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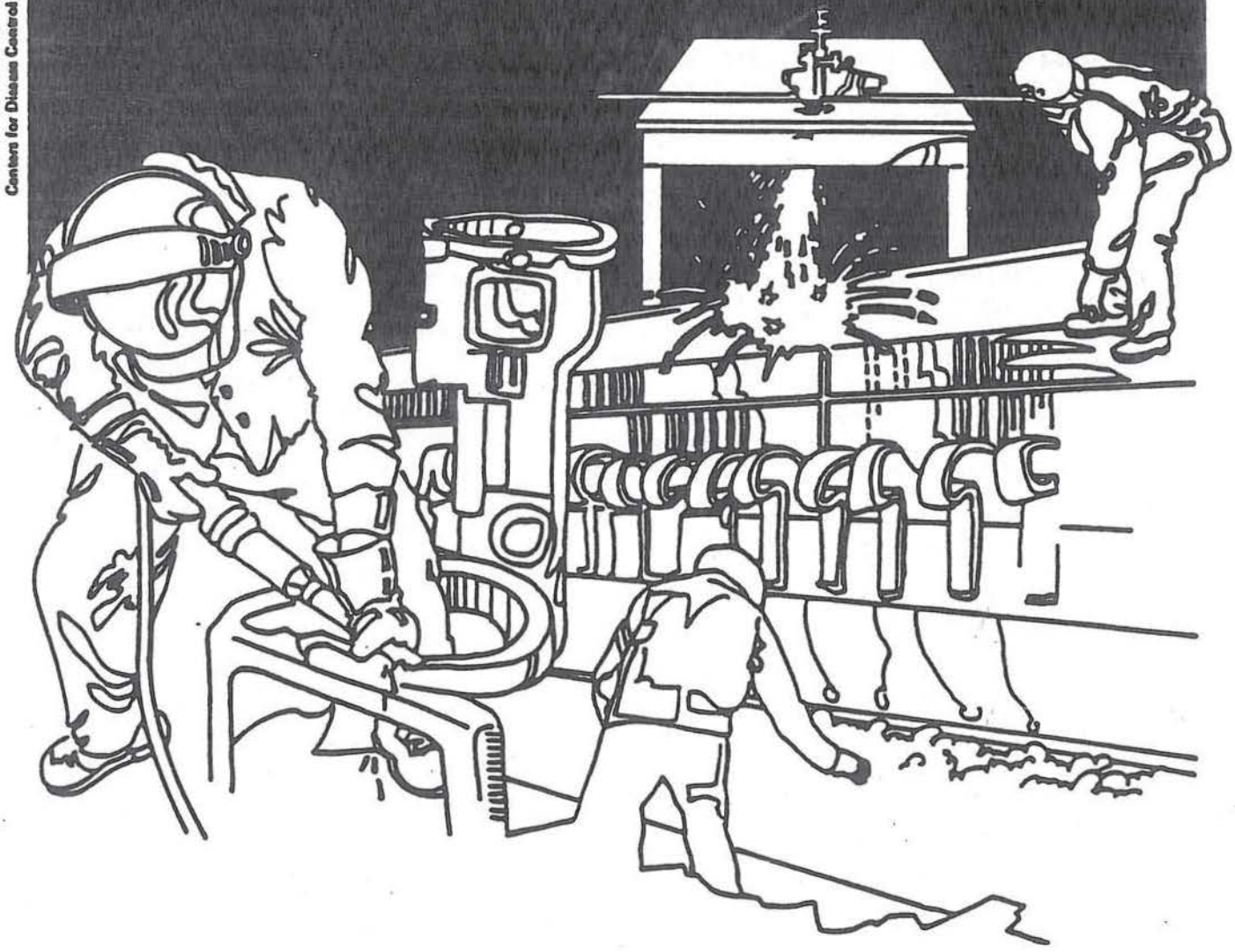

# Health Hazard Evaluation Report

HETA 83-453-1488
CHEF PIERRE, INC.
TRAVERSE CITY, MICHIGAN

## 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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CHEF PIERRE, INC.
TRAVERSE CITY, MICHIGAN

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## I. SUMMARY

On September 15, 1983, the National Institute for Occupational Safety and Health (NIOSH) received a request to evaluate complaints of discomfort and allergic reaction among employees working with cinnamon in the production of apple dumplings at Chef Pierre, Inc., Traverse City, Michigan.

