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DURO BAG MANUFACTURING COMPANY
RICHWOOD, KENTUCKY

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I. SUMMARY

In November 1986, the National Institute for Occupational Safety and Health (NIOSH) received a request to investigate the occurrence of skin rashes at the Duro Bag Manufacturing Company, Richwood, Kentucky. The plant was a newly built facility which began operations in January 1986.

On December 11, 1986, NIOSH investigators conducted an initial survey and walk-through evaluation of the plant. On December 16, 1986, and January 9, 1987, medical examinations were conducted and a questionnaire was administered to evaluate the incidence of skin rashes and hair loss among the 245 production workers during 1986. On February 17, 1987, an initial industrial hygiene walk-through evaluation was conducted and on March 5, 1987, environmental sampling for total dust was conducted in the Paper Division.

Results of the questionnaire showed that 61 respondents had experienced a skin rash in the period since January 1986. Fifty-eight positive respondents were examined and 40 had clinical findings of dermatitis. Among 41 negative responders who were randomly examined, only three dermatitis cases were detected.

Subsequent analysis was based on 41 employees indicating the development of skin rash on uncovered skin (face/neck and arms/hands) which started after employment at the Richwood facility, and was not clearly related to nonoccupational causes. The onset of skin rashes occurred eight to 20 times more often during the start-up of production (February, March) than during the last three months (October, November, December) of 1986.

Skin rashes on arms/hands were more frequent among Bag Catchers working in the Plastics Division (RR 8.1; p=0.00004). An increase of skin rashes on the face/neck among Bag Catchers working in the Paper Division, (RR=3.0, p=0.03) could not be correlated with elevated levels of paper dust.

Personal samples were collected for total dust (paper dust) near the breathing zone of employees working as wrapper/loaders, bag catchers, and collator tenders. Airborne concentrations of total dust ranged from 0.18 milligrams of total dust per cubic meter of air (mg/m^3) to 0.53 mg/m^3. All results were below the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL) of 15 mg/m^3 and the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) of 10 mg/m^3 for total nuisance particulates.

Based on observations of affected employees, NIOSH investigators concluded that the increased incidence of dermatitis among Bag Catchers in the Plastics Division was most likely explained by the use of solvents to clean machine parts. The increased incidences of dermatitis of the head and neck among Bag Catchers in the Paper Division could not be correlated with airborne exposures to paper dust and may have been due to statistical chance, since multiple analyses were performed. NIOSH investigators could not determine a significant clustering of dermatitis of the arms/hands among various job classifications within the Paper Division in this investigation. Other factors such as, cinnamic aldehyde in the glue, use of solvents, friction and rubbing, and low relative humidity of the air, may have contributed to the development of skin rashes in individual cases. Recommendations aimed at minimizing the occurrence of contact dermatitis from these exposures are contained in Section VIII of this report.

KEYWORDS: SIC 2643 (Bags), dermatitis, skin rash, starch, glue, solvents, cinnamic aldehyde.

II. INTRODUCTION

In November 1986, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation from the Duro Bag Manufacturing Company, Richwood, Kentucky. The requester asked that NIOSH investigate the occurrence of skin rashes among production workers at the newly constructed Richwood, Kentucky plant. Employees became concerned after one employee broke out with dermatitis that other cases of skin problems might be work related. Some employees expressed concern that hair loss might also be related to work exposures. Additionally, NIOSH was asked to evaluate the respiratory protection program.

On December 11, 1986, NIOSH medical investigators conducted a walk-through survey at the Richwood facility and examined some employees. The investigators decided to focus the investigation on dermatitis and hair-loss among production workers. On December 16, 1986, and January 9, 1987, a questionnaire was administered and medical examinations were conducted. On February 17, 1987, an industrial hygiene walk-through evaluation was conducted and on March 5, 1987, environmental sampling for total nuisance particulates (paper dust) was conducted.

