

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE  
CENTER FOR DISEASE CONTROL  
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH  
CINCINNATI, OHIO 45226

HEALTH HAZARD EVALUATION DETERMINATION  
REPORT HE 78-13-577

EQUITABLE BAG COMPANY, INC.  
FLORENCE, KENTUCKY

APRIL 1979

I. TOXICITY DETERMINATION

The National Institute for Occupational Safety and Health (NIOSH) conducted a Health Hazard Evaluation January 12, August 10 and 16, and September 20, 1978, at the Equitable Bag Co., Inc. located in Florence, Kentucky. The evaluation was concerned with assessment of employee exposure to an unknown substance later identified to be formaldehyde. Methodology used in the evaluation included: (1) environmental sampling, (2) analyses of wet stock paper for the presence of formaldehyde, (3) confidential employee interviews, (4) observation of work practices, and (5) review of the workplace and materials used.

Non-directed interviews for medical complaints were conducted on 11 employees. Approximately 75% of the employees interviewed reported past and/or present symptomatology consistent with formaldehyde exposure. These symptoms included mucous membrane irritation (upper respiratory and eye), chest discomfort, and dermatitis. The airborne concentrations of formaldehyde on August 10 and 16, and September 20, approached but did not exceed the applied health criteria based on a 30-minute sampling period. Personal samples for formaldehyde ranged from 0.14-0.90 ppm (parts per million), which are within the NIOSH recommended standard of 1.0 ppm. Approximately 40% of the area samples ranged from 0.50-1.0 ppm formaldehyde with 1 sample exceeding 1.0 ppm. Environmental samples collected for total aldehydes (acetaldehyde, propionaldehyde, butyraldehyde, and valeraldehyde) were below the analytical limits of detection.

Recommendations designed to insure a safe and healthful working environment are included in Section V of this Report.

## II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are currently available upon request from NIOSH, Division of Technical Services, 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 NIOSH, Publications Office at the Cincinnati address. Copies of this report have been sent to the following:

- a. Equitable Bag Co., Inc., Florence, Kentucky
- b. Authorized representative of Local 470, United Paperworkers Union
- c. United Paperworkers International Union
- d. U.S. Department of Labor - Region IV
- e. NIOSH - Region IV

For the purpose of informing the approximately 20 "affected employees" the employer shall promptly "post" for a period of 30 calendar days, the Determination Report in a prominent place (s) near where the exposed employees work.

## III. INTRODUCTION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669 (a)(6), authorizes the Secretary of Health, Education, and Welfare, following a written request by an 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 National Institute for Occupational Safety and Health received such a request from an authorized representative of employees. The request stated that workers were exposed to an unknown substance (believed to be formaldehyde) in Department 12 and Warehouse 3 at the Equitable Bag Company. It was alleged that upper respiratory tract (eye, nose, and throat) and skin irritation have occurred at the facility.

## IV. HEALTH HAZARD EVALUATION

### A. Process Description

Department 12 is involved with the manufacture of potato bags from wet stock rolled paper and mesh materials. The facility receives the processing materials in roll form, with the paper subsequently being cut to shape and adhesives applied to form the bags. In Department 12 there are 5 "multi-wall bag machines" which produce a total of about 450,000 bags per week.

Adjacent to Department 12 is Warehouse 3 where the raw materials and finished product are stored. The combined floor space for the two areas is 185,000 square feet (15,000 ft<sup>2</sup> in Department 12 and 170,000 ft<sup>2</sup> in Warehouse 3) with ceiling heights of 20 feet. There are 19 production personnel distributed over 2 shifts in Department 12 and 1 employee in the warehouse. The warehouse area is equipped with 4 roof exhaust fans having a total capacity of 72,000 cubic feet per minute (cfm). The ventilation system in Department 12 consists of 1 roof exhaust fan with an estimated capacity of 20,000 cfm. During the environmental evaluation, the exhaust fans at the following locations were operating: (a) 8/10 and 16/78, warehouse fans EE4 and HH12; (b) 9/20/78, warehouse fans EE4, EE12, and HH12; (c) 8/16 and 9/20/78, exhaust fan in Department 12 (it is not known if the fan operated on 8/10/78).