In October 1983, NIOSH investigators conducted an initial survey of the facility during which confidential medical questionnaires were administered to the employees. In December 1983, an environmental survey was conducted during which personal and area samples were collected to assess airborne exposures to total particulate, respirable particulate, and cinnamaldehyde.

Laboratory analysis showed that concentrations in six personal samples of airborne total particulate ranged from 0.67 to 1.5 milligrams per cubic meter of air ($mg/M^3$), with a mean of 0.85 $mg/M^3$. All concentrations were well below the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value of 10 $mg/M^3$ for nuisance particulate, and the Occupational Safety and Health Administration (OSHA) standard of 15 $mg/M^3$ as an 8-hour time weighted average (TWA). Analysis of two area samples collected for airborne respirable particulate revealed concentrations of 0.23 and 0.25 $mg/M^3$, both of which were well below the OSHA standard of 5 $mg/M^3$. No cinnamaldehyde was detected above the limit of detection of 20 micrograms (ug)/sample for the two sorbent tubes, and 40 ug/sample for the two filter samples collected.

The types of symptoms reported in the employee interviews were diverse, with no single symptom reported by greater than 20% of the workforce on the apple dumpling line. A majority of complaints were of an episodic nature, with many employees identifying the filling of the cinnamon or flour hoppers as a causative factor. No widespread incidence of allergic-type health problems were noted in the employees interviewed. Two employees reported occasional dermatitis which may possibly have been allergic in nature.

On the basis of the data obtained during this investigation, it is concluded that no health hazard existed at the time of this survey. Recommendations designed to alleviate the reported symptomatology are included in this report.

KEY WORDS: SIC 2051 (Bakery Products) Cinnamon, Cinnamaldehyde, Irritation, Hypersensitivity

## II. INTRODUCTION

On September 15, 1983, a representative of the Bakery, Confectionery, and Tobacco Workers Union requested that NIOSH conduct a health hazard evaluation at Chef Pierre, Inc., Traverse City, Michigan. The requestor was concerned with complaints of discomfort and allergic reaction among employees working with cinnamon in the production of apple dumplings.

On October 14, 1983, NIOSH investigators conducted an initial survey of the facility. An opening conference was conducted with representatives of management and the union during which background information was obtained relating to the basis for the request, the plant workforce, and production operations. Following a walk-through survey of the area of concern, medical questionnaires were administered confidentially to the employees working at the apple dumpling process. On December 14, 1983, an environmental survey was conducted during which personal and general area samples were collected to assess airborne exposures to total particulate, respirable particulate, and cinnamaldehyde.

## III. BACKGROUND

Chef Pierre, Inc., produces a variety of bakery and food items for institutional use and commercial sales. The plant employs approximately 680 production workers and has been at its present location since 1962. The process of concern, "5" and "12 pack" apple dumpling production, has been conducted for approximately 18 years during which many equipment and procedural changes have occurred. The process is currently located in the "D" area of the plant and utilizes between 13 and 20 employees on a yearly average of 1 shift per day. The workforce at this operation is predominantly female (86% at the time of the initial survey visit), with large variations in age and length of service.

In the production process, dough is mixed at the beginning of the line and is processed into sheets. As the sheeted dough moves down the conveyor, it is automatically cross rolled, sprayed with water, cut, and scored. Next, whole frozen apples are placed by hand on the sheets of dough. These then pass directly under a rectangular hopper and a small quantity of a cinnamon/sugar mixture is automatically dispensed onto each apple. The edges of the dough are then manually folded over the top of the apple to form the dumpling. These then travel down the line and are placed in boxes along with a package of a cinnamon syrup, palletized, and taken to storage. The employees are stationed along the length of the production line, with the largest number of employees engaged in the folding process. With the exception of the mixer and palletizer, the employees rotate job duties throughout the day. Dust respirators are made available to any employees requesting them.

The cinnamon mixture used in this process is primarily granulated sugar with small amounts of cinnamon (dried, ground, reddish brown bark of the evergreen trees of cinnamonum cassia or equivalent), malic acid, and vegetable oil. The mixture is formulated in a separate area of the plant, and transported to the production line in large containers from which it is periodically added to the dispensing hopper using a hand scoop.

