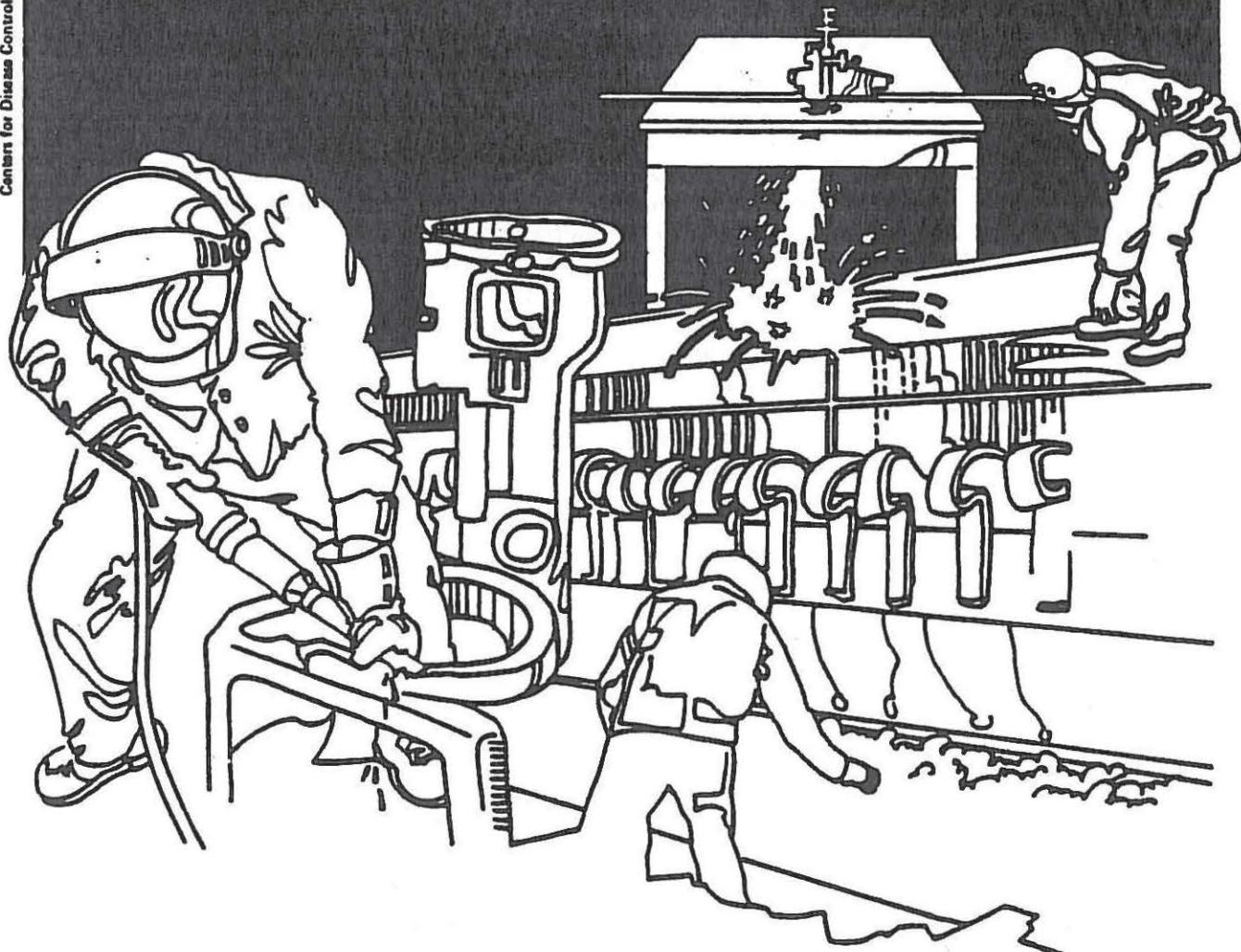


# NIOSH



## Health Hazard Evaluation Report

HETA 85-329-1708  
R. T. FRENCH COMPANY  
SPRINGFIELD, MISSOURI

## PREFACE

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

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

HETA 85-329-1708  
JUNE 1986  
R. T. FRENCH COMPANY  
SPRINGFIELD, MISSOURI

NIOSH INVESTIGATOR:  
George A. Carson, Ph.D., CIH

## I. SUMMARY

On April 30, 1985, NIOSH was requested by the United Food and Commercial Workers Union of America to evaluate working conditions at the R. T. French Company in Springfield, Missouri.