## B. Evaluation Design and Methods

### 1. Analyses of Paper Samples for Formaldehyde

Bulk samples of wet stock rolled paper processed in Department 12 and stored in Warehouse 3 were obtained and analyzed for the presence of formaldehyde. Portions of the bulk samples were suspended over water in sample jars, sealed, and placed in an oven for 20 hours at 120° Fahrenheit. The solutions were analyzed spectrophotometrically after the addition of chromotropic acid and compared to a calibration curve based on known concentrations of formaldehyde.

### 2. Air Sampling

Personal and area samples were collected for formaldehyde and total aldehydes (acetaldehyde, propionaldehyde, butyraldehyde, and valeraldehyde) to evaluate employee exposures. The personal samples were attached to the employees' lapels in order to collect air samples representative of their breathing zones. Area samples were positioned at locations frequented by employees and at specific sites considered to characterize the general air quality. Several of the area samples were collected within 2 feet of the immediate work stations.

Exposure to formaldehyde and total aldehydes was determined by bubbling air at 1.0 liters per minute (lpm) through two impingers in series containing 10 milliliters each of sodium bisulfite solution. Each sample was analyzed colorimetrically for formaldehyde using NIOSH method No. 125.<sup>1</sup> The samples collected for total aldehydes were analyzed by gas chromatography with a flame ionization detector. The lower limit of detection per sample was 0.0005 milligrams (mg) of formaldehyde, and 0.03 mg of acetaldehyde, propionaldehyde, butyraldehyde, and valeraldehyde.

Instantaneous measurements using Drager indicator tubes for formaldehyde were also taken during all visits except on September 20, 1978. The range of measurement for the tubes was 0.5 to 10 parts per million of formaldehyde. The tubes were not NIOSH certified, and therefore were used only as a screening technique for determining the presence of formaldehyde.

### 3. Psychrometric Measurements

Psychrometric (temperature and humidity) measurements were taken in Warehouse 3 and Department 12 throughout the environmental investigations conducted on 8/10 and 16, and 9/20/78. These measurements were taken since it was generally reported that the presence/severity of the formaldehyde problem was related to ambient conditions.

### 4. Medical Evaluation

Interviews were given by the industrial hygienist to 11 of the 20 production employees assigned to Department 12 and Warehouse 3. The interviews were conducted in a non-directed manner in order to elicit any symptoms or medical problems which were immediately apparent to the employee. The interviews included such information as employees' work history, symptoms experienced on the job, and any aggravating or alleviating factors.

## C. Evaluation Study Criteria

### 1. Toxicological Effects of Formaldehyde

Irritation to the eyes, nose, mouth, and throat are the most common effects from inhalation of formaldehyde. Formaldehyde has a pungent odor which is detectable at levels less than 1 ppm; discomfort with a tingling sensation in eyes, nose, and throat noted at 2-3 ppm, and difficulty in breathing at 10-20 ppm<sup>2</sup>. Considerable variation with individual sensitivity to formaldehyde is noticeable.<sup>3</sup> Some people are able to develop a physical tolerance to the irritant effects of formaldehyde, while others may become more sensitive. Dermatitis may result from contact with either liquid solutions, solid materials, or resins containing free formaldehyde.<sup>4</sup>

### 2. Environmental Evaluation Criteria

Airborne exposure levels intended to protect the health of workers have been recommended or promulgated by several sources. These limits represent conditions under which it is believed that nearly all workers may be repeatedly exposed to a substance for an 8-hour or up to a 10-hour workday, 40-hour per week basis without adverse effect. For this investigation, the criteria used to assess the degree of health hazards to workers were selected from three sources: (1) airborne exposure limits which NIOSH

has recommended to the Occupational Safety and Health Administration (OSHA) for occupational health standards, (2) Threshold Limit Values (TLVs) for 1978 and their supporting documentation as set forth by the American Conference of Governmental Industrial Hygienists (ACGIH), and (3) Occupational Health Standards as promulgated by the U.S. Department of Labor (Federal Register, 29CFR1910, pp. 506-509, January 1, 1976).