III. BACKGROUND

The Duro Bag Company is a manufacturer of paper and plastic bags. In January 1987, a new plant located in Richwood, Kentucky, was opened and production was gradually transferred from an older plant in Covington, Kentucky, to the new facility. By July 1987, full operation was reached with a production work force of about 245 personnel. The production operations are organizationally and physically separated into the Paper Division and Plastics Division.

Paper bags of various sizes and shapes are produced in the Paper Division. Large rolls of paper are loaded onto machines with the aid of an overhead hoist. The paper is mechanically cut, folded, printed, and glued together to make paper bags of various sizes and shapes. The Paper Division is situated in a single production hall, and is divided into four production areas:

1) Shopping Bags - These machines are capable of forming twisted paper handles on shopping bags.

2) Grocery Bags - This is the main product.

3) Millinary and Notion - A variety of mostly smaller bags are produced in this area.
4) Wrapping - The wrapping machine is positioned in the center of the paper bag production area. Bundles of paper bags are loaded onto wooden pallets and wrapped in plastic for shipment to the customer.

In the Plastic Division thin sheets of plastic are made from polyethylene granules via an automated extrusion process. The plastic sheets are cut, printed, folded, and heat sealed to form various size plastic bags.

The main job categories and duties within the production areas include:

- Bag Catchers - Catch and bundle bags and load bundles into a cording machine.

- Adjustor-Supervisors - Set up and adjust machines for the various size and shape bags. This investigation evaluated only so-called "hands-on" Adjustor-Supervisors, who were directly involved in the production process.

- Machine Tenders - Load paper rolls and add ink to ink reservoirs for printing of bags.

- Presshelper/Pressmen - Operates printing machines in the Plastic Division. In the Paper Division, printing and folding bags is done by a single machine.

- Collater Tenders - Operate machines that produce paper bags and automatically bundle them. They unload the paper bundles and have similar duties as Machine Tenders.

- Wrappers - Load and unload the wrapping machines.

Water based inks are used for the printing of paper bags and solvent based inks are used for the printing of plastic bags. Employees responsible for cleaning the ink rollers and drums in the plastics division use mineral spirits for cleaning the equipment. The used ink reservoirs are sent to the Solvent Storage and Recovery Room for cleaning of the ink reservoirs and recovery of solvents from left over inks. The solvents used in the inks are alcohol based and are recovered by a distillation process.

The glue mixing operation is a batch type operation and the glue is a water based mixture. A typical batch contains corn starch, industrially modified starch, soap, salt and cinnamic aldehyde in water. For a short period, during August 1986 until early September, cinnamic aldehyde was replaced by another preservative, Dowicide A.
In January 1986, at the start of production in the new plant, some construction was still going on. The glue mixing room was not finished and the glue mixing operation was temporarily located in one corner of the Paper Division and the mixing equipment had not been connected to the paper bag manufacturing machines. According to both the company and employees, dust from the glue mixing operation (presumably starch) may have been contaminating parts of the production area closest to the mixing operation. Furthermore, the paste glue itself was added to the bag manufacturing machines by hand, since the pipes from the glue mixing equipment were not yet connected, increasing skin exposures to the paste glue. In May 1986, the glue mixing room was completed and the operation was moved to an area which was physically separated from the production areas. In June 1986, the pipes were connected, which allowed the glue to be automatically distributed to bag manufacturing machines in the Paper Division.

IV. EVALUATION DESIGN AND METHODS

During the initial visit to the plant a walk-through survey of the Paper Division and Plastics Division was conducted. Based on information obtained during the initial visit it was decided that a questionnaire should be administered to determine the incidence of dermatitis in the Paper Division. Visual observations indicated that cases of dermatitis in the Plastics Division were most likely due to the use of solvent based inks used in the printing of plastic bags and the use of mineral spirits for the cleaning of ink rollers and drums.

Questionnaire

A questionnaire was administered to all hourly employees working in the production areas who were employed at the time of this investigation. All employees classified as Adjustor-Supervisors (both hourly and salaried) who were identified by the company as having manual duties were also asked to complete this questionnaire.

The questionnaire asked for the following data:

- Demographic information, name, address, age, sex, race.