An initial site visit was conducted on July 30, 1985. During the week of September 24, 1985, an environmental investigation was conducted at the plant. Personal and area air samples were collected for ethylene oxide and methyl bromide in the area of the plant where these chemicals were being utilized.

Thirteen personal air samples were collected for ethylene oxide; concentrations ranged from 0.01 to 1.07 ppm. Three of these samples exceeded the NIOSH recommended criteria of 0.1 ppm during the unloading of a truck that normally would not have been unloaded because it showed greater than 1.0 ppm ethylene oxide when it was opened. The twelve area samples for ethylene oxide ranged from 0.01 to 15 ppm, from inside trucks being unloaded and in the warehouse and processing areas. In addition to several samples in the trucks exceeding the NIOSH recommended criteria, two samples adjacent to the recently unloaded spices in the warehouse exceeded the criteria. None of the four personal samples for methyl bromide contained any detectable quantities. However, tote bins containing dry product had detectable quantities of 12.5 and 45 ppm at the upper opening. One two-hour area dust sample exceeded all the recommended criteria for dust concentration.

The sterilization of spices with ethylene oxide needs further study from a number of perspectives before definitive guidelines can be recommended.

Based on the information gathered during this investigation, it was concluded that there are many uncontrolled conditions that existed during the handling and manufacturing of spices that may result in employee exposure to ethylene oxide and methyl bromide. However, the levels to which workers were exposed during this survey would not represent a health hazard. Recommendations for reducing exposures further and limiting some of the uncontrolled conditions are included in section IX of this report.

KEYWORDS: SIC 2099 (Spice Manufacturing) Ethylene oxide, methyl bromide, dusts, spices

## II. INTRODUCTION:

On April 30, 1985, the National Institute for Occupational Safety and Health (NIOSH) received a health hazard evaluation request from the United Food and Commercial Workers at the R. T. French Company, Springfield, Missouri. Their request expressed concern for workers' health from exposure to ethylene oxide and methyl bromide. An accompanying letter provided details of a variety of health problems afflicting workers at the plant.

On July 30, 1985, the NIOSH investigator made an initial site visit to the plant to discuss the request with management and labor representatives from the plant. Information gathered during this site visit indicated that an environmental study was warranted but that an epidemiological study was not feasible because of the number of workers exposed and the intermittent nature of their exposure.

On September 24, 1985, the NIOSH investigator again visited the plant to conduct an indepth evaluation of current worker exposure to ethylene oxide and methyl bromide.

## III. BACKGROUND

The R. T. French Company plant is located on a 50-acre site just east of Springfield, Missouri. The 500,000 square foot plant was constructed exclusively for spice handling and manufacturing and began operation in June of 1972. The plant currently employs 375 workers on two shifts. During times of peak employment, they may employ up to 100 additional workers.

Materials to be processed by the plant are received by truck or rail. Spices are received from all over the world and they require sterilization to maintain product integrity and to protect consumers. Until recently, the spices were off-loaded from trucks and taken into the warehouse and OSHA's proposed standard, the company decided to dismantle their own sterilizing chambers and have the spices treated by a contract firm outside the plant and trucked to the plant.

## IV. PROCESS DESCRIPTION:

Trucks known to contain sterilized spices arriving at the warehouse door are opened and monitored with a direct reading Miran instrument. If greater than one ppm is detected, the truck is not unloaded and is moved away from the dock and allowed to outgas. A variety of spices arrive in a number of different containers. The containers include: burlap bags, plastic-lined burlap bags, woven plastic bags, paper drums, paper bags, etc., just to name a few. Some arrive on pallets and they are off loaded by propane powered fork lifts and other containers may have to be loaded by hand onto pallets inside the container trucks before being removed from the truck.

The spices loaded on pallets are then stacked and stored in the warehouse until further processing. The spices are then cleaned to remove foreign materials by sifting, magnets, and visual inspection. Some are ground to specific particle sizes, depending on the intended use. Other spices are packaged directly. Most spices are blended with other materials brought into the plant to produce a large number of finished products. The bulk dry-blended products are treated with methyl bromide in large totes or in two large chambers to destroy any remaining insect laryae or eggs.

These products are packaged on 30 manufacturing lines into jars, plastic jugs, plastic containers, aluminized sealed packages and other containers. The containerized products are stored in the finished goods warehouse until pickup by trucks for delivery to wholesale and retail markets, food service industries, or other industrial uses.