The NIOSH Recommended Standard for formaldehyde is given prominence in this evaluation since it is considered by the Institute to be the most appropriate health criteria. The OSHA Standards are provided only as a reference to determine the state of compliance or non-compliance with Federal Regulations. The Federal Standards are enforced by the U.S. Department of Labor, OSHA.

The exposure limits cited by the various sources for formaldehyde are as follows:

<u>Source</u>	<u>Ceiling Value (ppm)*</u>	<u>Eight Hour Time-Weighted Average Exposure Limit (ppm)*</u>
NIOSH	1(C)**	Not applicable
TLV	2(C)	Not applicable
OSHA	10(C)	3

\*ppm - denotes parts of contaminant per million parts of air by volume(ppm).

\*\* (C) - designates a ceiling value which should not be exceeded (determined for intervals of 30 minutes or less depending on source of criteria).

#### D. Evaluation Results

##### 1. Environmental

During various discussions with management and labor on January 12, 1978, it was disclosed that the alleged irritation problems (potential formaldehyde exposure) were seasonally related and generally confined to the summer months. These problems were most prevalent in Warehouse 3 where wet stock paper and finished product were stored. When reviewing the materials handled in Department 12 and Warehouse 3, it was theorized that the wet stock paper possibly contained latent formaldehyde. This theory was substantiated by analyses conducted on 6 bulk samples of the paper. The analyses showed that the various types of wet stock paper processed/stored at the facility contained 0.49 to 1.63 milligrams of formaldehyde per gram of paper. Both the occurrence and the seasonal characteristics of the irritation problem are thus seemingly the result of latent formaldehyde leached from the paper by the warm temperatures during the summer months.

In view of: (1) the apparent seasonal characteristics of the problem, (2) the absence of employee symptoms during the initial survey, and (3) the non-detectable levels of formaldehyde in the atmosphere as indicated by the detector tube measurements taken during the initial survey, the project was postponed until the environmental conditions/symptoms reoccurred.

In August, 1978, NIOSH was notified that sporadic instances of tissue irritation were beginning to occur. Follow-up survey dates were then scheduled for warm days based upon the U.S. Weather Service forecast; sampling was conducted on August 10 and 16, and on September 20, 1978. While the temperatures on the former two dates did not reach the predicted high of approximately 90°F, the temperature on September 20 did reach 91°F. The temperature and humidity measurements recorded for these dates are presented in Table 1.

The airborne concentrations of formaldehyde on August 10 and 16, and September 20, approached but did not exceed the NIOSH recommended standard of 1.0 ppm. The range of formaldehyde concentrations for the personal samples ranged from 0.14 to 0.90 ppm, and the area samples ranged from 0.14 to 0.99 ppm. Approximately 10% of the personal samples and 40% of the area samples were above half of the recommended standard. One area sample did contain 2.2 ppm of formaldehyde, however this value is believed to be incorrect (over-estimate of the actual concentration) due to sample leakage during shipment to the laboratory. Environmental samples collected for total aldehydes-acetaldehyde, propionaldehyde, butyraldehyde, and valeraldehyde-were below the analytical limits of detection. Refer to Tables 2 through 5 for the results of all environmental sampling conducted for formaldehyde and total aldehydes.

