit exposure to low levels of nuisance dusts would not, in itself, necessitate the need for a respiratory protection program."[14] This exemption from a written respiratory protection program is repeated in the 1998 OSHA respiratory protection final rule with clarification that a disposable dust mask is a "filtering facepiece (dust mask)."[15]

According to the 1998 OSHA respiratory protection final rule, even if exposures do not require use of respirators because exposures are below applicable limits, employers may provide respirators or allow employees to use their own respirators. The employer must ensure that the respirators in use do not present a hazard to the health of employees. If only filtering facepiece respirators are voluntarily worn, the employer is not required to implement a written respiratory protection program. According to

OSHA, it is the employer who must rely on "professional judgement and available data sources when selecting respirators for protection against hazardous chemicals that have no OSHA PEL." According to OSHA, it is prudent to select more rather than less protective respirators.[15,16]

CONCLUSIONS

The published literature on paper dust provides little, if any, guidance on the likely effects of post office paper dust since: 1) the exposures occurred in paper-making plants where the nature of the exposure was likely to be very different to that in mail handling facilities; and 2) the dust levels in paper-making plants were considerably higher than seen in this facility.

The results of the environmental dust sampling helped to characterize the concentration of dust and size distribution of dust in the plant and office environment, but cannot address the health concerns with certainty. Conclusions regarding the link between dust exposures and health effects are limited since dust generated on the plant floor is a mixed dust and not simply paper dust. Therefore, the content of the dust between plant and office areas is likely to be different given the different sources of dust. In addition, particulate sampling performed during this relatively short survey does not fully characterize the range of exposures likely to occur at the plant, and exposures were assessed by area measurements; personal sampling may yield different exposure data. Other issues regarding ventilation, truck exhaust, and low oxygen levels can be addressed by observations of the NIOSH investigators.

Regarding ventilation, there are no minimum outdoor air flow guidelines specifically for the light industrial environment. By observation of controls in place to prevent mixing of plant and loading dock air, and by observation of carbon monoxide (CO) sensors to alert management to a hazard from exhaust, it was determined by NIOSH investigators that vehicle exhaust was not a significant hazard to workers in the plant. In addition, no mechanism for oxygen depletion was observed. Oxygen depletion was judged to be not a significant hazard to workers in the plant.

RECOMMENDATIONS

In a letter dated July 23, 1997, to Omaha Mail Processing and Distribution Center (OMPDC) management, Omaha, Nebraska, an OSHA area director observed that "employees with pre-existing respiratory ailments such as seasonal allergies, chronic asthma, [or] bronchitis are routinely exposed to paper dusts that initiate or aggravate these health conditions." In the letter, OSHA recommended controls that include respiratory protection, smoking cessation, administrative rotation, and/or engineering solutions which minimize dust generation at the Optical Character Reader (OCR) / Delivery Point Bar Code Sorter (DPBCS) areas with air filtration or wet vacuuming of surfaces.[16]

The following NIOSH recommendations focus on the control of non-specific and paper dust exposures, control of paper dust accumulation within the plant, and maintenance of HVAC system components:

Non-specific Dust Exposures

NIOSH investigators agree with OSHA that concentrations of certain non-specific dusts or paper dust can be elevated at times such that dusts or components of the dusts might initiate symptoms or aggravate pre-existing respiratory conditions. We further agree with OSHA recommendations to provide respiratory protection for employees with chronic respiratory conditions, provide a smoking cessation program for affected individuals, and experiment with permanent administrative job rotations for affected workers.

Control of Non-specific Dust Exposures

According to OSHA, if the employer decides that voluntary respirator use is permissible and will not present a hazard to the health of the employee, the employer is responsible for selecting the type of respirator facepiece and filter. According to the latest OSHA Final Rule for Respiratory Protection, selection is determined by "informed professional judgement" and "available data sources."[15] Filter selection is straightforward, even if the mass median aerodynamic diameter (MMAD) of the particulate is not known; any Part 84 filter may be used. If a physician prescribes a "dust mask," then a respirator that uses a Part 84 filter is a good selection. A loose-fitting filtering facepiece respirator is a good first choice for respiratory protection against non-specific dust exposures that initiate or aggravate employee health conditions. Because of their higher efficiency against 0.3 micron particulate, Part 84 filters are a good choice for these respirators. Part 84 filters provide from 95 to 99.97% efficiency in the removal of 0.3 micrometer particles. After July 10, 1998, non-powered, air-purifying, particulate-filter respirators were approved under Part 84.[17]

If respiratory symptoms are not controlled with a loose-fitting filtering facepiece respirator, then a tighter-fitting filtering facepiece respirator should be selected in the proper size for the worker's face. These respirators are specially molded to form a more complete seal with the face. If symptoms persist with a tight-fitting filtering facepiece respirator that has been fit tested for the worker, then respirators which progressively minimize facepiece penetration should be selected.

If any respirator other than a filtering facepiece respirator is used, the employer must implement a medical evaluation to ensure that the worker is medically able to wear the respirator, and ensure that the respirator is cleaned, stored, and maintained so that its use does not present a health hazard to the worker.[14,15]

It is important to note that when respirators are used voluntarily without fit testing (or other training) no level of protection is assured. The level of protection provided by a negative-pressure respirator will be more dependent on the quality of the fit testing than on the respirator.

Control of Paper Dust Exposures

Paper dust exposure from blowout operations is a source of concern for postal employees who relate exposure to the dust with health effects. Eight HHE requests since October 1997 have been filed that relate exposures to paper dust with respiratory infections, cough, asthma, and allergic rhinitis in certain workers. Typically, the process associated with generating the dust is the use of compressed air to blow dust from sorting machines. At this time, it is not possible to definitively state the mechanisms underlying symptoms in certain individuals. The association of symptoms with blowout only suggests that aerosolized particulate is an etiologic factor for symptoms.

Until the etiology can be assessed in a more definitive study, it should be reiterated that the USPS considers vacuuming to be mandatory before blowout. It is the NIOSH investigators' opinion that the aerosolization of blowout dust should be minimized, perhaps by using the lowest velocity airsteam that is compatible with effective cleaning.

Respiratory protection should be used by employees performing blowout and by employees who experience symptoms associated with blowout. Ideally, employees who have symptoms triggered by blowout should not be exposed, or blowout should be timed such that affected workers are not in the vicinity of blowout.