- Work history, date of employment at the Richwood facility, actual and previous department, and job classification.

- Medical history of skin rashes. The main question asked: "Since January 1986, have you experienced any rashes (redness or inflammation) of your skin, lasting for one or more days? (Yes; No; Don't know).

- Twenty-four body areas (scalp, eyelids... bottoms of feet, toes) were listed, and the employee was asked to circle the parts where the skin condition had been experienced.

- Date of onset of skin rash, and department and classification at the date of onset. Was rash still present?

- History of hair loss since January 1, 1986.

For analysis, the complaints were grouped by parts of body on which rash occurred. Since work-related dermatitis usually occurs on skin directly exposed to some aspect of the work process, the two areas of main interest were: the arm/hand area - which comes in contact with all materials which are handled; and the head/neck area, which might have been exposed to airborne paper dust.

Medical Examination

All employees indicating a skin rash or hair loss on the questionnaire were examined. Approximately every fourth employee not indicating any skin rash or hair loss was also examined. A dermatologist examined exposed areas of the skin, (scalp, face, neck, hands, arms). Skin otherwise covered by clothing was not examined. Cutaneous findings were classified into three categories:

i) dermatitis (cutaneous inflammation) not otherwise explained by an endogenous skin disorder or unrelated condition.

ii) dermatitis unrelated to work (endogenous skin condition or otherwise unrelated abnormality).

iii) no detectable abnormalities.

A history of hair loss was evaluated by a hair-pull test. This is a crude clinical test for active hair loss, in which a bundle of approximately 60 hairs are taken between thumb and index finger. The test is considered positive if six or more hairs are plucked from the scalp with a gentle pull.

Environmental

On February 17, 1987, an initial industrial hygiene walk-through evaluation of the Plastics Division, the Paper Division, and the Solvent Recovery and Storage Room was conducted. During the walk-through some employees related airborne dust exposures to skin problems. Since particulate dusts or dry skin caused by low relative humidity may provoke itching, it was decided that environmental sampling for paper dusts should be conducted along with measurements of room temperature and relative humidity in the Paper Division.

On March 5, 1987, personal samples for total nuisance particulates (paper dust) were collected near the breathing zone of employees working as wrapper/loaders, bag catchers, and collator tenders. Samples were collected on pre-weighed polyvinyl chloride (PVC) filters connected via Tygon tubing to battery powered sampling pumps operating at 2.0 liter per minute (LPM). Samples were analyzed gravimetrically according to NIOSH method 0500. Temperature and relative humidity readings were collected using a psychrometer.

V. EVALUATION CRITERIA

A. Environmental Evaluation Criteria

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for 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 if 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 evaluation 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 increase 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)[1], 2) the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLVs)[2], and 3) the U.S. Department of Labor/Occupational Safety and Health Administration (OSHA) occupational health standards[3]. Often, the NIOSH RELs and ACGIH TLVs are lower than the corresponding OSHA standards. Both NIOSH RELs and ACGIH TLVs usually are based on more recent information than are the OSHA standards. The OSHA standards also may be required to take into account the feasibility of controlling exposures in various industries where the agents are used; the NIOSH RELs, by contrast, are based primarily on concerns relating to the prevention of occupational disease. In evaluating the exposure levels and the recommendations for reducing these levels found in this report, it should be noted that industry is required by the Occupational Safety and Health Act of 1970 (29 USC 651, et seq.) to meet those levels specified by an OSHA standard.

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 high, short-term exposures.

B. Health Effects of Nuisance Particulates[2]

Available toxicity data indicates that paper dust should be characterized as a "nuisance particulate". Nuisance dusts, in contrast to fibrogenic dusts which cause scar tissue to be formed in the lungs when inhaled in excessive amounts, have a long history of little adverse effect on the lungs. They do not produce significant organic disease or toxic effect when exposures are kept under reasonable control. The nuisance dusts have also been called (biologically) "inert" dusts, but the latter term is inappropriate to the extent that there is no dust which does not evoke some cellular response in the lungs, when inhaled in sufficient amount.