## 2. Medical

Individual interviews were given to 11 personnel assigned to Department 12 and Warehouse 3. Table 6 summarizes the job related medical complaints elicited during these interviews. Of the 11 employees interviewed, 8 mentioned health complaints consistent with low level formaldehyde exposure. The symptomatology included mucous membrane irritation (upper respiratory and eye), chest discomfort, and dermatitis. The symptomatic conditions were intermittent, with the most frequent occurrence during the summer months. These problems were most prevalent in Warehouse 3 and adjacent areas.

## E. Conclusions/Summary

Personal and area samples were collected over a 3-day sampling period to assess the airborne concentrations of formaldehyde. Although results of the environmental sampling were within the NIOSH recommended standard, the concentrations of formaldehyde were frequently above 0.5 ppm (half of the recommended standard). The highest concentrations of formaldehyde were

measured in Warehouse 3, primarily near the backwall area, and at locations immediately adjacent to the warehouse area. The levels of formaldehyde were a function of temperature, with higher levels occurring on warmer days. This is illustrated by a comparison of the number of area samples on August 10 and 16 (27%) to September 20 (68%) which are above 0.5 ppm.

Personal interviews did indicate past and/or present symptomatology common to formaldehyde exposure. Approximately 75% of the employees interviewed complained of various symptomatic conditions (mucous membrane irritation, chest discomfort and dermatitis) which they associated to their work environment. Therefore, in view of: (1) the number of employees who experienced symptoms parallel to formaldehyde exposure, (2) the number of area samples exceeding 0.5 ppm formaldehyde, and (3) the occurrence of formaldehyde concentrations above 0.9 ppm, it is concluded that a potential for excessive formaldehyde exposure does exist. Observations, environmental measurements, and discussions with management and labor indicate that the potential for a problem is greatest during periods of elevated ambient temperature conditions.

#### V. RECOMMENDATIONS

1. During the environmental evaluation either two (August 10 and 16) or three (September 20) of the roof exhaust fans in Warehouse 3 were operational. It is recommended that all four exhaust fans be used whenever a potential for formaldehyde exposure exists.
2. Additional ventilation should be installed at locations where wet stock paper is processed or stored (ie; backwall of Warehouse 3).
3. Since several of the area/personal samples exceeded half of the recommended standard, it is recommended that periodic environmental sampling be conducted to insure that an over-exposure to formaldehyde does not occur.
4. During the initial visit on January 12, 1978, it was observed that a few bags of lead chromate pigment were badly torn. Since lead chromate is a suspected carcinogen, it is recommended that precautions be taken to prevent needless environmental contamination. Recommendations pertaining to carcinogenic forms of chromium (VI) - e.g. lead chromate - outlined in sections 1 thru 8 of the NIOSH criteria document entitled Occupational Exposure to Chromium (VI) should be observed. Special emphasis should be placed on: (1) proper cleaning procedures and work practices, (2) proper contaminant disposal, (3) required protective clothing and respiratory protective equipment, (4) appropriate sanitation practices, and (5) employee education - informing employees of the hazards associated with lead chromate. Copies of the criteria document have been provided to representatives of labor and management.

VI. REFERENCES

1. P&CAM Method No 125, Formaldehyde in Air. NIOSH Manual of Analytical Methods. HEW Publication No. (NIOSH) 77-157-C, (1977).
2. Patty, Fa.A., Industrial Hygiene and Toxicology, Vol. II. Interscience Publishers, New York, New York, pp. 1971-72, (1967).
3. Elkins, H., The Chemistry of Industrial Toxicology. Wiley and Sons, New York, New York, pp. 116-231, (1950).
4. Kominsky, J.R. and Thoburn, T.W., Health Hazard Evaluation Determination Report H.H.E. 76-43 A-F-429, Hersey Products Company, Inc., Gilbertville, Massachusetts, NIOSH, Cincinnati, Ohio.

