U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
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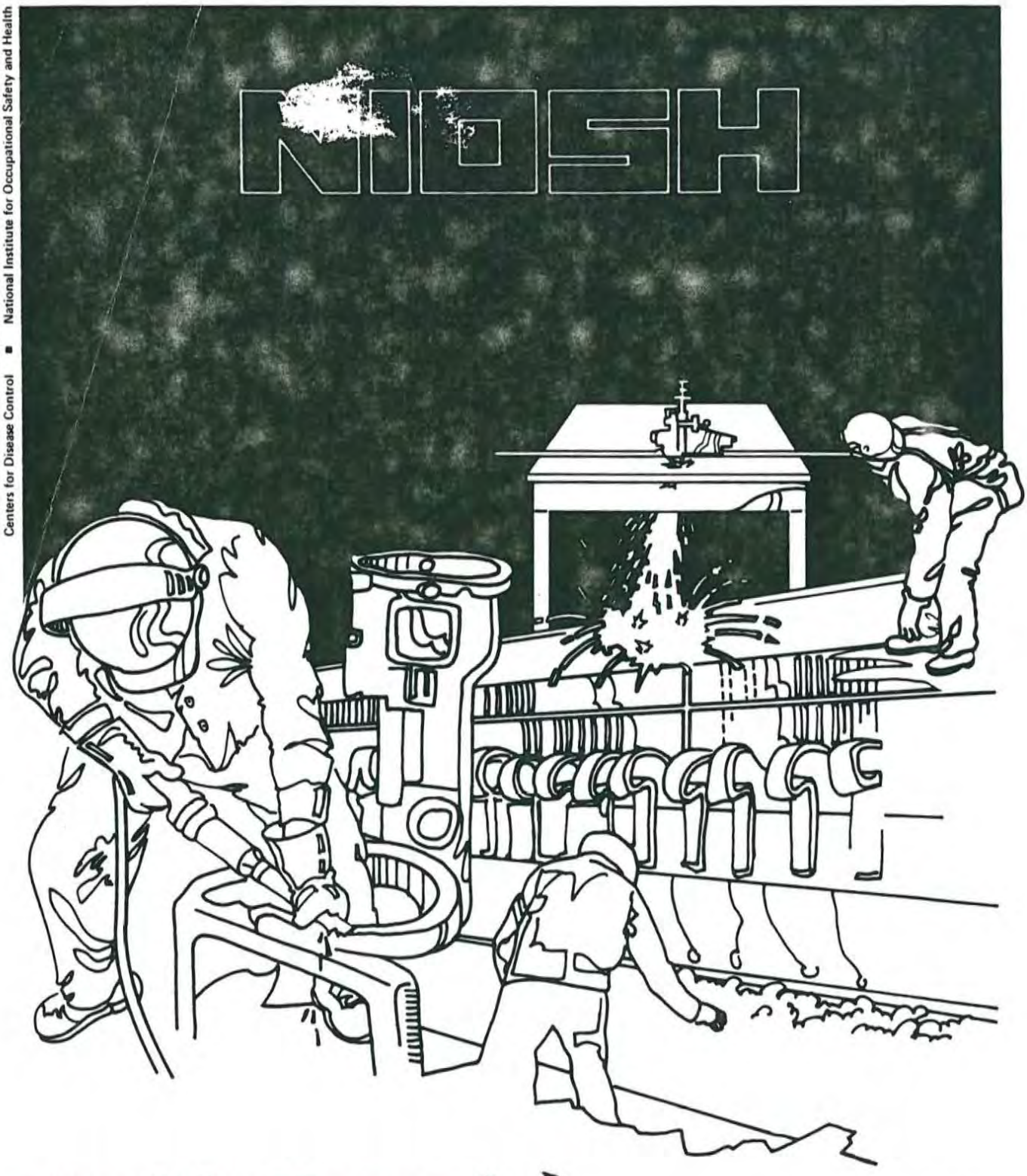

Health Hazard Evaluation Report

HHE 80-225-1130
KROGER COMPANY
CINCINNATI, OHIO

PREFACE

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

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

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KROGER COMPANY
CINCINNATI, OHIO

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I. SUMMARY

On August 13, 1980, the National Institute for Occupational Safety and Health (NIOSH) received a request from the Retail Store Employees Union, Local 1099, to evaluate an outbreak of skin problems among employees at a Cincinnati store of the Kroger Company.