Control of Paper Dust Accumulation

In a letter to the OMPDC dated July 23, 1997, OSHA suggests engineering control of airborne paper dust in the form of auxiliary air filtration or wet vacuuming of floors or machines to remove paper dust. NIOSH investigators encourage the control of paper dust accumulation within the building on the grounds that paper dust provides a

good matrix for microbial growth, and microbial growth, particularly within HVAC systems, should be minimized. Ideally, paper dust should be controlled at the source to prevent accumulation within the building. At a minimum, its accumulation should be controlled within HVAC return and supply airstreams. Control by prefilters, increased efficiency of primary filters, and prevention of filter blow-by are some options. NIOSH investigators do not encourage the application of water to collect paper dust unless moistened surfaces are dried within 24 hours.

HVAC Systems

For all air handlers, priority should be given to the removal of slime, the creation of free-flowing drain pans, the disinfection of surfaces, and the prevention of blow-by of unfiltered air from around filter media. It is recommended that the enclosed Building Air Quality Action Plan (published June 1998, authored by the Environmental Protection Agency and NIOSH) be used as a guide for maintaining and improving HVAC operations. HVAC system maintenance workers should receive training in the recognition and control of contamination in air handlers and in other components of HVAC systems.

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TABLE 1

Observations of Air Handler Conditions

Orlando Mail Handling and Distribution Center, Orlando, Florida
HETA 98-0068

Air Handler Number	Zone	Comments
AH 1	Plant	No comments
AH 2	Plant	No comments
AH 3	Plant	No comments
AH 4	Lobby	No comments
AH 5	Administrative area	No comments
AH 6	Administrative area	Possible white mold growth on interior insulation, condensation pan with slight slime, slightly dusty interior
AH 8	Plant	Outside air damper closed, flaky grey/black organic matter in drain pan
AH 9	Plant	Outside air damper rusted and closed, light dust
AH 10	Plant	Outside air damper closed, debris in return plenum
AH 11	Data Site	No comments
AH 12	MIS Computer Room	No comments
AH GF 13	North Dock	Slight dust
AH GF 14	North Dock	Slight dust
AH 17	Cafeteria	Light dust

TABLE 2

Airborne Dust Concentrations and Estimates of Respirable and Thoracic Concentrations Based On Dust Collection by Marple 8-Stage Impactors, Tour 3 (3:00 p.m. to 11:00 p.m.), March 17, 1999

Orlando Mail Handling and Distribution Center, Orlando, Florida
HETA 99-0068

Location # [See Figure 1] (Machine type; Job type)	Sampling Period	Sample Volume (liters)	Concentration (mg/m^3) Based on Total Mass Collected	Estimated Respirable Concentration (mg/m^3)[1]	Estimated Thoracic Concentration (mg/m^3)[1]
1 (Mail Processors; OCR Operators)	1521 - 2303	944.8	0.03	0.01	0.02
2 (Manual Sorting; Mail Service Clerks)	1524 - 2307	936.7	0.07	0.02	0.04
3 (Manual Sorting; Mail Service Clerks)	1528 - 2315	915.3	0.10	0.03	0.05
4 (Mail Processors; OCR Operators)	1509 - 2300	979.2	INS[2]	INS	INS
5 (Mail Processors; OCR Operators)	1553 - 2319	899.1	0.09	0.03	0.05
6 (Manual Sorting; Mail Service Clerks)	1532 - 2316	925.7	INS	INS	INS
7 (Mail Handlers; Mail Processing Machine Operators & Mail Handlers)	1505 - 2258	943.6	0.14	0.04	0.07
8 (FSM & Mail Processors; FSM Operators & OCR Operators	1542 - 2325	915.4	0.06	0.02	0.04
9 (Manual Sorting &FSM; Mail Service Clerks & FSM Operators)	1536 - 2322	945.1	0.05	0.03	0.04
Plant Locations (Average Concentration):			**0.08**	**0.03**	**0.04**
10 (Office Location)	1558 - 2329	902.5	**0.06**	**0.02**	**0.04**

1 = Deposition curve source: ACGIH [1995] Air sampling instruments for evaluation of atmospheric contaminants, 8th ed., American Conference of Governmental Industrial Hygienists, Table 5-5, Inhalable, Thoracic, and Respirable Dust Criteria of ACGIH-ISO-CEN, p. 102.
2 = INS; Insufficient mass on one or more stages of the sampler.

Airborne Dust Concentrations and Estimates of Respirable and Thoracic Concentrations Based On Dust Collection by Marple 8-Stage Impactors, Tour 1 (11:00 p.m. to 7:00 a.m.), March 17-18, 1999

Orlando Mail Handling and Distribution Center, Orlando, Florida
HETA 99-0068

Location # [See Figure 1] (Machine type; Job type)	Sampling Period	Sample Volume (liters)	Concentration (mg/m^3) Based on Total Mass Collected	Estimated Respirable Concentration (mg/m^3)[1]	Estimated Thoracic Concentration (mg/m^3)[1]
1 (Mail Processors; OCR Operators)	2335 - 0748	1006	INS[2]	INS	INS
2 (Manual Sorting; Mail Service Clerks)	2338 - 0750	993.8	INS	INS	INS
3 (Manual Sorting; Mail Service Clerks)	2342 - 0752	989.8	0.07	0.02	0.04
4 (Mail Processors; OCR Operators)	2329 - 0746	999.0	INS	INS	INS
5 (Mail Processors; OCR Operators)	2351 - 0756	970.0	INS	INS	INS
6 (Manual Sorting; Mail Service Clerks)	2400 - 0754	952.7	0.12	0.05	0.07
7 (Mail Handlers; Mail Processing Machine Operators & Mail Handlers)	2325 - 0743	1011	FAULT[3]	FAULT	FAULT
8 (FSM & Mail Processors; FSM Operators & OCR Operators	2405 - 0800	950.0	0.11	0.03	0.05
9 (Manual Sorting &FSM; Mail Service Clerks & FSM Operators)	2357 - 0759	964.0	0.10	0.03	0.04
Plant Locations (Average Concentration):			**0.10**	**0.03**	**0.05**
10 (Office Location)	**2320 - 0804**	**1048**	**INS**	**INS**	**INS**

1 = Deposition curve source: ACGIH [1995] Air sampling instruments for evaluation of atmospheric contaminants, 8th ed., American Conference of Governmental Industrial Hygienists, Table 5-5, Inhalable, Thoracic, and Respirable Dust Criteria of ACGIH-ISO-CEN, p. 102.
2 = INS; Insufficient mass on one or more stages of the sampler. 3 = Sample voided; mechanical fault of sampling pump.