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Table 1

Psychrometric Measurements  
 Equitable Bag Co., Inc.  
 Florence, Kentucky

<u>Date</u>	<u>Time</u>	<u>Location</u>	<u>Temperature(°F)</u>	<u>Relative Humidity(%)</u>
8/10/78	0847	Warehouse (HH9)	78	66
	1230	Warehouse (HH9)	81	68
	1415	Warehouse (HH9)	82	64
	1410	Department 12	84	62
8/16/78	0840	Warehouse (HH9)	80	71
	0845	Department 12	82	65
	1205	Warehouse (HH9)	83	68
	1210	Department 12	85	63
	1420	Warehouse (HH9)	83	65
	1425	Department 12	85	66
9/20/78	0845	Warehouse (HH9)	79	70
	0850	Department 12	83	62
	1215	Warehouse (HH9)	83	66
	1220	Department 12	89	52
	1445	Warehouse (HH9)	87	60
	1450	Department 12	91	50

Table 2

Summary of Air Sampling For Formaldehyde and Total Aldehydes<sup>1</sup>

Equitable Bag Co., Inc.  
Florence, Kentucky  
8/10/78

Sample Number	Location	Sample Type	Sample Period	Sample Volume(liters)	Concentrations (ppm <sup>2</sup> )	
					Formaldehyde	Total Aldehydes
1A	Warehouse 3 (at Guards Area)	A <sup>3</sup>	0730-0807	37	0.35	N.D. <sup>4</sup>
1B	Warehouse 3 (at Guards Area)	A	0853-0935	42	0.33	N.D.
1C	Warehouse 3 (at Guards Area)	A	1004-1040	36	0.34	N.D.
1D	Warehouse 3 (at Guards Area)	A	1105-1300	115	0.44	N.D.
1E	Warehouse 3 (at Guards Area)	A	1318-1352	34	0.31	N.D.
1F	Warehouse 3 (at Guards Area)	A	1425-1505	40	0.38	N.D.
2A	Warehouse 3 - HH9	A	0731-0810	39	0.52	N.D.
2B	Warehouse 3 - HH9	A	0903-0937	34	0.55	N.D.
2C	Warehouse 3 - HH9	A	1007-1042	35	0.51	N.D.
2D	Warehouse 3 - HH9	A	1108-1302	114	0.48	N.D.
2E	Warehouse 3 - HH9	A	1319-1355	36	0.47	N.D.
2F	Warehouse 3 - HH9	A	1426-1503	37	0.48	N.D.
3A	Warehouse 3 (lift truck operator)	P <sup>5</sup>	0738-0815	37	0.33	
3B	Warehouse 3 (lift truck operator)	P	0920-0952	32	0.30	
3C	Warehouse 3 (lift truck operator)	P	1025-1055	30	0.21	
3D	Warehouse 3 (lift truck operator)	P	1127-1304	97	0.84	
3E	Warehouse 3 (lift truck operator)	P	1352-1422	30	0.41	
3F	Warehouse 3 (lift truck operator)	P	1422-1452	30	0.46	
4A	Dept. 12 (on table at machine 7B)	A	0745-0818	33	0.18	
4B	Dept. 12 (on table at machine 7B)	A	0905-0940	35	0.35	
4C	Dept. 12 (on table at machine 7B)	A	1010-1044	34	0.48	
4D	Dept. 12 (on table at machine 7B)	A	1112-1310	118	0.32	
4E	Dept. 12 (on table at machine 7B)	A	1322-1356	34	0.29	
4F	Dept. 12 (on table at machine 7B)	A	1427-1503	36	0.25	
5A	Dept. 12 (between machines 10AR & C4)	A	0753-0823	30	0.22	
5B	Dept. 12 (between machines 10AR & C4)	A	0908-0943	35	2.20 <sup>6</sup>	
5C	Dept. 12 (between machines 10AR & C4)	A	1013-1045	32	0.33	
5D	Dept. 12 (between machines 10AR & C4)	A	1115-1311	116	0.42	
5E	Dept. 12 (between machines 10AR & C4)	A	1325-1357	32	0.41	
5F	Dept. 12 (between machines 10AR & C4)	A	1430-1502	32	0.38	
6A	Dept. 12 (Machine 7A Operator)	P	0750-0820	30	0.24	
6B	Dept. 12 (Machine 7A Operator)	P	0910-0941	31	0.42	
6C	Dept. 12 (Machine 7A Operator)	P	1015-1057	42	0.29	
6D	Dept. 12 (Machine 7A Operator)	P	1113-1313	120	0.33	
6E	Dept. 12 (Machine 7A Operator)	P	1324-1400	36	0.29	
6F	Dept. 12 (Machine 7A Operator)	P	1430-1455	25	0.42	
7A	Warehouse 3 C-1	A	0805-1307	302	0.27	
7B	Warehouse 3 C-1	A	1309-1500	111	0.31	