Evaluation included two surveys in 1980 involving four Cincinnati Kroger stores. In the first survey, 18 cases of dermatitis were identified. These were diagnosed as phototoxic contact dermatitis by the two dermatologists involved in the study. Thirteen of these 18 cases were in sackers, and 13 of the 31 (42%) sackers interviewed had the dermatitis. Attack rates in other employee groups were much lower. In the second survey, of 41 sackers interviewed 21 (51%) were, by examination, found to have this dermatitis. Affected sackers spent 2.0 daylight hours working outdoors, as compared to 1.3 for unaffected sackers ($p < .06$ Student t test), and significantly more affected than unaffected sackers (38% and 10%, respectively) said that they came into frequent contact with unpackaged celery ($p = 0.04$, Fisher's Exact Test, 1-tail). However, the pre-packaging of celery in one of the stores during the following summer (1981) failed to prevent a recurrence of the dermatitis in that store.

In August and September 1981 NIOSH examined the skin of sackers from 20 Kroger stores in four other cities. Of 47 sackers interviewed, only two very mild cases (4%) were discovered. The only difference found between these relatively unaffected stores and the affected stores in Cincinnati was the longer shift worked by sackers in Cincinnati.

NIOSH has found evidence of a high prevalence of phototoxic contact dermatitis among sackers at several Kroger stores in Cincinnati. A search for the phototoxin responsible has been unsuccessful.

KEYWORDS: SIC 5411 (grocery stores) - Phototoxicity, contact dermatitis.

II. INTRODUCTION

On August 13, 1980, the National Institute for Occupational Safety and Health (NIOSH) received a request from the Retail Store Employees Union, Local 1099, to evaluate an outbreak of skin problems among employees at the Kroger Company's Western Hills store in Cincinnati, Ohio. On August 14, 1980, an opening conference was held with representatives of the union and management. Also present, at the request of management, was a consulting dermatologist from the University of Cincinnati. After this meeting, a walk-through survey was conducted at the affected store.

Between August 14 and 19 NIOSH medical officers administered questionnaires to employees at Western Hills and two other stores in the area, and examined the hands and forearms of each participant.

A second survey was performed, in September 1980, at three Kroger stores in the Cincinnati area, including Western Hills, one of the other stores in the first survey, and a store not previously studied.

In August and September 1981 further surveys were performed at Kroger stores in St. Louis, Missouri; Lexington and Louisville, Kentucky; and Columbus, Ohio.

An interim report, containing results of the first two surveys, was completed in February 1981.

III. BACKGROUND

The Kroger Company operates grocery stores in several regions of the United States. Employees are involved in such activities as the handling of produce, meats, and other grocery items, cashiering, clerking, and bagging (sacking) of groceries.

During the summer of 1980, several employees at the Western Hills Kroger store in Cincinnati reported to their union the occurrence of patches of brown discoloration on arms and hands. Examination of a few employees during the walk-through survey in August, 1980 confirmed the presence of brown patches and streaks on the skin, sometimes associated with blistering and peeling. The consulting dermatologist considered these pigmented patches most consistent with phototoxic contact dermatitis. Most of these cases were later also seen by a NIOSH dermatologist, who concurred in this diagnosis. The impression from the walk-through was that sackers, who bag groceries at the check-out counters, were most affected.