## IV. MATERIALS AND METHODS

During the initial survey of October 14, 1983, confidential questionnaires were administered to all of the employees working on the apple dumpling line. Information was solicited regarding the employee's work history and the presence of any general or work related health problems.

Based on the responses to the questionnaires collected during the initial survey, it was determined that environmental sampling would be appropriate to document general dust levels and to determine the presence of any volatile components of the cinnamon in the area. On December 14, 1983, an environmental survey was conducted during which personal samples for total particulates were collected in the breathing zone of six employees using battery-powered sampling pumps operating at 1.5 liters of air per minute (lpm). The pumps were connected via Tygon® tubing to pre-weighed 37 millimeter polyvinylchloride (PVC) filters. These filters were analyzed gravimetrically for total particulate weight. In addition, area air samples were collected at two locations near the production line; one attached to the side of the cinnamon dispenser, and a second location approximately 3 feet from the dispenser). At each location, the samples collected included one pre-weighed 37 mm PVC filter collected at 1.7 lpm using a 10 mm nylon cyclone, and one pre-weighed 37 mm PVC filter followed in-line by a porous aromatic polymer sorbent tube collected at 1.0 lpm. The respirable dust filters were analyzed gravimetrically for particulate weight. The remaining filters and sorbent tubes were extracted with ethanol and analyzed by gas chromatography with a flame ionization detector for cinnamaldehyde. The durations and locations of sample collection are provided in Table 1.

## V. 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 becomes available.

The primary sources of environmental evaluation criteria for the workplace are: 1) NIOSH Criteria Documents and recommendations, 2) the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLV's), and 3) the U.S. Department of Labor (OSHA) occupational health standards.[4,5,6] Often, the NIOSH recommendations and ACGIH TLV's are lower than the corresponding OSHA standards. Both NIOSH recommendations and ACGIH TLV's 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-recommended standards, by contrast, are based solely 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 legally required to meet only 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 or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from high short-term exposures.

A. Cinnamaldehyde

Cinnamaldehyde is a primary constituent (up to 90%) of the volatile oil of the bark of certain types of cinnamon trees.[1] A review of the literature indicates that cinnamaldehyde is a skin irritant and a strong sensitizer. Allergic contact dermatitis and stomatitis have been attributed to the presence of cinnamaldehyde in toothpaste and various other commercial products during either their manufacture or use.[2] Many other aldehyde compounds are known for their irritative effects to the mucous membranes of the eyes and upper respiratory tract, and in some instances their ability to cause pulmonary sensitization.[3] In one recent study of workers in the cinnamon processing industry (cinnamomum zeylanicum), medical findings included asthma, skin and eye irritation, and weight loss among employees. Although no environmental data was provided in this study, conditions were described as "dusty", where "upon entering the (workplace) one was struck with the overpowering aroma of cinnamon".[4] There is presently no environmental exposure criteria for cinnamaldehyde.

B. "Nuisance" Particulates

The majority of the material comprising the cinnamon mixture would be regarded as a nuisance particulate (i.e. sucrose). In contrast to fibrogenic dusts which cause scar tissue to be formed in lungs when inhaled in excessive amounts, so-called "nuisance" dusts are stated to have little adverse effect on lungs and 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 lung when inhaled in sufficient amount. However, the lung-tissue reaction caused by inhalation of nuisance dusts has the following characteristics: (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.[5]

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 by the rigorous skin cleansing procedures necessary for their removal.[5] The current OSHA standard for nuisance particulates is 15 milligrams per cubic meter of air ($mg/M^3$) as total dust, and 5 $mg/M^3$ as respirable dust as an 8-hour TWA.[6] ACGIH recommends a TLV of 10 $mg/M^3$ for total dust.[5]

## VI. RESULTS

### A. Environmental

Laboratory analysis of the area samples did not detect the presence of cinnamaldehyde in any of the filter or sorbent tube samples. The limit of detection was 20 micrograms per milliliter, which would correspond to 20 ug/sample for the desorbed sorbent tubes, and 40 ug/sample for the extracted filters.