- Total aldehydes included acetaldehyde, propionaldehyde, butyraldehyde, and valeraldehyde
- ppm - Parts of contaminant per million parts of air by volume
- A - Area sample
- N.D. - (Non-Detected) the lower limits of detection for acetaldehyde, propionaldehyde, butyraldehyde and valeraldehyde are 0.03 milligrams per sample
- P - Personal sample collected in breathing zone of employee

## Evaluation Criteria:

Formaldehyde - 1 ppm (ceiling value)

Acetaldehyde - 100 ppm

Valeraldehyde - 50 ppm

No exposure limits have been assigned by NIOSH, ACGIH, or Federal OSHA for propionaldehyde and butyraldehyde.

- Part of sample lost during shipment to laboratory. It is believed that the value (2.20 ppm) presented is an over estimation of the actual concentration.

Table 3

## Summary of Air Sampling for Formaldehyde

Equitable Bag Co., Inc.  
Florence, Kentucky

8/16/78

Sample Number	Location	Sample Type	Sample Period	Sample Volume (liters)	Concentrations of Formaldehyde (ppm)
10A	Warehouse 3-Backwall in middle area of potato bag storage approx. 90 ft E of guard area	A <sup>2</sup>	0748-0832	44	0.63
10B	Warehouse 3-Backwall in middle area of potato bag storage approx. 90 ft E of guard area	A	0931-1005	34	0.67
10C	Warehouse 3-Backwall in middle area of potato bag storage approx. 90 ft E of guard area	A	1053-1217	84	0.95
10D	Warehouse 3-Backwall in middle area of potato bag storage approx. 90 ft E of guard area	A	1300-1331	31	0.73
10E	Warehouse 3-Backwall in middle area of potato bag storage approx. 90 ft E of guard area	A	1408-1438	30	0.92
11A	Warehouse 3-HH9	A	0751-0837	46	0.42
11B	Warehouse 3-HH9	A	0932-1010	38	0.42
11C	Warehouse 3-HH9	A	1054-1223	89	0.55
11D	Warehouse 3-HH9	A	1301-1333	32	0.51
11E	Warehouse 3-HH9	A	1409-1442	33	0.59
12A	Warehouse 3 (lift truck operator)	A <sup>3</sup>	0805-0853	48	0.31
12B	Warehouse 3 (lift truck operator)	P	0930-1000	30	0.28
12C	Warehouse 3 (lift truck operator)	P	1126-1238	72	0.32
12D	Warehouse 3 (lift truck operator)	P	1300-1336	36	0.35
12E	Warehouse 3 (lift truck operator)	P	1415-1445	30	0.51
13A	Dept. 12-on table machine 68	A	0754-0843	49	0.43
13B	Dept. 12-on table machine 68	A	0935-1019	44	0.41
13C	Dept. 12-on table machine 68	A	1057-1236	99	0.59
13D	Dept. 12-on table machine 68	A	1303-1335	32	0.56
13E	Dept. 12-on table machine 68	A	1412-1448	36	0.54
14A	Dept. 12-between machines 10AR and C4	A	0754-0840	46	0.14
14B	Dept. 12-between machines 10AR and C4	A	0934-1016	42	0.14
14C	Dept. 12-between machines 10AR and C4	A	1056-1231	95	0.20
14D	Dept. 12-between machines 10AR and C4	A	1303-1334	31	0.25
14E	Dept. 12-between machines 10AR and C4	A	1411-1448	37	0.24
15A	Dept. 12-at machine 7B approx. 2 ft from operator's breathing zone	A	0800-0847	47	0.21
15B	Dept. 12-at machine 7B approx. 2 ft from operator's breathing zone	A	0934-1022	48	0.19
15C	Dept. 12-at machine 7B approx. 2 ft from operator's breathing zone	A	1055-1242	107	0.26
15D	Dept. 12-at machine 7B approx. 2 ft from operator's breathing zone	A	1304-1334	30	0.29
15E	Dept. 12-at machine 7B approx. 2 ft from operator's breathing zone	A	1410-1448	38	0.23
16A	Warehouse 3 - C-1	A	0753-1205	252	0.29
16B	Warehouse 3 - C-1	A	1211-1443	152	0.34