Phototoxic skin reactions are produced by certain classes of chemicals that increase the sensitivity of the skin to ultraviolet radiation, resulting in erythema (redness), hyper-pigmentation (darkening), and sometimes blistering. Phototoxins may be ingested or applied topically and are even used therapeutically in the treatment of vitiligo. Among the most common phototoxins are the psoralens or furocoumarins contained in perfumes, in wild plants (stinking mayweed and giant hogweed, for example) and in common vegetables such as celery, carrots, dill, parsley, and Persian limes. When infected by a common fungus known as "pink rot" (Sclerotinia sclerotiorum), celery becomes a potent phototoxin. Outbreaks of phototoxic dermatitis have been seen in both celery harvesters and celery canners. Other common phototoxins include various medications (e.g. tetracyclines, sulfonamides), coal tar derivatives, some halogenated anti-baterial substances, and certain sun-screening agents. Ultraviolet light in the wavelength range of 3200-4200 Angstroms is most efficacious in producing a phototoxic reaction.[1,2,3,4]

IV. ENVIRONMENTAL EVALUATIONS

During the initial and follow-up evaluations, information was obtained on liquid cleaning agents used in the stores. The air handling systems (heating units and air conditioning) were observed for contaminated ducts and filters. None were found. The insulation in one area of duct was damaged, but otherwise the system was intact. Since these systems circulate the air rather than exhaust or supply it, ventilation (velocity) measurements were not made. Much of the dust cleaning was done by sweeping, dry mopping, and vacuuming. Dust generation during cleaning did not appear to be excessive.

V. MEDICAL EPIDEMIOLOGICAL EVALUATION

A. FIRST SURVEY: AUGUST 1980

Between August 14 and 19 we administered questionnaires to employees at Western Hills and two other Kroger stores in the Cincinnati area. The questionnaire included questions about demographic and job characteristics, occurrence of skin problems, use of cleaning agents, exposure to medications, perfumes, lotions, and, for sackers, methods used in sacking. As a part of this survey, we examined the arms and hands of each participant.

At Western Hills we attempted to interview all sackers, ultimately talking with 15 of 21 (71%). The six not interviewed were on vacation or medical leave unrelated to the skin problem. We chose the 33 other participants systematically from employment lists, weighting the sample to include a higher proportion of cashiers and produce clerks than of other employees. At the other two stores visited during this preliminary survey, only employees present at the time of a daytime visit were interviewed.

The activities of sackers included bagging groceries, cleaning, and collecting carts from the outdoor parking lot. Cashiers performed cashiering, sacking, some cleaning, and no scheduled outdoor work, although their work station was at the front of the building, near the windows. Produce clerks prepared and cleaned produce prior to putting it on the display counter, and worked at the weighing counter. They did some cleaning but spent no time outdoors during the workday. Virtually all sackers had scratches on their arms and hands, trauma caused by contact with the coarse paper and serrated edges of the bags.

Table 1 lists the number of employees at the three stores who were found by direct examination to have the characteristic brown patches or streaks on their hands or forearms.

Table 1
Percentage of employees affected by rash.
August, 1980

	Sackers		Others	
Store	Affected/ Interviewed	Blisters	Affected/ Interviewed	Blisters
Western Hills	9/15 (60%)	5/9 (56%)	5/33 (15%)	0/5 (0%)
Ft. Mitchell	3/6 (50%)	3/3 (100%)	0/9 (0%)	0 (0%)
Montgomery	1/10 (10%)	0/1 (0%)	0/8 (0%)	0 (0%)

Because the data obtained from Western Hills was more complete and was obtained more systematically than that at the other stores, we analyzed only the data collected at the Western Hills store.

Most affected workers noted the onset of lesions between one and twelve weeks prior to the survey. At onset, the lesions were reddish and often pruritic. Within 24-48 hours, these reddish areas turned brown, sometimes after blistering, and this pigmentation persisted for several weeks or even months before fading. More sackers than cashiers or produce clerks were affected (60%, 18%, and 38% respectively). This approached statistical significance in the case of cashiers ($p = 0.0506$, Fisher's Exact Test, 2 - tailed). No other employees appeared to be affected. The predominance of this problem among sackers as compared to other employees is also demonstrated by the high proportion of sackers with more severe reactions, as reflected by the number who suffered blistering (5 of the 9 affected). Affected employees tended to be younger than unaffected workers (mean age 21 years and 29 years respectively), reflecting the younger ages of sackers.