#### V. ENVIRONMENTAL METHODS:

On September 25 and 26, 1985, area and personal air samples were collected in areas where ethylene oxide and methyl bromide were thought to be present. Since company policy is such that trucks showing greater than one ppm ethylene oxide will not be unloaded, it was felt that sampling would not show anything significant. It was therefore suggested and later agreed to by the company and worker representatives that a truck be unloaded that showed over the one ppm. value so that representative numbers could be generated.

Three trucks arrived at the plant containing spices that had been treated with ethylene oxide by the contract firm. Truck #1 was opened on Tuesday, September 24, 1985 and showed 50-70 ppm ethylene oxide by very aggressive monitoring using a direct measuring instrument. These spices had been treated on September 15-16, 1985. This truck contained 40 kilo woven plastic bags of fennel seed. It was felt that these concentrations were excessive therefore truck #1 was moved away from the dock and left open to outgas. Truck #2 arrived Wednesday morning and contained cassia sticks in burlap bags. The spices from four lot numbers in this truck had been treated on September 14-15, 1985. The inside of truck #2 showed one to two ppm ethylene oxide and it was decided that we should monitor during the unloading operation. Representative personal samples were collected from receiving clerks, supervisors, forklift operators, and warehousemen working in the area. Area samples were collected in the general warehouse area as well as inside the truck during the unloading operations. Truck #3 was also unloaded on September 25, 1985. This truck contained basil and chilis that had been treated on September 14-15, 1985 and showed seven to eight ppm ethylene oxide when the unloading started.

Several process areas downstream from the warehouse were also monitored to determine if people working the lines were being exposed to ethylene oxide. Total respirable dust samples were collected in the sifting and grinding areas.

Personal and area air sampling for methyl bromide was conducted in the fumigation room and also on one of the process lines utilizing materials that had been treated with methyl bromide.

Bulk air samples and material samples were also collected for GC/MS analysis. The company had expressed concern that some of the oils in the spices may be interfering with the direct reading infrared analysis and therefore showing more ethylene oxide present than there actually was. It was anticipated that the respective GC/MS scans could be examined for interfering absorbance peaks.

Ethylene oxide air samples were collected using a 400mg and a 200mg charcoal tube in series. Each tube was analyzed individually to make sure there was no breakthrough. The tubes were shipped to the laboratory packed in ice. The laboratory desorbed the tubes for 30 minutes in 1.0 milliter of benzene containing 1% by volume of carbon disulfide. The amount of ethylene oxide was quantified by gas chromatography using an electron capture detector according to NIOSH Method 1607.

Grab samples were collected for ethylene oxide during unloading operations inside the truck using aluminized sampling bags. The bags were filled by attaching the discharge side of pumps to the bag and 15 liter bags were filled in approximately five minutes. The air and contents in the bag were later desorbed onto the standard charcoal tube sampling train using the low flow pumps.

Methyl bromide air samples were collected and analyzed using a modified version of NIOSH Method 2520. There were no 400 and 200 mg tubes available at the time of the survey, therefore the standard 100 and 50 mg tubes were used as the front and backup tubes for each sample. The laboratory then combined both sections of each tube and used it as the sample sorbent. These samples were desorbed for 30 minutes with 1.0 milliliters of carbon disulfide containing one microliter/milliliter of benzene as an internal standard. The amount of methyl bromide was quantified using a gas chromatography with flame ionization detection.

## VI. EVALUATION CRITERIA AND TOXICOLOGY

### A. 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. 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 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. Often, the NIOSH recommendations and ACGIH TLV's are lower than the corresponding 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 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 legally required 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 or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from high short-term exposures.

OCCUPATIONAL EXPOSURE LIMIT

<u>SUBSTANCE</u>	<u>OSHA<sup>1</sup></u>	<u>ACGIH<sup>2</sup></u>	<u>NIOSH<sup>3</sup></u>
Ethylene Oxide	1 ppm	1 ppm	0.1 ppm
Methyl Bromide	20 ppm	5 ppm	20 ppm
Respirable Dust	15 mg/m <sup>3</sup>	10 mg/m <sup>3</sup>	-----
Total Dust	5 mg/m <sup>3</sup>	5 mg/m <sup>3</sup>	-----

VII. RESULTS:

The personal air sampling results for ethylene oxide are shown in TABLE 1. The thirteen samples range from .01 to 1.07 ppm ethylene oxide. One sample (1.07 ppm) exceeded the OSHA and ACGIH TWA, while three samples (1.07, .38 and .15 ppm) exceeded the NIOSH recommended guideline. All three of these samples were less than full shift and were taken from workers inside the trucks who were unloading the sacks of spices. None of the people driving forklifts, working in the warehouse, or further down the processing line were exposed at levels exceeding any of the criteria.