1. Evaluation Criteria - 1.0 parts of formaldehyde per million parts of air by volume (1.0 ppm). - Ceiling Value
2. A - Area sample
3. P - Personal sample collected in breathing zone of employee.

Table 4

## Summary of Air Sampling for Formaldehyde

Equitable Bag Co., Inc.  
Florence, Kentucky

Sample Number	Location	9/20/78	Sample Type	Sample Period	Sample Volume (liters)	Concentrations of Formaldehyde (ppm) <sup>1</sup>
40A	Warehouse 3-Backwall	in middle area of potato bag storage approx. 90 ft E of guard area	A <sup>2</sup>	0810-0842	32	0.71
40B	Warehouse 3-Backwall	in middle area of potato bag storage approx. 90 ft E of guard area	A	1000-1030	30	0.65
40C	Warehouse 3-Backwall	in middle area of potato bag storage approx. 90 ft E of guard area	A	1130-1203	33	0.74
40D	Warehouse 3-Backwall	in middle area of potato bag storage approx. 90 ft E of guard area	A	1300-1338	38	0.98
40E	Warehouse 3-Backwall	in middle area of potato bag storage approx. 90 ft E of guard area	A	1415-1457	42	0.93
41A	Warehouse 3-HH9		A	0811-0855	44	0.77
41B	Warehouse 3-HH9		A	1001-1036	35	0.65
41C	Warehouse 3-HH9		A	1131-1205	34	0.76
41D	Warehouse 3-HH9		A	1301-1342	41	0.99
41E	Warehouse 3-HH9		A	1416-1458	42	0.96
42A	Warehouse 3 C-1		A	0812-1120	188	0.20
42B	Warehouse 3 C-1		A	1123-1500	217	0.34
43A	Dept. 12-at machine 7B approx. 2 ft from operator's breathing zone		A	0815-0900	45	0.36
43B	Dept. 12-at machine 7B approx. 2 ft from operator's breathing zone		A	1002-1037	35	0.51
43C	Dept. 12-at machine 7B approx. 2 ft from operator's breathing zone		A	1133-1206	33	0.64
43D	Dept. 12-at machine 7B approx. 2 ft from operator's breathing zone		A	1302-1344	42	0.66
43E	Dept. 12-at machine 7B approx. 2 ft from operator's breathing zone		A	1417-1500	43	0.64
44A	Dept. 12-on table between machines 10AR and C4		A	0816-0900	44	0.29
44B	Dept. 12-on table between machines 10AR and C4		A	1008-1038	30	0.65
44C	Dept. 12-on table between machines 10AR and C4		A	1135-1207	32	0.33
44D	Dept. 12-on table between machines 10AR and C4		A	1303-1346	43	0.34
44E	Dept. 12-on table between machines 10AR and C4		A <sup>3</sup>	1418-1500	42	0.30
45A	Utility man in east end of warehouse		P	0800-0830	30	0.14 <sup>7</sup>
45B	Utility man in east end of warehouse		P	1000-1034	34	0.23
45C	Utility man in east end of warehouse		P	1130-1210	40	0.23
45D	Utility man in east end of warehouse		P	1258-1330	32	0.44
45E	Utility man in east end of warehouse		P	1414-1444	30	0.49
46A	Warehouse 3 (lift truck operator)		P	0825-0905	40	0.18
46B	Warehouse 3 (lift truck operator)		P	1000-1045	45	0.32
46C	Warehouse 3 (lift truck operator)		P	1130-1210	40	0.36
46D	Warehouse 3 (lift truck operator)		P	1255-1329	34	0.44
46E	Warehouse 3 (lift truck operator)		P	1415-1451	36	0.90