TABLE 4

Airborne Dust Concentrations and Estimates of Respirable and Thoracic Concentrations Based On Dust Collection by Marple 8-Stage Impactors, Tour 2 (7:00 a.m. to 3:00 p.m.), March 18, 1999

Orlando Mail Handling and Distribution Center, Orlando, Florida
HETA 99-0068

Location # [See Figure 1] (Machine type; Job type)	Sampling Period	Sample Volume (liters)	Concentration (mg/m^3) Based on Total Mass Collected	Estimated Respirable Concentration (mg/m^3)[1]	Estimated Thoracic Concentration (mg/m^3)[1]
1 (Mail Processors; OCR Operators)	0748 - 1523	914.5	0.05	0.01	0.03
2 (Manual Sorting; Mail Service Clerks)	0750 - 1526	946.9	0.09	0.02	0.04
3 (Manual Sorting; Mail Service Clerks)	0753 - 1533	973.1	0.04	0.01	0.03
4 (Mail Processors; OCR Operators)	0745 - 1513	943.8	0.03	0.01	0.02
5 (Mail Processors; OCR Operators)	0800 - 1545	837.9	0.14	0.04	0.07
6 (Manual Sorting; Mail Service Clerks)	0756 - 1537	978.6	0.08	0.03	0.05
7 (Mail Handlers; Mail Processing Machine Operators & Mail Handlers)	0742 - 1509	901.2	INS[2]	INS	INS
8 (FSM & Mail Processors; FSM Operators & OCR Operators	0806 - 1556	842.4	0.09	0.01	0.03
9 (Manual Sorting &FSM; Mail Service Clerks & FSM Operators)	0803 - 1553	875.8	0.04	0.02	0.02
Plant Locations (Average Concentration):			**0.07**	**0.02**	**0.04**
10 (Office Location)	**0809 - 1604**	**911.2**	**0.04**	**0.02**	**0.02**

1 = Deposition curve source: ACGIH [1995] Air sampling instruments for evaluation of atmospheric contaminants, 8th ed., American Conference of Governmental Industrial Hygienists, Table 5-5, Inhalable, Thoracic, and Respirable Dust Criteria of ACGIH-ISO-CEN, p. 102.
2 = INS; Insufficient mass on one or more stages of the sampler.

TABLE 5

Inhalable Dust Concentrations by IOM Samplers, Tours 3, 1, and 2, March 17 - 18, 1999

Orlando Mail Handling and Distribution Center, Orlando, Florida
HETA 99-0068

Location # [See Figure 1] (Machine type; Job type)	Sampling Period: March 17, Tour 3 3:00 p.m. to 11:00 p.m.			Sampling Period: March 17 - 18, Tour 1 11:00 p.m. to 7:00 a.m.			Sampling Period: March 18, Tour 2 7:00 a.m. to 3:00 p.m.		
	Sampling Duration	Sample Volume (liters)	Concentration (mg/m^3)	Sampling Duration	Sample Volume (liters)	Concentration (mg/m^3)	Sampling Duration	Sample Volume (liters)	Concentration (mg/m^3)
1 (Mail Processors; OCR Operators)	1521 - 2303	944.8	1.44	2335 - 0748	1006	0.61	0748 - 1523	914.5	1.40
2 (Manual Sorting; Mail Service Clerks)	1524 - 2307	936.7	0.19	2338 - 0750	993.8	1.58	0750 - 1526	946.9	1.45
3 (Manual Sorting; Mail Service Clerks)	1528 - 2315	915.3	0.22	2342 - 0752	989.8	0.37	0753 - 1533	973.1	0.18
4 (Mail Processors; OCR Operators)	1509 - 2300	979.2	1.40	2329 - 0746	999.0	0.31	0745 - 1513	943.8	0.71
5 (Mail Processors; OCR Operators)	1553 - 2319	899.1	0.30	2351 - 0756	970.0	0.25	0800 - 1545	837.9	0.36
6 (Manual Sorting; Mail Service Clerks)	1532 - 2316	925.7	1.66	2400 - 0754	952.7	0.25	0756 - 1537	978.6	0.43
7 (Mail Handlers; Mail Processing Machine Operators & Mail Handlers)	1505 - 2258	943.6	1.61	2325 - 0743	1011	0.76	0742 - 1509	901.2	0.41
8 (FSM & Mail Processors; FSM Operators & OCR Operators	1542 - 2325	915.4	0.15	2405 - 0800	950.0	0.44	0806 - 1556	842.4	0.40
9 (Manual Sorting &FSM; Mail Service Clerks & FSM Operators)	1536 - 2322	945.1	0.73	2357 - 0759	964.0	0.43	0803 - 1553	875.8	0.11
Plant Locations (Average Concentration):			0.66			0.66			0.61
10 (Office Location)	1558 - 2329	902.5	0.71	2320 - 0804	1048	0.35	0809 - 1604	911.2	0.22

TABLE 6

Respiratory-Related Medical Unit Visits by Tour of Duty

Orlando Mail Handling and Distribution Center, Orlando, Florida
HETA 98-0068

Fiscal Year	Tour 1 (11:00 p.m. to 7:00 a.m.)	Tour 2 (7:00 a.m. to 3:00 p.m.)	Tour 3 (3:00 p.m. to 11:00 p.m.)	Totals
1994	30.4 % (202/665)[1]	28.2 % (120/425)	27.8 % (303/1089)	28.7 % (625/2179)
1995	10.2 % (82/803)	25.8 % (147/568)	29.2 % (376/1287)	22.7 % (605/2658)
1996	19.8 % (259/1305)	19.6 % (107/545)	5.4% (24/443)	17.0 % (390/2293)
1997	9.4 % (46/491)	20.7 % (82/396)	17.5 % (160/912)	15.9 % (288/1799)
1998	10.3 % (42/406)	9.1 % (37/404)	Data unavailable	9.7 % (79/810)
1999 (9/98-3/99)	15 % (27/180)	22.3 % (25/112)	25 % (48/191)	20.7 % (100/483)