Excessive concentrations of nuisance dusts in the workroom air may seriously reduce visibility; may cause unpleasant deposits in the eyes, ears, and nasal passages; or cause injury to the skin or mucous membranes by chemical or mechanical action per se or from the rigorous skin cleaning procedures necessary for their removal. The OSHA Permissible Exposure Limit (PEL)[3] for total nuisance particulates is 15 mg/m^3 and the ACGIH TLV[2] is 10 mg/m^3 as an eight-hour TWA.

VI. RESULTS

A. Prevalence of Skin Rashes

The questionnaire was completed by 215 hourly production workers. According to company information the respective work force was 245. Consequently the participation rate was approximately 87%. Missing respondents were equally distributed among the various departments and job

classifications. Sixty-one (28% of the respondents) indicated a skin rash in the period since January 1, 1986.

The medical skin examination included 58 of the 61 respondents indicating a skin rash on exposed areas and 41 random controls without skin complaints. Table 1 compares the questionnaire results with the medical examination results.

Only 3 out of 41 control subjects answered negative in the questionnaire but had clinical signs of dermatitis, as diagnosed by the dermatologist. Forty out of 58 indicating a skin rash since January 1, 1986, still had clinical signs of dermatitis.

B. Prevalence of hair-loss

Twelve employees (6% of the respondents) reported hair loss in the period since January 1, 1986. No active hair-loss could be detected by the hair-pull test in the 12 employees reporting hair loss, in 58 employees examined for complaints of skin rashes, or in 37 employees without complaints of hair loss or skin rashes. No other abnormalities of hair growth other than male pattern baldness was observed. No further attempt was made to investigate the loss of hair.

C. Incidence of New Skin Rashes after Employment at the Richwood facility

The following case definition for possible occupational dermatitis was established: complaints of skin rashes on exposed skin of the scalp, face, neck, hands or arms on questionnaire. Initial onset after January 1, 1986; onset after start of employment at the Richmond facility; and a dermatological examination at least consistent with occupational dermatitis, if active dermatitis were present on examination. Forty-one of the 58 employees who complained of skin rashes on the questionnaire satisfied the case definition. The 17 who did not satisfy the case definition were excluded from further analysis. These included 5 workers suffering from skin diseases due to obvious nonoccupational causes [tinea versicolor (2), acne vulgaris (1), head lice (1), allergy to eye cosmetics (1)], 9 with onset of symptoms on the arms/hands or face/neck prior to employment, and 3 with dermatitis on covered skin only (trunk, groin, legs) were excluded from further analyses. Cases had an average age of 34 years (standard deviation (SD) 12 years), which was not significantly different from the average age of the rest of the employees (37 years, SD=11) in the production area.

Cases of dermatitis occurred more frequently among female employees (relative risk=1.9; p=0.02). However, since more women also worked in different job categories (mainly Bag Catchers) than men, sex differences alone may not have been an important risk factor for the development of skin rashes.

Table 2 shows the incidence of skin rashes during 1986. Incidence rates were calculated by dividing the number of new cases within a month by the number of employed workers at the end of the previous month. The onset of new cases occurred 8 to 20 times more frequently during February and March 1986, while engineering controls were still being constructed, than during the last 3 months of the year. An unexplained rise in incidence rate also occurred in June.

D. Skin Rashes and Job Classifications

We compared complaints of skin rashes in two different exposed anatomical areas, arms/hands (upper arms, elbow, lower arms, hands, fingers), and head/neck (scalp, eyelids, face, neck) among different job classifications (Table 3).

Three groups showed significantly elevated relative risks (RR). The Bag Catchers of the Plastic Division had a relative risk of 5.0 for skin rashes on the arms/hands. They also had significantly more dermatitis in the clinical examination (RR=3.5; p=0.05). All six cases among these Bag Catchers involved the hands (RR=8.1; p=0.00004). Two thought that it was related to the glue used to label bundles of bags. It is the same glue that is used in the Paper Division. Three thought that the solvents used to clean machine parts caused the skin rashes. Direct visual observations of work practices in the Plastics Division established that skin contact of the hands and arms with solvents (mineral spirits) used for cleaning ink rollers and drums occurred much more frequently than skin contact with the glue.