The laboratory analysis of the filter samples collected for airborne total particulate revealed concentrations ranging from 0.67 to 1.5 $mg/M^3$, with a mean of 0.85 $mg/M^3$. All concentrations were well below the ACGIH Threshold Limit Value of 10 $mg/M^3$ for nuisance particulate, and the OSHA standard of 15 $mg/M^3$, as an 8-hour TWA. Analysis of the area samples collected for airborne respirable particulate revealed concentrations of 0.23 and 0.25 $mg/M^3$, which were well below the OSHA standard of 5 $mg/M^3$. A complete listing of these results is presented in Table 1.

Table 1
Results of Samples for Total and Respirable Airborne Particulates
(samples collected 12/14/83)

| Sample Type/ Location or Job Duty | Sample Time (Minutes) | Sample Volume (Liters) | Particulate Concentration (mg/m3) |
|---|---|---|---|
| Personal/Line worker | 306 | 612 | 0.69 |
| Personal/Line worker | 307 | 614 | 0.73 |
| Personal/Line worker | 305 | 610 | 0.67 |
| Personal/Line worker | 306 | 336 | 0.78 |
| Personal/Line worker | 304 | 608 | 0.72 |
| Personal/Mixer | 303 | 606 | 1.5 |
| Area/3' from dispenser (respirable) | 335 | 570 | 0.23 |
| Area/side of dispenser (respirable) | 335 | 510 | 0.25 |

B. Medical

An evaluation of the medical questionnaires revealed that 12 of the 21 employees interviewed indicated episodic instances of symptomatology which they believed were associated with their work on the apple dumpling line. The reported symptom and the number of complaints were as follows; dermatitis (2), headaches (3), stuffiness (4), dry throat (2), cough (2), eye irritation (3), nose irritation (1), bronchitis (1), sinus problems (1), and nasal polyps (1). Most employees attributed these problems to occasional high levels of cinnamon and/or flour dust in the air, particularly during the filling of the cinnamon and flour hoppers.

## VII. DISCUSSION AND CONCLUSIONS

Based on the results of the environmental samples collected in this survey, it appeared that levels of airborne total and respirable particulate were relatively low when compared to the environmental criteria for nuisance particulate. In addition, no detectable levels of cinnamaldehyde were found in the area air samples collected. This is not surprising in view of the small percentage of volatile oil in the cinnamon/sugar mixture (less than 0.06%).

The results of the employee interviews did indicate a considerable amount of symptomatology which was attributed to the cinnamon and/or flour dust in the area. The types of symptoms reported were diverse, with no single symptom reported by more than 20% of the workforce on the apple dumpling line. A majority of these complaints were of an episodic nature, with many employees identifying the filling of the cinnamon or flour hoppers as a major causative factor. This was further aggravated by working at jobs in close proximity to the hoppers. It should be noted that the total particulate concentration in the personal air sample for the mixer operator, was over twice that of the average concentration in personal samples for the line workers (1.5 $mg/M^3$ vs. average of 0.72 $mg/M^3$). Since the mixer operator is responsible for the filling of the hoppers, it is probable that this activity may have contributed to this higher exposure.

No widespread incidence of allergic-type health problems were noted in the employees interviewed. Two employees reported occasional dermatitis which may possibly have been allergic in nature. There were also reports of previous employees who had experienced respiratory problems, but these cases were not evaluated in this survey.

## VIII. RECOMMENDATIONS

The company should evaluate the current procedure for filling the cinnamon and flour hoppers. Modification through engineering controls (i.e., partial enclosures) or improved work practices should result in a lower incidence of employee complaints. However, if recurrent dermatitis or respiratory problems develop among any employees in the future, they should be immediately reported and evaluated by a qualified physician to determine if the problem may be allergic in nature.

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## IX. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days the report will be available through the National Technical Information Services (NTIS), Springfield, Virginia. Information regarding its availability through NTIS can be obtained from the NIOSH publications office at the Cincinnati, address. Copies of this report have been sent to the following:

A. Bakery, Confectionery, and Tobacco Workers Union
B. Chef Pierre, Inc.
C. U. S. Department of Labor, OSHA - Region V
D. NIOSH Regional Offices/Divisions

For the purposes of informing the affected employees, copies of the report should be posted in a prominent place accessible to the employees, for a period of 30 calendar days.