1= numerator is respiratory visits, denominator is total visits

FIGURE 1

Airborne Dust Sampling Locations 1 Through 10

Orlando Mail Handling and Distribution Center, Orlando, Florida
HETA 98-0068

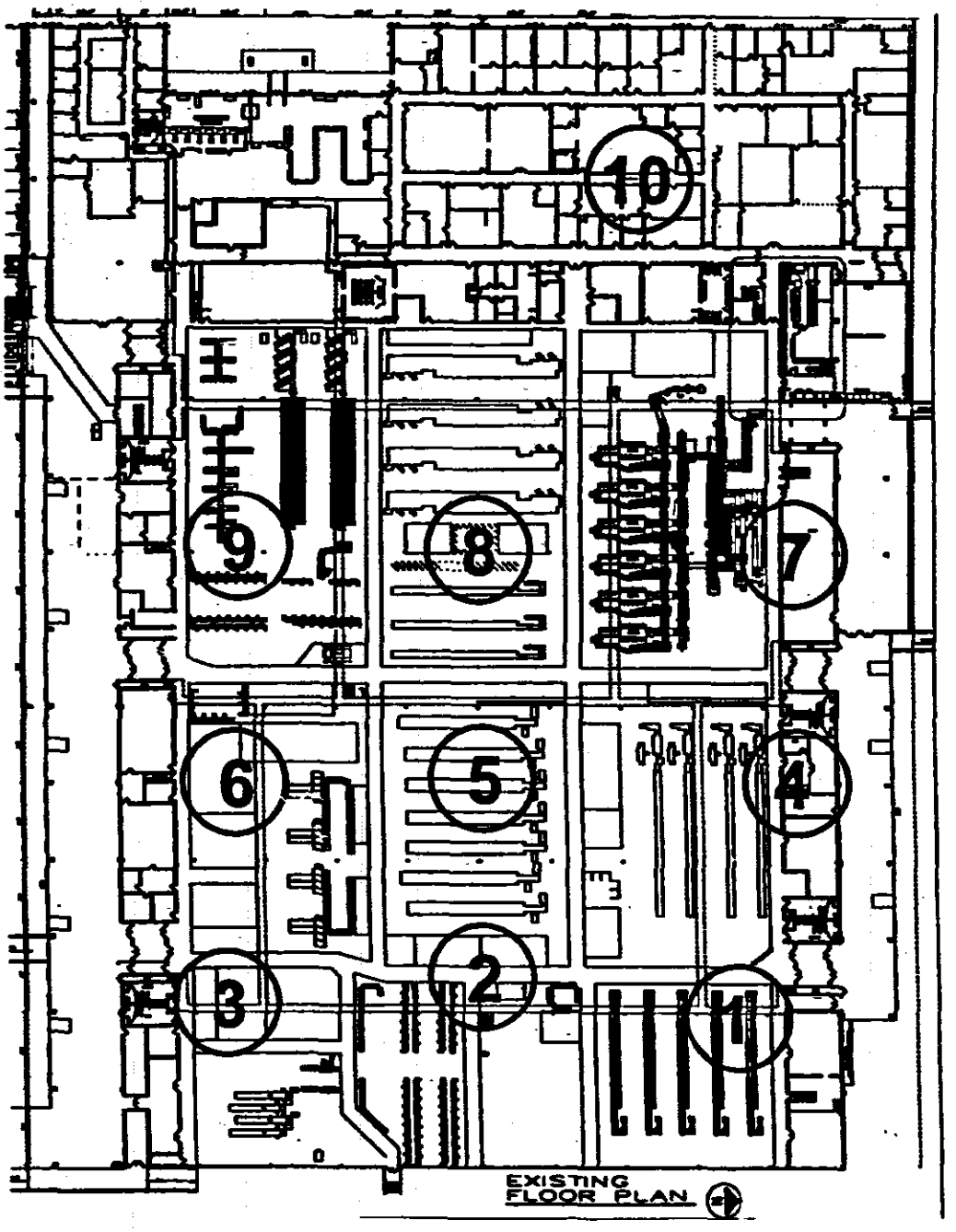


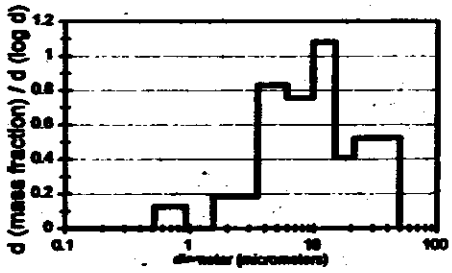
FIGURE 2

Particle Size Selective Dust Sampling Locations and Size Distributions, March 17 - 18, 1999

Orlando Mail Handling and Distribution Center, Orlando, Florida HETA 98-0068

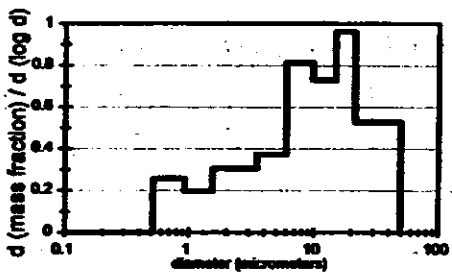
Location 1

Tour 3



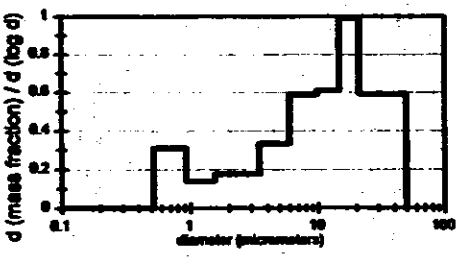
Location 1

Tour 2



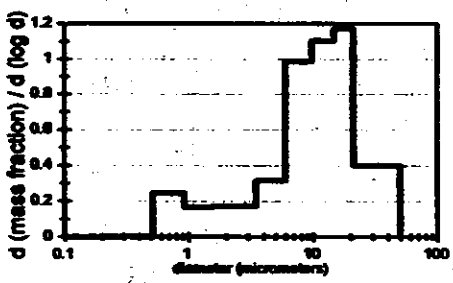
Location 2

Tour 3



Location 2

Tour 2



Location 3

Tour 3

Location 3

Tour 2

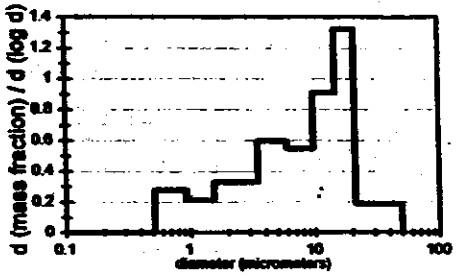


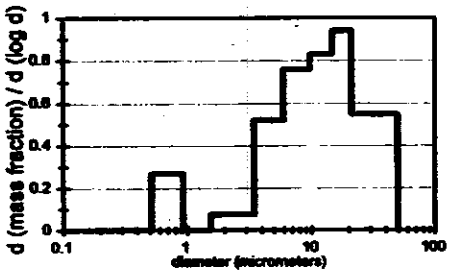
FIGURE 2 - continued

Particle Size Selective Dust Sampling Locations
and Size Distributions, March 17 - 18, 1999