Within the Grocery Bag production area, there were increases in skin rashes of the head/neck area among Bag Catchers, Collator Tenders, and Adjuster Supervisors. Significance levels were based on single tests, but more than 30 tests were computed. Considering multiple comparisons, the only significantly elevated risk was among Bag Catchers in the Plastic Division.

E. Environmental

The results of environmental sampling for total nuisance particulates (paper dust) are presented in Tables 4 and 5. Airborne concentrations of paper dust ranged from 0.18 mg/m^3 to 0.53 mg/m^3 and are below the ACGIH TLV for total nuisance particulates of 10 mg/m^3 and the OSHA PEL of 15 mg/m^3. Airborne concentration of paper dust did not reveal any significant differences for the different job categories or locations and were not higher in areas with a higher prevalence of skin rashes. Relative humidity readings ranged from 22% to 40%, comfortable ranges are considered to lay between 40% to 70%.[4]

A review of the written respiratory protection program indicated most areas of 29 CFR 1910.134 were addressed; however, a few deficiencies were noted. Engineering controls (e.g. local exhaust ventilation) are the preferred method of controlling employee exposures and respiratory protection should be used only when engineering controls and/or substitution of the toxic agent(s) is not feasible. The written program did not specify the exact type respirator which should be used when working in areas requiring respirator usage. Additionally, the program did not specify that employees required to wear respiratory protection be clean shaven.

VII. DISCUSSION AND CONCLUSIONS

In February and March 1986, there was a significantly increased incidence of new skin rashes among the hourly production workers at the newly started Richwood facility. Most of the first cases occurred in the Plastics Department.

A search for high risk areas among the different job classifications and departments has led to the conclusion that employees of the Plastic Division (especially Bag Catchers) developed more skin rashes on their hand than the rest of the production workers. Two possible causes could be identified: use of solvents (mineral spirits) to clean the machines, and use of the paste glue to label the bundles of bags. Based on visual observations it was determined that hand and arm contact with mineral spirits used for cleaning the ink rollers nd drums in the Plastics Division was much more frequent than contact with the glue and was most likely the cause of incidences of dermatitis in this division.

From general experience it is known that solvents dry the skin and may cause skin rashes (1). Additionally, a paste glue which is allowed to dry on the skin may cause nonspecific itching and concurrent scratching. Cinnamic aldehyde, used as a biocide in the glue, may cause skin erythema (redness of skin). Despite its relatively low concentration in the glue, cinnamic aldehyde may have caused transient erythematous reactions in a few individuals. It is also a potential skin sensitizer, although no active cases of dermatitis were observed which strongly suggested contact allergy.

During the start-up months of production at the Richwood facility (February and March, 1986) incidence rates of new skin rashes were significantly higher (28.6 and 11.1 per 100 employees) compared to the end of the year. During the fourth quarter of 1986, the average rate of new skin rashes had declined to 1.4 per 100 employees among the slightly more than 200 production workers. There are no available data to compare these rates with rates that are normally expected in the general population. These data suggest that inadequate engineering controls during start-up of the plant may have contributed to the dermatitis problem. There were no observed temporary increases in dermatitis rates during the month of August, 1986 when Dowicide A was substituted for cinnamic aldehyde as the biocide in the paste glue.

Initially it was hypothesized that the increased level of skin rashes of the head and neck in the Grocery Bag area of the Paper Division might have been due to increased exposure to airborne concentrations of paper dust. However, the absence of any correlation between measured concentrations of airborne nuisance particulates and the occurrence of dermatitis did not support this hypothesis. But, it is still possible that individual cases may have been irritated by paper dust accumulating on work surfaces or intermittent higher levels of airborne paper dust exposures not detected at the time of sampling.