1. Evaluation Criteria - 1.0 parts of formaldehyde per million parts of air by volume (1.0 ppm) - Ceiling Value
2. A - Area sample
3. P - Personal sample collected in breathing zone of employee

Table 5

Drager Indicator Tube Measurements  
for Formaldehyde

Equitable Bag Co., Inc.  
Florence, Kentucky

<u>Date</u>	<u>Sample Time</u>	<u>Location</u>	<u>Tube Reading (ppm)<sup>1</sup></u>
1/12/78	1010	Dept. 12	None
	1035	Dept. 12	None
	1045	Dept. 12	None
	1100	Dept. 12	None
	1005	Warehouse 3 - Backwall	None
	1010	Warehouse 3 - Backwall	None
	1020	Sample taken inside a packaged bundle of potato bags	None
	8/10/78	0945	Warehouse 3 - Guard Area
1035		Warehouse 3 - HH9	0.5
1045		Warehouse 3 - C1	< 0.5
1055		Dept. 12 - Machine 7B	< 0.5
1100		Dept. 12 - Operator at Machine 7A	< 0.5
1108		Dept. 12 - Between Machines 10AR and C4	< 0.5
1300		Warehouse 3 - Guard Area	< 0.5
1320		Warehouse 3 - HH9	≈ 0.5
1330		Warehouse 3 - C2	< 0.5
1340		Dept. 12 - Machine 7B	< 0.5
1345		Dept. 12 - Operator at Machine 7A	< 0.5
1350	Dept. 12 - Between Machines 10AR and C4	≈ 0.5	
8/16/78	0945	Warehouse 3 - Backwall	1-1.5
	0955	Warehouse 3 - HH9	0.7-1.0
	1000	Dept. 12 - Between Machines AR10 and C4	None
	1200	Warehouse 3 - Backwall	1-1.5
	1205	Warehouse 3 - HH9	1-1.5
	1215	Department 12 - Operator at Machine 7B	< 0.5
	1415	Warehouse 3 - Backwall	1-1.5

1. Evaluation Criteria - 1.0 parts of formaldehyde per million parts of air by volume (1.0 ppm).

Table 6

Job Related Medical Problems As Obtained  
By Employee Interviews

Equitable Bag Co., Inc.  
Florence, Kentucky

<u>Case Number</u>	<u>Complaints</u>	<u>Source of Problem &amp; Comments Cited</u>
1	Occasional eye irritation	unknown
2	Occasional eye, nose, and throat irritation	Warehouse area where potato bags are stored. Problem confined to warm weather.
3	Occasional eye and throat irritation	Problem occurs on hot days and when a new shipment of wet stock paper is received.
4	Tight chest, sinus and throat dry, blurry vision, and dermatitis	Not stated
5	Burning eyes and dry throat	Problem occurs on hot days
6	Bronchitis and sinus problem (Employee not sure if job related)	
7	Eye irritation	Potato bag storage
8	None	
9	Eye trouble	Not Stated
10	None (eye irritation when walking through warehouse)	
11	Tissue irritation	Problem generally occurs in the morning when walking through the warehouse. Problem most prevalent in the summer.