We found no significant difference in race or sex, and no significant difference in use of medications or lotions, between affected and unaffected workers.

It was difficult to define the beginning of the outbreak precisely. Employees' lesions coincided with the advent of summer, except for one sacker who reported the onset of her lesions in January 1980, not long after she began work as a sacker. A managerial employee reported having had identical lesions when working as a sacker four years earlier but had had no further lesions in the four years since working in management. It did appear that, with the one exception noted above, the affected sackers employed by Kroger in both 1979 and 1980 did not experience their lesions until the summer of 1980.

B. INTERIM ACTIONS

NIOSH questioned employees and management to determine what changes had occurred at Kroger stores that might account for the appearance of phototoxic reactions in employees. Kroger sells carrots, both packaged and unpackaged, unpackaged celery, and other unpackaged fresh vegetables, a practice in effect for eight years. There had been no recent changes in cleaning agents, no recent tarring of the parking lots, and no known changes in the grocery bags except for a color change in the bag logo. This logo is printed on the bottom and side of the bag; sackers have little contact with the logo.

Samples and formulas of the inks used in the grocery bags were obtained from the supplier. None are known photoxins. The two blue pigments used in the new logo were submitted to NIOSH's lab for analysis of their visible and UV light spectra. One of the two showed a peak of activity in the 2800-3000 Angstrom range. The bag paste was also submitted for analysis, but no meaningful spectra could be elicited, even with dilution of the paste. The vice-president and the company physician of the bag company denied any reports of skin illness among bag company employees. Observation of the manufacture of Kroger bags at the plant revealed that bag production was almost entirely automated. Only quality control personnel, and occasionally the machine operator, touched the finished bags. Casual observation of the quality control group at work revealed no skin lesions like those seen among Kroger sackers.

NIOSH contacted Kroger's celery distributor in California who was not aware of any increase in pink rot or dermatitis among pickers.

We obtained the formulas and samples of all cleaning agents. Only the liquid handsoap used in the washroom contained an ingredient whose structure suggested potential phototoxicity. A literature search on this ingredient--2,4,4' trichloro-2'-hydroxydiphenylether--revealed no reports of phototoxicity, even in experimentally tape-stripped skin, a pre-testing procedure that strips the stratum corneum (outer layer of skin).

C. SECOND SURVEY: SEPTEMBER 1980

To further evaluate employee exposure to potential phototoxins, NIOSH performed a second survey in September 1980. In addition to resurveying the Western Hills and Fort Mitchell stores, we also included a "control" store, Hyde Park, at which neither union nor management had received any reports of skin problems. The questionnaire included demographic information, history of skin disease, job history, seniority, use of the liquid handwash, handling of produce, and working time spent outdoors during daylight hours. The arms and hands of all participants were examined.

We attempted to interview the majority of sackers and cashiers, with others chosen systematically from employment lists. Those interviewed were distributed as follows:

Store	Sackers	Cashiers	Produce	Other
Western Hills	14	8	4	8
Ft. Mitchell	13	9	3	10
Hyde Park	14	2	1	8
	41	19	8	26

We defined a case of phototoxic rash as the presence of one or more brownish spots or streaks on the hand or arm, observed by a NIOSH investigator, and having appeared within the past six months. Among 94 individuals, we found 23 cases of rash, 21 of them in sackers (91%), and two of them (8%) in cashiers. This yields a prevalence of 51% for sackers and 11% for cashiers. The second survey thus confirmed the initial impression that the majority of affected workers were sackers. Therefore, for the purposes of further analysis, we considered only sackers.

The distribution of affected sackers is shown in the table below.