Throughout the plant, workers handle paper rolls or stiff paper bags. Friction of the skin may have been the cause of dermatitis in some workers. The low humidity levels also documented in this investigation may have contributed to symptoms, particularly on the face and neck. Since exposures to glue, friction with paper, and low humidity were ubiquitous among employees within the Paper Division, we were unable to identify high risk occupations on the basis of exposure to these agents.

VIII. RECOMMENDATIONS

Dermatitis Control

1. Personal protective equipment (e.g. gloves, apron, respirator) should be used when loading or unloading the washing and distillation unit in the Solvent Recovery and Storage Room.

2. Appropriate gloves should be used to prevent skin contact with solvents when operating the solvent distillation unit, the washing unit, when cleaning the ink rollers and drums on the printer, and when filling and cleaning the ink reservoirs. Gloves should be selected based on the solvent being used. Gloves made of nitrile or natural rubber appear to provide the best protection from the alcohol based solvents used in the solvent based inks and the solvent distillation unit and washing unit.

3. Employees should be encouraged to practice good personal hygiene. Workers should wash prior to work breaks or when skin contamination is suspected. Drying glue on the skin is irritating and contains cinnamic aldehyde, which may cause transient redness of the skin and discomfort. Cinnamic aldehyde also is a potential skin sensitizer. Direct skin contact with the glue should be minimized. If the glue is accidentally spilled on the skin, it should be washed off immediately.

4. Friction and rubbing from paper may cause dermatitis. Protective gloves and long sleeved garments offer protection from friction when handling bags or paper rolls.

5. All recommendations contained in the Material Safety Data Sheets (MSDSs) regarding use of appropriate ventilation, personal protective equipment, and special precautions should be closely followed.

6. All accumulated dusts in the paste mixing room and all other areas of the facility should be cleaned up by the use of a vacuum system, dry sweeping techniques should not be used. A regular housekeeping schedule should be implemented to prevent future accumulation of dusts.

7. Relative humidity of the air should be kept in a range between 40% and 70% to prevent drying of the skin and for comfort reasons.

8. Employees should be encouraged to use skin moisturizers on a regular basis on the hands and arms to counteract the drying effects of low humidity, paste glue, and friction.

Solvent Vapor Control/Respiratory Protection

1. The solvent distillation and washing units in the Solvent Recovery and Storage Room should be equipped with a local exhaust ventilation system. When the installation of the local exhaust ventilation unit for the solvent recovery unit and the washing unit is completed monitoring, for airborne concentrations of solvents should be conducted to determine the effectiveness of these controls.

2. Smoking, eating and drinking should not be allowed in the immediate work areas and should be confined to the cafeteria. Employees should be instructed to wash their hands before drinking, eating, and smoking, or using toilet facilities.

3. Until effective engineering controls are installed, the use of an appropriate respirator should be required and enforced in the paste mixing room and the solvent recovery and storage room.

4. All aspects of the respirator program should comply with the requirements of 29 CFR 1910.134.[4] The respirator program should be updated to include provisions for annual medical examinations for all employees who are required to wear respiratory protection during the course of their work. Additionally, employees who are required to wear respiratory protection should be clean shaven to the point that there is no possible interference with the sealing surfaces of the respirator.

IX. REFERENCES

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1. DURO BAG COMPANY

2. NIOSH, Region IV

3. OSHA, Region IV

For the purpose of informing 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 1

Comparison of questionnaire results and clinical examination for skin rashes

DURO BAG MANUFACTURING COMPANY
RICHWOOD, KENTUCKY
HETA 87-080

		dermatitis on clinical examination: yes	no	
skin rash in period since January 1, 1986 (questionnaire result)	yes	40	18	58*
	no	3	38	41
		43	56	99

* - Seventeen employees responding "yes" to dermatitis question failed to satisfy all criteria of the case definition and were excluded from subsequent analysis. (Active dermatitis was not part of the case definition.)

Table 2

Monthly Incidence of New Skin Rashes During 1986.

