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 NO. 75-145-327

FORMICA CORPORATION
CINCINNATI, OHIO

SEPTEMBER 1976

I. TOXICITY DETERMINATION

A Health Hazard Evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) in the Resin Plant, Filler Treating, Filler Sorting, Collating, Graining and Press areas of the Formica Corporation in Cincinnati, Ohio. Environmental sampling was done in February, and medical sampling in April, 1976, regarding potential exposure to phenol, formaldehyde, isopropyl alcohol, triethylamine, ethylene glycol monoethyl ether, isopropylacetate, and N-propylacetate.

A relatively high percentage of symptoms and signs of eye, skin and mucous membrane irritation, though not statistically significant, may indicate some acute irritant effects under certain conditions or in sensitive individuals. The evidence does not indicate chronic health effects due to any of the materials investigated.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are available upon request from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. Copies have been sent to:

a) Formica Corporation, Cincinnati, Ohio
b) Authorized Representative of Employees
c) U. S. Department of Labor - Region V
d) NIOSH - Region V

For the purposes of informing the approximately 350 affected employees, the employer shall promptly post for a period of 30 calendar days the Determination Report in a prominent place(s) near where 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 (NIOSH) received such a request from an authorized representative of the International Union of Electrical, Radio and Machine Workers to evaluate potential hazards to employees in the Resin Plant, Filler Treating, Filler Sorting, Collating, Graining and Press areas at Formica's Cincinnati plant.

IV. HEALTH HAZARD EVALUATION

A. Process Description

The Formica Corporation manufactures laminates by bonding several layers of resin-impregnated paper under pressure. Most of the resin used by the company is produced on site in their resin plant, located in a separate building adjacent to their main manufacturing plant, by combining formaldehyde, phenol, melamine, and various catalysts, inhibitors, carriers, and minor reactants. These resins are piped to the filler treating area of the manufacturing plant, where they are used to impregnate kraft paper either by spray or immersion. The impregnated paper is cut into four-by-eight foot sections to form filler sheets.

Large pallets of filler sheets are taken successively to the filler sorting area, the collating area, and the press build-up area. Depending on the type of laminant being prepared, workers count out varying numbers of these filler sheets, pile them on a second pallet, add a cover sheet printed in the graining room with some pattern, possibly add a layer of material to give a special effect, then add a separator sheet and repeat the process for successive layers. When a load of material is assembled in this manner, it is placed in a press where the sheets of each layer are bonded to one another to produce the laminate, with the separator sheets creating a non-bonding barrier between laminates.

B. Evaluation Design

1. Environmental

On February 18 and 19, 1976, environmental samples were collected in areas and for substances requested. Personal breathing zone samples were collected using equipment worn by the worker and carried by him as he moved through his normal work routine. Work area samples were collected using similar equipment placed in fixed positions near where workers normally spend a large amount of time. Phenol and formaldehyde samples were taken with MSA Model G pumps using impingers containing absorbing solutions for those compounds. The other compounds were sampled

using Sipin pumps to draw air through activated charcoal upon which the organic compounds would be adsorbed. Analysis was by gas chromatography for all compounds.

A ventilation study was done to determine the velocity of air moving through the work areas. This study was conducted using smoke tubes and an Alnor "Senior" Velometer.

An attempt was made with the use of detector tubes to determine short term, peak concentrations of formaldehyde (which has a ceiling threshold limit value), ammonia, phenol, and triethylamine.

2. Medical

On April 20 and April 22, 1976 a medical survey was conducted. A total of approximately 350 workers in all three shifts are employed in the departments studied. Rosters were obtained of all workers on all shifts in these departments. From these, 50 workers were randomly selected to participate in the study. The number of workers selected from each shift in each department was roughly proportional to the contribution of that department in that shift to the total work force in all departments in question during that particular shift. Not all the workers selected by this method were available or would agree to volunteer for this study on the day the study was conducted. If workers selected at random would or could not participate in the study, any other volunteer from that department in that shift was allowed to participate in the study. Despite these measures and because of time restrictions only 40 workers were finally surveyed. As controls, volunteers from Department 439 (warehouse) were also surveyed in the same manner as the 40 workers from the exposed departments. A total of 23 workers from Department 439 volunteered to participate in the study. Department 439 was chosen as a control area because these workers only have contact with finished Formica products usually already packaged and thus their exposure to the agents in question would probably be minimal, if any at all. Examination of the work histories of these volunteers from Department 439, however, revealed that 13 of them had worked for varying periods in the exposed departments before coming to work in Department 439. Ten of these workers had always worked in Department 439 or other departments in which exposure to most of the agents in question are minimal. Accordingly, the workers surveyed in this study were divided into three groups for purposes of analysis. Group I (currently exposed group) consisted of the 40 workers currently working in the departments being studied. Group II (exposed in the past) consisted of 13 workers from the warehouse who had in the past worked in exposure areas. Group III (never exposed) consisted of the 10 workers in the warehouse who always worked in that or similar areas.

Informed consent was obtained from all volunteers participating in the study. The following procedures were performed on all participants:

1. A medical questionnaire and occupational history including specific questions concerning the renal, gastro-intestinal, central nervous, ophthalmological and integumentary systems (a copy of this questionnaire is included in the Appendix) was administered.

2. A brief physical examination was conducted focusing on the eyes, mucous membranes, heart, lungs, abdomen, CNS and skin (a copy of the medical exam form used is included in the Appendix).