The area air samples for ethylene oxide are shown in TABLE II. The twelve samples range from less than .01 to 15. ppm. The highest levels were obtained inside the trucks during unloading operations. These levels correspond with the high personal levels mentioned above. Two of the area samples (7 and 8) from the general warehouse area exceeded the NIOSH recommended criteria. These samples were collected from areas that were suspected of having high concentrations because recent loads of spices were in the immediate area. Two other area samples (30 and 31) were less than .01 ppm and were away from loading dock area.

The methyl bromide results are shown in TABLES III and IV. Nothing was detected in any of the personal samples on the packaging line and the two area samples on top of the tote bins in the fumigation room showed 12.5 and 45. ppm. The remaining area samples from both the fumigation room and the packaging area showed no methyl bromide detected.

The dust samples are shown in TABLE V. The six dust samples ranged from 0.3 to 13.6 mg/m<sup>3</sup> and did not exceed the evaluation criteria. However, one spice mill area sample showed 13.5 mg/m<sup>3</sup> of total dust during the two-hour sampling period.

#### VIII. DISCUSSION:

The outgassing of ethylene oxide from spices is a very complex issue. Based on the limited information collected during this survey, there are at least four factors that appear to impact the concentrations of ethylene oxide present in the trucks that appear at R.T. French's dock. These include the length of time between treatment and delivery, the physical construction of the trailer the spices are hauled in, the type of spice, and the type of container that the spice is shipped in. Until the impact of these parameters is fully understood, it will not be possible to totally control workers' exposures to ethylene oxide in the spice manufacturing industry.

The company's policy of not unloading a truck if it is over 1.0 ppm ethylene oxide when it arrives at the dock is a good one and one that should be continued. The levels that were obtained during the survey therefore were not typical because trucks were unloaded that were against current company policy.

As previously mentioned, methyl bromide was utilized for two different purposes in the plant's operation. One use was to decontaminate dry finished product in tote bins and the other was its use in a large chamber to decontaminate large quantities of material coming into the plant. We were not able to sample during the time in which a tote was being treated, but from the looks of how it was being done, there may be some problems with worker exposure during the operation.

The ventilation system for the large chambers and fumigation room was not designed properly. Propeller-type fans in ducts were used as air movers which allowed less and less air to be moved when there is not adequate make-up air. It was standard procedure to close up the fumigation room when the large chamber was in use. When this condition was simulated, air containing methyl bromide was actually drawn out of the chamber into the fumigation room. This could be prevented if adequate fresh air make-up was provided.

IX. RECOMMENDATIONS:

Although there are no serious exposure problems at this plant, we offer the following recommendations:

1. Some method should be investigated whereby the trucks hauling spices to the plant could be continuously ventilated during the trip.
2. Plant personnel should continue to sample the trucks when they arrive at the dock and not unload those that show over one ppm ethylene oxide. It is also suggested that the truck be monitored at intervals during the unloading to assure workers that the levels of ethylene oxide do not rise during movement of the spices.
3. The ventilation system in the fumigation room should be thoroughly reviewed. Propeller fans should be replaced with fans that deliver constant volumes as back pressure builds up. A system to deliver fresh air to the room should also be designed into the system.
4. The manner in which totes are treated with methyl bromide should be reviewed. Certainly the length of time a tote is allowed to outgas should be increased as well as the totes should be located in an area with exhaust ventilation so the offgas does not get into the room proper.

X. REFERENCES:

1. 29 CFR Part 1710, Occupational Exposure to Ethylene Oxide; Final Standard, Federal Register, Friday, June 22, 1984.
2. Threshold Limit Values for 1985-86, American Conference of Governmental Industrial Hygienists, ISBN; 0-936712-61-9.
3. NIOSH Current Intelligence Bulletin, May 21, 1981, DHHS/USPHS/CDC/NIOSH, Publication #81-130.