Orlando Mail Handling and Distribution Center, Orlando, Florida
HETA 98-0068

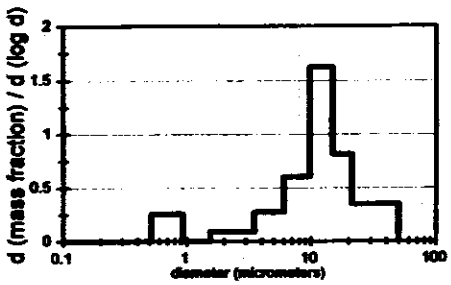
Location 3

Tour 1



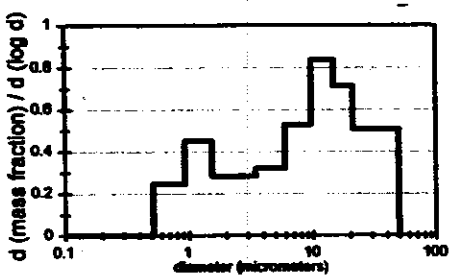
Location 4

Tour 2



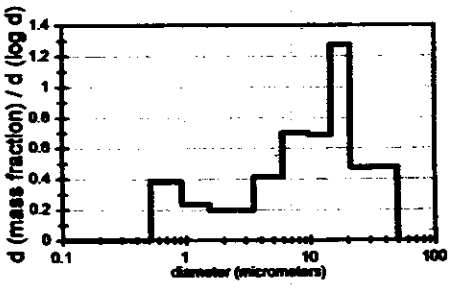
Location 5

Tour 3



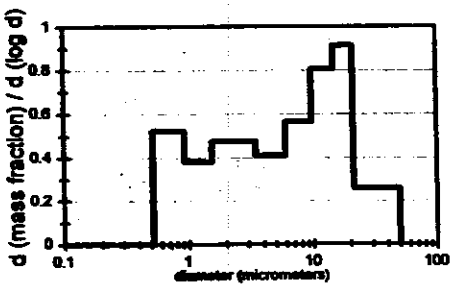
Location 5

Tour 2



Location 6

Tour 2



Location 6

Tour 1

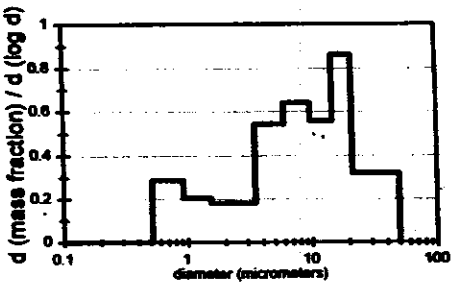


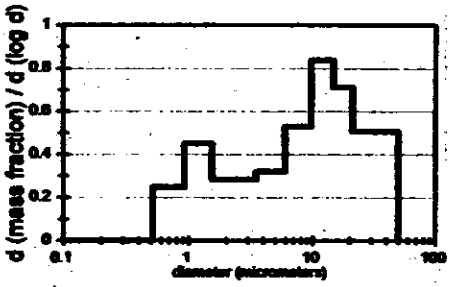
FIGURE 2 - continued

Particle Size Selective Dust Sampling Locations
and Size Distributions, March 17 - 18, 1999

Orlando Mail Handling and Distribution Center, Orlando, Florida
HETA 98-0068

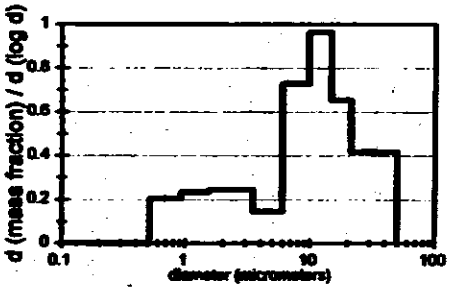
Location 7

Tour 3



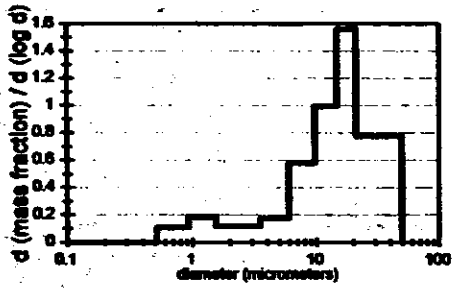
Location 8

Tour 3



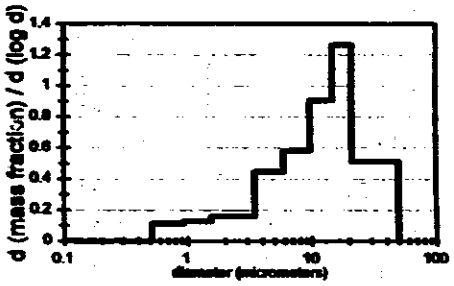
Location 8

Tour 2



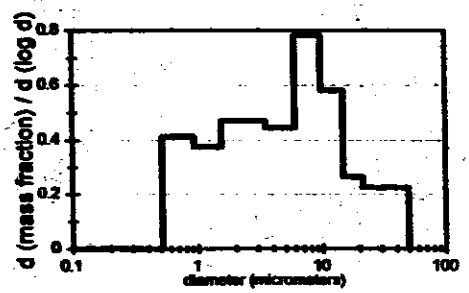
Location 8

Tour 1



Location 9

Tour 3



Location 9

Tour 2

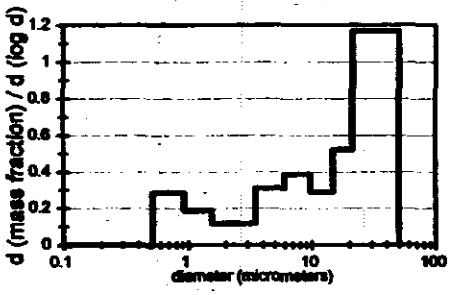
FIGURE 2 - continued

Particle Size Selective Dust Sampling Locations
and Size Distributions, March 17 - 18, 1999