Store	Cases	Total Interviewed	Prevalence
Western Hills	10	14	71%
Ft. Mitchell	4	13	31%
Hyde Park	7	14	50%
	21	41	51%

The "control" store, Hyde Park, had a prevalence of 50%. The average age of cases was 20 years, compared with 24 years among non-cases. Sex and racial distribution were similar in the two groups. Affected sackers said that they spent an average of 2.0 daylight hours working outdoors, compared with 1.3 hours for unaffected sackers ($p < .08$, student t test). Unaffected sackers actually used the liquid handsoap more frequently than did affected sackers. Significantly more cases (8, or 38%) than non-cases (2, or 10%) said that their hands and arms came into frequent contact with unpackaged celery ($p = .040$, Fishers's Exact Test, 1-tail). This difference was also significant for the

subset of sackers employed at Hyde Park ($p = 0.035$, Fisher's Exact Test, 1-tail), where workers were unaware that celery was a suspect phototoxin. The stores were similar in organization, layout, and work practices.

D. SURVEILLANCE

Since celery is known to contain phototoxic furocoumarins, and since affected workers recalled greater exposure to it than did unaffected workers, the Kroger company began, in the months following these surveys, to pre-package in plastic all of its celery at the Western Hills store. A surveillance system was developed whereby union and management representatives for several stores were to report any suspected cases of phototoxicity to NIOSH representatives for further investigation. If celery were responsible for the dermatitis outbreak of the summer of 1980, then we would expect the Western Hills store to have a relatively low rate of new cases in the summer of 1981.

E. FOLLOW-UP SURVEYS: Summer 1981

By June 1981 cases of pigmentation had reappeared. Visits to the Western Hills and Hyde Park stores demonstrated that the attack rates in the two stores were comparable. Hence, the packaging of celery at Western Hills had had no demonstrable preventive effect.

In addition to the cases at stores already visited in 1980, cases were reported from other stores, including a large number of cases at the Cherry Grove store. A visit to this store revealed a very high attack rate among sackers. Virtually all of the sackers present on the day of our visit to Cherry Grove were affected.

At this point, with the cooperation of the Kroger Company, we decided to gather information as to the presence or absence of this problem in similar stores in other cities. This would give us an idea of how widespread the problem was and allow us to compare the characteristics of a greater variety of affected and unaffected stores.

Consequently, we visited Kroger stores in St. Louis, Missouri; Lexington, Kentucky; Louisville, Kentucky; and Columbus, Ohio. We visited several stores in each city. At each store we conducted a walk-through survey in which we compared it to the Cincinnati stores in terms of store layout, bags used for sacking, cleaning agents and other materials used, origin of produce used in the store, work schedules, and other factors. We then interviewed all sackers present at the time of our visit and examined their hands and forearms for the characteristic pigmentations. Since we wished to sample several stores in each city, we did not spend the considerable time necessary to interview all sackers at a single store, nor did we interview employees other than sackers, since we felt the probability of finding the dermatitis in these other employees was low. All visits were made in August and September 1981.

In St. Louis, hands and arms of sackers were examined but each employee was interviewed only briefly. In the other cities, a questionnaire, similar to that used in Cincinnati, was also administered.

The results of these surveys are summarized in Table II.

Table II - Characteristics of sackers interviewed
August-September, 1980

City	Stores Visited	Sackers Interviewed	Males/Female	White/Black	Cases
St. Louis	4	13/60	12/1	12/1	1 (8%)
Lexington	6	13/90	8/5	11/2	0 (0%)
Columbus	5	21/180	13/8	20/1	1 (5%)
Louisville*	5	20	-	-	0 (0%)
	15	47/330	33/14	43/4	2 (4%)

*The data for Louisville has been lost. Data in the table is approximate.

In the four stores visited in St. Louis, 13 sackers were interviewed. One of these had two very lightly pigmented spots on the right hand and left volar forearm. She had not noticed its presence and could not account for it. No cases were noted in Lexington or Louisville. In Columbus, 21 sackers were interviewed; one person had a small, very light, brown patch on the left forearm but did not know how long she had had it.

We found no differences between the stores in cleaning agents used nor in the kind of work performed by sackers. The bags used were the same as those used in Cincinnati and, in several instances, were made by the same company. The layouts of the stores and the way in which produce was displayed and handled were virtually identical in all stores. We found no differences in employee usage of perfumes or exposure to unpackaged produce.

The only consistent difference that we found was a difference in shift length for the sackers. While sackers in Cincinnati work an 8-hour shift, those in the other cities that we visited, almost without exception, work only a half-shift of 4-5 hours.