XI. AUTHORSHIP AND ACKNOWLEDGEMENTS

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XII. DISTRIBUTION AND AVAILABILITY:

Copies of this 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 Service (NTIS), Springfield, Virginia. 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. R. T. French Company
2. United Food and Commercial Workers Union of America Local #340
3. U. S. Department of Labor/OSHA, Region VII
4. NIOSH, REgion VII

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

TABLE I  
ETHYLENE OXIDE - PERSONAL SAMPLES

R. T. French Company

HETA #85-329

May 1986

<u>Sample #</u>	<u>Job</u>	<u>Date</u>	<u>Sampling Period</u>	<u>Conc. ppm</u>
1	Receiving Clerk Warehouse Area	9/25	0724-1500	.04
2	Warehouseman	9/25	0745-1500	.04
3	Forklift Operator Warehouse	9/25	0750-1500	.03
4	Forklift Operator Unloading Truck #2	9/25	0750-0930	.03
5	Forklift Operator Unloading Truck #3	9/25	0750-0930	.04
6	Supervisor for Warehouse Area	9/25	0800-1500	.06
9	Quality Control Warehouse	9/25	0839-1530	.01
10	Unloading Truck #1	9/25	0930-1140	1.07
11	Unloading Truck #2	9/25	0930-1140	.38
12	Unloading Truck #3	9/25	1140-1515	.03
13	Unloading Truck #3	9/25	1140-1515	.15
31	Spice Mill Worker - hand dipping	9/26	0730-1130	.01
32	Hopper Blenderman Packing Line	9/25	0742-1130	.01

TABLE II  
ETHYLENE OXIDE - AREA SAMPLES

R. T. French Company

HETA #85-329

May 1986

Sample #	Sample Location	Date	Sampling Period	Conc. ppm
7	Warehouse Area on Column	9/25	0740-1210	.12
8	Warehouse Area by Most Recent Load	9/25	0809-1203	.34
14	Inside Truck #2 First Grab Sample	9/25		15.
15	Inside Truck #2 Second Grab Sample	9/25		2.3
16	Inside Truck #2 Third Grab Sample	9/25		1.8
17	Inside Truck #2 Fourth Grab Sample	9/25		1.3
18	Inside Truck #2 Fifth Grab Sample	9/25		.64
19	Inside Truck #3 First Grab Sample	9/25		.60
20	Inside Truck #3 Second Grab Sample	9/25		.50
21	Inside Truck #3 Third Grab Sample	9/25		.50
30	Spice Mill Area	9/25	0722-1130	.01
33	Warehouse Area	9/25	0750-1130	.01

TABLE III  
METHYL BROMIDE - PERSONAL SAMPLES

R. T. French Company

HETA #85-329

May 1986

<u>Sample #</u>	<u>Job</u>	<u>Date</u>	<u>Sampling Period</u>	<u>Conc. ppm</u>
54	Group Leader on Packaging Line	9/26	1602-2130	n. d.
55	Worker, Packaging Line	9/26	1604-2130	n. d.
56	Worker, Packaging Line	9/26	1606-2130	n. d.
57	Worker, Packaging Line	9/26	1608-2130	n. d.

TABLE IV  
METHYL BROMIDE - AREA SAMPLES

R. T. French Company

HETA #85-329

May 1986

Sample #	Area Location	Date	Sampling Period	Conc, mg/m <sup>3</sup>
50	Fumigation Room on Column by Door	9/26	0941-1730	n.d.
51	Fumigation Room by Methyl Bromide Storage Room	9/26	0942-1730	n.d.
52	On Top of Tote Bin Containing Product Treated on 9/20	9/26	0943-1345	45.
53	On Top of Tote Bin Containing Product Treated on 9/20	9/26	1350-1730	12.5
58	Second Tote Dumping Area	9/26	1613-2107	n.d.
59	By Packing Line	9/26	1617-1710	n.d.

TABLE V

DUST SAMPLES

R. T. French Company

HETA #85-329

May 1986

Sample Type	Area Location	Date	Sampling Period	Conc. ppm
Personal (resp.)	Spice Mill Operator	9/26	0719-1441	0.3
Personal (total)	Screen Cleaner	9/26	0740-1430	1.0
Area	Spice Mill	9/26	0723-0949	13.6
Area	Third Floor	9/26	0745-1446	0.8
Area	Second Floor	9/26	0755-1449	0.8
Area	Spice Mill Pit Area	9/26	1125-1445	1.3