Orlando Mail Handling and Distribution Center, Orlando, Florida
HETA 98-0068

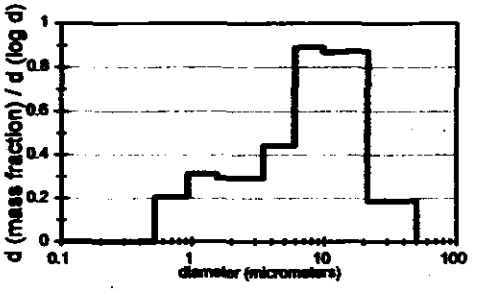
Location 9

Tour 1



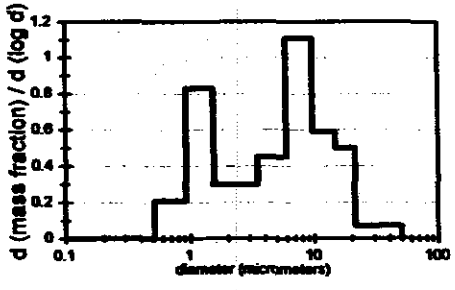
Location 10

Tour 3



Location 10

Tour 2



Appendix 1
Evaluation Criteria

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for the assessment of a number of chemical and physical agents. These criteria are intended to suggest levels of exposure to which most workers may be exposed up to 10 hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is, however, important to note that not all workers will be protected from adverse health effects even though their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and/or a hypersensitivity (allergy). In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the criterion. These combined effects are often not considered in the evaluation criteria. Also, some substances are absorbed by direct contact with the skin and mucous membranes, and thus potentially increases the overall exposure. Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent become available.

The primary sources of environmental evaluation criteria for the workplace are: (1) NIOSH Recommended Exposure Limits (RELs),[18] (2) the American Conference of Governmental Industrial Hygienists' (ACGIH®) Threshold Limit Values (TLVs®),[19] and (3) the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs).[20] Employers are encouraged to follow the OSHA limits, the NIOSH RELs, the ACGIH TLVs, or whichever are the more protective criterion.

OSHA requires an employer to furnish employees a place of employment that is free from recognized hazards that are causing or are likely to cause death or serious physical harm.[21] Thus, employers should understand that not all hazardous chemicals have specific OSHA exposure limits such as PEL's and STEL's. An employer is still required by OSHA to protect their employees from hazards, even in the absence of a specific OSHA PEL.

A time-weighted average (TWA) exposure refers to the average airborne concentration of a substance during a normal 8-to-10-hour workday. Some substances have recommended short-term exposure limits (STEL) or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from higher exposures over the short-term.

Paper Dust

The aggregate dust generated by mail sorters and aerosolized by maintenance procedures is difficult to characterize, but likely includes paper, adhesives, and rubber crumbs from drive belts. The paper content of this dust is a complex mixture of papers of unknown origin. It is likely that exposures to chemicals used in the manufacture of paper, in association with paper dust, would be well below any applicable occupational exposure limits for paper dyes, bleaching agents, and other chemicals associated with paper manufacturing. Paper dust can be categorized as an organic dust because it is of vegetable origin. Some types of organic dusts have been associated with acute responses (irritation or toxic pneumonitis), long-term responses (chronic bronchitis), or hypersensitivity responses.[22]

Prior to 1986, paper dust exposure had been regulated under the OSHA "nuisance dust" or particulate not otherwise regulated (PNOR) PEL. In 1986, OSHAs Occupational Health Review Commission ruled that paper dust is an organic dust; therefore the nuisance dust standard did not apply to paper dust.[23] In 1993, OSHA issued

a notice that all inert, nuisance, and organic particulate would be covered under the PNOR standard if no other exposure limit was applicable. Presently, paper dust exposures are limited under the OSHA PNOR standard (15 mg/m^3 total dust, 5 mg/m^3 respirable dust).[24,25] The PNOR criteria were established to minimize mechanical irritation of the eyes and nasal passages, and to prevent visual interference.

Formerly referred to as nuisance dust, the preferred ACGIH TLV terminology for non-specific particulate is particulates not otherwise classified (PNOC). The criteria for the classification of a substance as a PNOC include the following lung pathology: 1) the architecture of the air spaces remains intact; 2) collagen (scar tissue) is not formed to a significant extent; and 3) the tissue reaction is potentially reversible.[26] The ACGIH recommended TLV for exposure to a PNOC is 10.0 mg/m^3 inhalable particulate, 3 mg/m^3 respirable particulate, 8-hour TWA. NIOSH has not developed specific evaluation criteria for PNOR/C exposures.

Cellulose is a major component of paper. It is considered to be a biologically non-toxic natural polysaccharide which is widely distributed in nature. Airborne cellulose dust has been described as both non-irritating and non-toxic with little adverse effects on the lung at concentrations of less than 10 mg/m^3.[26] Since wood contains about 50 to 70% cellulose,[26] the cellulose content of paper could plausibly limit an 8-hour TWA exposure to paper dust by the OSHA PEL (15 mg/m^3 total dust, 5 mg/m^3 respirable dust), NIOSH REL (10 mg/m^3 total dust, 5 mg/m^3 respirable dust) or ACGIH TLV (10 mg/m^3 total dust) exposure limits for cellulose.

Dust Mite Antigen

Dust mites are eight-legged, sightless arthropods about 0.3 millimeters (mm) in length. They feed on skin scales, fungi, and other debris. They absorb water, therefore mites are dependent on ambient humidity and thrive in high humidity environments. Mites excrete digested food and enzymes as fecal pellets which range in size from about 10 to 35 μm, similar in size to pollen grains.[27,28]

Sensitivity to mite proteins is associated with inhalation of mite body parts or proteins associated with mite fecal pellets.[27] Exposure to these antigens can result in rhinitis and immediate or delayed asthma upon exposure in sensitized individuals. Typical symptoms range from nasal and ocular itching, rhinorrhea, sneezing, shortness of breath, wheezing, and productive cough.[28] Commercially available allergen extracts of mite proteins are available to determine sensitivity to the proteins either by skin testing or for *in vitro* assays of IgE antibodies.[27,29]

Typically, mite antigen is sampled from surface dust and analyzed by enzyme immunoassay. This is because epidemiological studies of mite exposure in domestic environments involve small quantities of airborne dust in undisturbed environments. Sufficient dust mass cannot be obtained to measure what are considered to be typical airborne mite antigen concentrations (commonly 0.005 to 0.050 $\mu g/m^3$). In addition, these studies typically do not report the relevance of the particle size of antigenic material. It has been common practice to assess exposure based on the measurement of an allergen in a reservoir of dust with the assumption that the allergen content of the dust is positively correlated with inhaled exposure.[27,29]