DURO BAG MANUFACTURING COMPANY
RICHWOOD, KENTUCKY
HETA 87-080

	Number of new Skin * Cases	Cumulative Number of Production Workers	Monthly Incidence of Skin Rashes (cases/100 employees) ¶	
January	0	7	-	
February	2	27	28.6	**p=0.009
March	3	66	11.1	**p=0.02
April	1	106	1.5	
May	2	132	1.9	
June	8	169	6.1	**p=0.02
July	3	191	1.8	
August	4	200	2.1	
September	2	204	1.0	
October	3	207	1.5	
November	6	210	2.9	
December	0	212	0	

* Seven additional cases indicated onset of dermatitis sometime after beginning work at the Richwood plant, but month of onset not specified.

¶ The monthly incidence is based on the number of workers at the end of the previous month, to allow at least for a short exposure time.

** Significantly increased compared to the average rate between October and December (1.4 cases per 100 employees).

Table 3
Skin rashes in the arms/hands and face/neck
among different job classifications.
DURO BAG MANUFACTURING COMPANY
RICHWOOD, KENTUCKY
HETA 87-080

		Number of Employees (denominator)	Number of cases with skin rashes	
			arms/hands	face/neck
Plastic Division				
	Bag Catcher	8	6 (RR = 5.0)***	1 (RR = 1.7)
	Machine Tender	9	2 (RR = 1.3)	--
	Presshelper/Pressman	3	3 (RR = 1.4)	1
	Adjuster Supervisor	13	--	--
Total Plastics		33	11 (RR = 2.3)**	2
Paper Division				
Grocery Bag -				
	Bag Catcher	45	5	7 (RR = 3.0)*
	Collator Tender	19	6 (RR = 2.1)	2 (RR = 1.6)
	Machine Tender	11	--	--
	Adjuster Supervisor	11	3 (RR = 1.6)	2 (RR = 2.6)
Total Grocery Bag		85	14	11 (RR = 3.4)
Shopping Bag -				
	Bag Catcher	18	4 (RR = 1.3)	3
	Machine Tender	11	--	--
	Adjuster Supervisor	17	2	--
Total Shopping Bag		46	6	3
Millinary and Notion -				
	Bag Catcher	20	4 (RR = 1.2)	--
	Machine Tender	7	--	--
	Adjuster Supervisor	5	--	--
Total Millinary and Notion		32	4	--
Wrapper		19	2	--
Total Paper Division		182	26	14 (RR = 1.3)
Total Production Area		215	37	16

RR = relative risk compared to the rest of the company.
* = p § 0.05
** = p § 0.01
*** = p § 0.001

(Chi square test or Fishers test [two-tailed])

Table 4

Personal Breathing Zone Air Concentrations of Paper Dust

DURO BAG MANUFACTURING COMPANY
RICHWOOD, KENTUCKY
HETA 87-080
March 5, 1987

Job/Location	Sample Time (minutes)	Sample Volume (liters)	mg/M^3
Bag Catcher, tuffy (white, brown) (Machine #1)	413	826	0.39
Bag Catcher, millinary (brown) (Machine #9)	416	832	0.53
Bag catcher, grocery (white) (Machine #17)	407	814	0.18
Bag catcher, grocery (brown) (Machine #19)	404	808	0.26
Collator tender, grocery (white) (Machine #33)	398	796	0.45
Wrapper loader (white, brown) (Machine #1)	395	790	0.42
Collator tender, grocery (brown) (Machine #40)	394	788	0.25
Environmental Criteria		OSHA PEL	15.0
		ACGIH TLV	10.0

Table 5

Psychrometer Readings

DURO BAG MANUFACTURING COMPANY
RICHWOOD, KENTUCKY
HETA 87-080
March 5, 1987

Location	Time	Temperature	Percent Relative Humidity
Shopping Bags	9:50	67	24
	2:30	72	27
Grocery Bags	10:00	68	25
	2:20	70	29
Millinary and Notion	10:10	75	26
	2:20	73	26
Wrapper	10:10	69	23
	2:30	69	28