Despite the small size of these samples, the attack rates found in the four cities differ strikingly from those in all but one of the Cincinnati stores we visited. This difference in prevalence contrasts with the remarkable similarities between the stores.

IX. DISCUSSION

Phototoxic dermatitis appears to be relatively common among Kroger sackers in Cincinnati. In only one of the five stores that we visited in Cincinnati was the attack rate low (10%). It occurred at a high rate (50%) even in sackers at a store where workers appeared unaware of the problem.

The two dermatologists involved in the investigations consider the diagnosis of phototoxic dermatitis certain. And, indeed, the natural history described by those affected, namely, the development of a reddish, often itching, lesion that turned brown after 24-48 hours but persisted for many weeks, is quite characteristic of phototoxic reactions and is not often seen in other types of dermatitis.

The first two surveys demonstrated that the dermatitis was both most common and most severe among sackers. Several conditions might predispose the sackers to phototoxic dermatitis. Trauma to the skin of hands and arms damages the protective outer layer, permitting easier penetration of a phototoxin. Since most of the reactions were mild, a mild phototoxin or minute quantities of a strong phototoxin might have affected the abraded skin of sackers. This, followed by several hours of sun exposure each day, would create ideal conditions for the development of a phototoxic dermatitis. Since glass transmits wavelengths longer than 3200 Angstroms, cashiers and sackers, who work near windows, could be exposed to ultraviolet light even when indoors. The predominance among sackers certainly depends on their frequent exposure to sunlight during the working day, in addition to their exposure to a phototoxin. This is an important factor in the development of the lesions since sun exposure must occur soon after exposure to a phototoxin for a phototoxic reaction to occur.

The search for the phototoxin responsible has, thus far, been unsuccessful. The first two surveys appeared to exclude the handsoap and cleaning agents as etiologic suspects. The failure of packaging celery to prevent an outbreak at Western Hills in 1981 excludes celery as the cause. Although we were unable to implicate fresh produce, so much produce (for example, carrots, celery, dill, limes) contain some furocaumarin that this remains a possible cause. There was no apparent difference between the Montgomery store and other Cincinnati stores to explain the low prevalence there. And, except for the variation in shift length, no difference could be found between the affected Cincinnati stores and the unaffected stores in four other cities. Although there is no information on "background" rates of phototoxicity, the sporadic cases we found in Kroger stores outside Cincinnati seem insufficient to constitute an outbreak.

Since our samples in the other cities were much smaller than in Cincinnati, it is possible that our sampling was insufficient to pick up cases. It is also conceivable that the offending agent is present in Cincinnati but not in the other cities. In addition, if the agent were one that occurred only intermittently among lots of a particular

product, one would see an outbreak only after the handling of affected material. However, it seems unlikely that we would have encountered this situation in more than four stores in Cincinnati but in none of the 20 stores outside Cincinnati. Furthermore, it is characteristic of phototoxic dermatitis that, once present, it persists for several weeks or months. Hence, an outbreak that occurred in July should have been observable for the remainder of the summer.

It is quite possible that the effect of a shorter working day is sufficient to dramatically reduce the prevalence of the dermatitis. In any event, this was the only difference we found between affected stores in Cincinnati and unaffected stores in other cities.

X. RECOMMENDATIONS

1. In the more severe cases, use of long sleeved shirts, cotton gloves, or barrier creams may be effective.

2. The Kroger Company and their consulting dermatologist plan to implement an active surveillance program. If cases again reappear, the employees union or the Kroger management may wish to consider consulting NIOSH for further epidemiological assistance.

XI. REFERENCES

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XI. AUTHORSHIP AND ACKNOWLEDGEMENTS

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XII. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), 5285 Port Royal, Springfield, Virginia 22161. Information regarding its availability through NTIS can be obtained from NIOSH Publications Office at the Cincinnati address.

Copies of this report have been sent to:

1. Retail Store Employees Union, Local No. 1099
2. Kroger Company
3. NIOSH, Region V
4. OSHA, Region V

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.

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