The threshold concentration (in micrograms of antigen per gram of dust, $\mu g/g$) for sensitization to the mite antigen Der p I (from *D. pteronyssinus*) and Der f I (from *D. farinae*) is 2 $\mu g/g$; the dose for symptoms is 10 $\mu g/g$. These thresholds are based on epidemiologic studies designed to estimate what level of antigen was likely to result in sensitization in patients with atopic tendencies, and the dose that elicited symptoms in clinically sensitive individuals. These thresholds should be applied as a basis for advising sensitized individuals to take steps to reduce exposure. They are not meant to establish permissible exposure limits, since certain individuals may have a response at a lower exposure.[29]

Certain studies have determined that fecal particles are the major form in which Der p I becomes airborne, and that less than 0.001 $\mu g/m^3$ is airborne in undisturbed rooms. During disturbance, aerosolized Der p I has been measured from 0.005 to 0.2 $\mu g/m^3$.[27,29] It is likely that mite antigen is associated with larger particulate which settles rapidly after disturbance.

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Appendix 2
Questionnaire

QUESTIONNAIRE FOR U.S. Postal Service, Orlando, Florida
HETA (99-0068)

DATE: _____
MO DAY YEAR

1. What is your first name, middle initial and last name?

_____
(First) MI (Last)

2. What is your social security number? ___ __ ____

3. In case we need to clarify some details later, we would like to be able to call you. Would you please tell me your home phone number? (___) _____
area - number

4. What was your date of birth? _____
MO DAY YEAR

5. Sex: 1. Male____ 2. Female____

HEALTH QUESTIONS

PLEASE ANSWER YES OR NO IF POSSIBLE. IF YOU ARE IN DOUBT ABOUT WHETHER YOUR ANSWER IS YES OR NO, CHOOSE NO.

COUGH

7A. Do you usually have a cough? 1. Yes___ 2. No___
(Count a cough with first smoke or on first going out-of-doors. Exclude clearing of throat)

IF NO TO 7A SKIP TO 8A.

B. Do you usually cough like this on most days for 3 consecutive months or more during the year?
1. Yes___ 2. No___

C. What month and year did you first have this cough?

_____
MO YEAR

PHLEGM

8A.Do you usually bring up phlegm from your chest? 1. Yes___ 2. No___
(Count phlegm with the first smoke or on first going out of doors. Exclude phlegm from the nose. Count swallowed phlegm).

IF NO TO 8A SKIP TO 9A.

B. Do you bring up phlegm like this on most days for 3 consecutive months or more during the year?
1. Yes___ 2. No___

C. What month and year did you first have trouble with phlegm? _____
MO YEAR

WHEEZING

9A.Have you had wheezing or whistling in your chest at any time in the last 12 months? 1. Yes___ 2. No___

IF YES TO 9A GO TO 9C

B. Have you ever had wheezing or whistling in your chest? 1. Yes___ 2. No___

IF NO T0 9B GO TO 10A

C. Have you been at all short of breath when the wheezing noise was present? 1. Yes___ 2. No___

D. Have you had this wheezing or whistling when you did not have a cold? 1. Yes___ 2. No___

E. What month and year did you first have this wheezing or whistling in your chest? _____
MO YEAR

BREATHLESSNESS

10A. Are you troubled by shortness of breath when hurrying on the level or walking up a slight hill?
1. Yes___ 2. No___

B. Do you have to walk slower than people of your age on the level because of breathlessness? 1. Yes___
2. No___

IF NO TO 10A AND 10B GO TO 11A.

C. What month and year did you first have this trouble with breathlessness? _____
MO YEAR

CHEST-TIGHTNESS

11A. Have you woken up with a feeling of tightness in your chest at any time in the last 12 months?
1. Yes___ 2. No___

IF YES TO 11A GO TO 11C

B. Have you ever woken up with a feeling of tightness in your chest? 1. Yes___ 2. No___

IF NO TO 11B GO TO 12.

C. What month and year did you first have this chest-tightness?_____
MO YEAR

ATTACKS OF SHORTNESS OF BREATH

12. Have you had an attack of shortness of breath that came on during the day when you were at rest at any time in the last 12 months?1. Yes___ 2. No___

13. Have you had an attack of shortness of breath that came on following strenuous activity at any time in the last 12 months? 1.Yes___ 2. No___

14A. Have you been woken by an attack of shortness of breath at any time in the last 12 months?
1. Yes___ 2. No___

IF YES TO 14A GO TO 15

14B. Have you ever been woken by an attack of shortness of breath? 1. Yes___ 2. No___

IF NO TO ALL OF 12, 13, 14 GO TO 16.

15. What month and year did you first have an attack of shortness of breath? _____
MO YEAR

16. Are you currently using any medicines for breathing problems, including inhalers, aerosols, tablets or non-prescription medicines? 1. Yes___ 2. No___

QUESTION 17 WILL ONLY BE ASKED IF THE PERSON HAS REPORTED ANY RESPIRATORY SYMPTOMS IN THE PAST 12 MONTHS OR EVER.

Please think about your job at the time you began having the chest symptoms you described.

17. Were you working in (fill-in present job classification)? 1. Yes___ 2. No___

QUESTIONS 18 - 22 WILL ONLY BE ASKED IF THE PERSON REPORTED RESPIRATORY SYMPTOMS IN THE LAST 12 MONTHS.

18. During your work shift are the symptoms: 1. Better __ 2. Worse __ 3. Unchanged __

19. After getting home from work, are the symptoms: 1. Better __ 2. Worse __ 3. Unchanged __

20. Over the course of the work week are the symptoms: 1. Better __ 2. Worse __ 3. Unchanged __

21. When you are away from work, on days-off or vacations, are the symptoms:
1. Better __
2. Worse __
3. Unchanged__

22. Are the symptoms worst on the first day back to work [after days-off] compared to other work days? 1. Yes___ 2. No___ 3. Don't Know__

23. While at U.S. Postal Service, Orlando, have you ever had breathing problems that resulted in your changing your job or your work location?
1. Yes___ 2. No___

SYSTEMIC SYMPTOMS

24. While working at U.S. Postal Service, how often have you had any of the following symptoms?

A. Fevers 1. Never___ 2. Rarely___ 3. Monthly___ 4. Weekly___ 5. Daily___
B. Chills 1. Never___ 2. Rarely___ 3. Monthly___ 4. Weekly___ 5. Daily___
C. Night-sweats 1. Never___ 2. Rarely___ 3. Monthly___ 4. Weekly___ 5. Daily___
D. Flu-like achiness
1. Never___ 2. Rarely___ 3. Monthly___ 4. Weekly___ 5. Daily___
E. Unusual tiredness or fatigue
1. Never___ 2. Rarely___ 3. Monthly___ 4. Weekly___ 5. Daily___

IF ALL OF 24A, B, C, D, E ANSWERED 1 GO TO 30A

25. Have you had these symptoms repeatedly in the last 12 months? 1. Yes___ 2. No___

26. What month and year did you first have these symptoms? _____
MO. YR.

Please think about your job at the time you began having the symptoms you described.

27. Were you working in (fill-in present job)? 1. Yes___ 2. No___

QUESTION 28 WILL ONLY BE ASKED IF THE PERSON REPORTED SYSTEMIC SYMPTOMS IN THE LAST 12 MONTHS (YES to 25).

28. When you are away from work on days-off or vacations, are the symptoms:
1. Better__
2. Worse__
3. Unchanged__

29. While at U.S. Postal Service, Orlando, have these symptoms, such as fevers, achiness, or unusual tiredness, resulted in your changing your job or your work location? 1. Yes___ 2. No___

30A. Have you ever lost at least 15 pounds without dieting while working at the U.S. Postal Service, Orlando Plant? 1. Yes___ 2. No___

IF YES TO 30A, ANSWER THE FOLLOWING; IF NO, THEN SKIP TO 31

B. What month and year did this weight loss begin? _____
MO YEAR

31. During your working hours, at U.S. Postal Service, Orlando do you usually have:

A. Irritation of the nose?
1. Yes___ 2. No___
B. Stuffy or runny nose?
1. Yes___ 2. No___
C. Irritation of the eyes?
1. Yes___ 2. No___
D. Irritation of the throat?
1. Yes___ 2. No___

PAST ILLNESSES

32A. Have you ever had asthma? 1. Yes___ 2. No___

IF NO TO 32A GO TO 33.

B. Do you still have it? 1. Yes___ 2. No___

C. Was it confirmed by a doctor? 1. Yes___ 2. No___

C. At what age did it start? _____Age in years

E. If you no longer have it, at what age did it stop? _____Age stopped

Since working at Orlando U.S. Postal Service, have you ever had any of the following illnesses?

33. Attacks of Bronchitis? 1. Yes___ 2. No___

34. Hay-fever or nasal allergies? 1. Yes___ 2. No___

35. Sinus trouble? 1. Yes___ 2. No___

36. Emphysema? 1. Yes___ 2. No___

37A. Pneumonia? 1. Yes___ 2. No___

IF NO TO 37A, SKIP TO 38.

B. What month and year did pneumonia first occur? _____
MO YEAR

C. How many episodes of pneumonia have you had while working at U.S. Postal Service, Orlando?
Number of episodes _____

THE PERSON ONLY GETS ASKED 37D-G IF THE NUMBER OF EPISODES OF PNEUMONIA IS 2 OR MORE.
Please think about your job at the time you began having the episodes of pneumonia you described.

D. Were you working in (fill-in present job classification)? 1. Yes___ 2. No___

38. Have you ever had other chest illnesses? 1. Yes___ 2. No___

IF NO TO 38, SKIP TO 39A.

Please list other chest illnesses:

1. _____
2. _____
3. _____
4. _____

SMOKING QUESTIONS

39A. Have you ever smoked cigarettes for as long as a year? 1. Yes___ 2. No___
('YES' means at least 20 packs of cigarettes in your lifetime, or at least one cigarette per day for one year)

IF NO TO 39A, GO TO QUESTION 40:

B. How old were you when you first started regular cigarette smoking?_____Age in years

C. Do you now smoke cigarettes (as of 1 month ago)? 1. Yes___ 2. No___

IF YES TO 39C, GO TO QUESTION 39E:

D. If you have stopped smoking cigarettes completely, how old were you when you stopped?
_____Age stopped

E. On the average of the entire time you smoked, how many cigarettes do (did) you smoke per day?
_____Cigarettes/day

40. Not counting yourself, how many people in your household smoke regularly? Number_____

41. How many hours per day are you exposed to other people's tobacco smoke? Hours_____

QUALITY OF LIFE QUESTIONS

42. All in all, apart from any concerns you may have about your health, how satisfied would you say you are with your job? Are you ...

A. Very satisfied
B. Moderately satisfied
C. Slightly satisfied
D. Slightly dissatisfied
E. Moderately dissatisfied
F. Very dissatisfied

43. How satisfied are you with your life as a whole these days? Are you ...

A. Very satisfied
B. Moderately satisfied
C. Slightly satisfied
D. Slightly dissatisfied
E. Moderately dissatisfied
F. Very dissatisfied

OCCUPATIONAL HISTORY

44. What month and year did you first work at U.S. Postal Service, Orlando?

_____
MO YEAR

45. What shift do you usually work at U.S. Postal Service, Orlando?
First____ Second___ Third____

46. How many days per week do you usually work at U.S. Postal Service, Orlando? _____ DAYS

47. For how many years in total have you worked with metalworking fluids at U.S. Postal Service, Orlando?
_____YEARS

48. For how many years in total have you worked in dusty jobs outside of U.S. Postal Service, Orlando, Florida?
_____ YEARS

49. In the last 12 months, which of the following activities have you done:

A. Farming
1. Yes___ 2. No___
B. Used two-part (Isocyanate) paints
1. Yes___ 2. No___
C. Wood-working
1. Yes___ 2. No___

D. Gluing for model building 1. Yes___ 2. No___
E. Welding 1. Yes___ 2. No___
F. Bird-keeping 1. Yes___ 2. No___

I AM GOING TO ASK YOU ABOUT JOBS YOU HAVE HELD AT U.S. Postal Service , Orlando, Florida SINCE January 1996. STARTING WITH THE JOB YOU HAVE NOW:

50. What is your job code?_____

51. What is your job title?_____

52. What department/section do you work in? _____

53. What is your main job task?_____

54. What percent of the workday do you do that task?_____

55. What are your other job tasks?_____

For Information on Other Occupational Safety and Health Concerns

Call NIOSH at:
1-800-35-NIOSH (356-4674)
or visit the NIOSH Web site at:
www.cdc.gov/niosh

National Institute for Occupational Safety and Health
NIOSH

Delivering on the Nation's promise:
- **Safety and health at work for all people through research and prevention**