3. A urinalysis of a freshly voided specimen for pH, specific gravity, albumin, glucose, acetone, occult blood, bile and urobilinogen and microscopic examination for white blood cells, red blood cells, casts, crystals and bacteria was performed.

4. A venous blood sample for hemoglobin, white blood cell count, differential and platelets was collected.

C. Evaluation Criteria#

1. Environmental

One of the criteria for this determination is the set of threshold limit values established by the American Conference of Governmental Industrial Hygienists (ACGIH).[1,2] The following table indicates the ACGIH maximum permissible exposure for various substances according to those TLV's.

Substance	Threshold Limit Value 8-hour time-weighted average	
Formaldehyde	2 ppm*	3 mg/M^3**
Phenol	5 ppm	19 mg/M^3
Isopropyl Alcohol	400 ppm	980 mg/M^3
Ethylene Glycol Monoethyl Ether	200 ppm	740 mg/M^3
Isopropyl Acetate	250 ppm	950 mg/M^3
N-Propyl Acetate	200 ppm	840 mg/M^3
Triethylamine	25 ppm	100 mg/M^3

In addition to the 8-hour time-weighted average exposure values, the TLV for formaldehyde is recommended as a ceiling value, not to be exceeded even for short periods of time. The ACGIH also designates phenol, isopropyl alcohol, and ethylene glycol monoethyl ether as substances which may enter the body through the skin either by direct or airborne contact.

The TLV established by the ACGIH for isopropyl alcohol is essentially the same as the standard recommended by NIOSH[3].

While the odor threshold of formaldehyde is well below 1 ppm, discomfort is not noted until concentrations near the TLV are reached. This discomfort takes the form of a mild tingling sensation in the eyes, nose or posterior pharynx.[4]

*Parts of contaminant per million parts of air
**Milligrams of contaminant per cubic meter of air
#Evaluation Criteria used here are not necessarily the same as the OSHA Standards. Only OSHA Standards are enforceable legal limits.

2. Medical

This survey was directed toward detecting adverse health effects to exposure to the agents to be discussed below. The expected findings from toxicity to these agents also are shown below.[5,6,7,8]

Phenol: Acute toxic effects include dermatitis and mucous membrane irritation. Chronic toxic effects include digestive disturbances, vomiting, diarrhea, anorexia, headache, syncope, vertigo and personality changes.

Formaldehyde: Eye irritation, upper respiratory tract irritation and dermatitis.

Isopropyl alcohol: Eye irritation, upper respiratory tract irritation and narcosis.

Triethylamine: Eye irritation, dermatitis and asthma.

Ethylene glycol monoethyl ether: Eye irritation, skin irritation, headache, dizziness, drowsiness, weakness, dysarthria, ataxia, tremor, blurred vision, personality changes, albuminuria, hematuria and anemia.

Isopropyl acetate: Eye irritation, upper respiratory tract irritation and chest tightness.

N-propyl acetate: Eye irritation, upper respiratory trace irritation and chest tightness.

The criteria used for evaluating the results of blood and urine tests are shown below.

Test	Normal Range
Blood Tests	
Hemoglobin	14-18 g (male) 12-16 g (female)
White Blood Cell Count	4,800-10,800 cells per cc
Percent Eosinophils	Less than 5%
Estimated Platelets	Normal - estimated
Urine Tests	
Urine pH	5.0-8.0
Specific Gravity	Greater than 1.010
Albumin	Negative or trace
Glucose	Negative or trace
Acetone	Negative or trace
Occult Blood	Negative or trace
Bile	Negative or trace

Urobilinogen	Negative or trace
White Blood Cells	Negative, occasional or rare per high powered field
Red Blood Cells	Negative, occasional or rare per high powered field
Casts	Negative
Bacteria	Negative, occasional or rare per high powered field

D. Evaluation Results

1. Environmental

The results of atmospheric sampling for phenol and formaldehyde are given in Tables 1 and 2 respectively. The phenol samples were of approximately eight hours duration, all were area samples, and were positioned where employees would be likely to spend a large portion of their work day. The formaldehyde samples were of approximately four hours duration, those designated with "A" being area samples, and those designated with "P" being personal samples. Phenol concentrations ranged from non-detectable to almost 10 mg/M^3, with most samples being less than a third of the TLV. Formaldehyde concentrations ranged up to 0.6 mg/M^3, although only about one in four was above 0.1 mg/M^3, and almost all samples were less than a tenth of the TLV.

The highest isopropyl alcohol concentration measured was on the order of 10 mg/M^3, or approximately 1% of the TLV. The highest ethylene glycol monoethyl ether concentration was approximately 100 mg/M^3 or 15% of the TLV. Isopropyl acetate was no greater than 10% of the TLV or 100 mg/M^3. Triethylamine was less than 20 mg/M^3 or 20% of the TLV. No N-propyl acetate was detected by environmental sampling.

Consideration was given to additive effects of exposure to more than one compound. However, since the maximum concentrations of various compounds appeared at different stages in the operation, and therefore in different areas of the plant, and to different workers, the additive effects of these contaminants on the workers were not significant.

Detector tubes indicated from one to two ppm formaldehyde in the filler treating area, but no ammonia or phenol. None of these three compounds or triethylamine were found using detector tubes in any other area of the plant.

Local exhaust ventilation was found to be 150 to 250 feet per minute (fpm) above the loading port during charging of the resin kettles. This compares favorably with a 100 fpm minimum velocity recommendeded by the ACGIH.[9]

Even though slot velocities on the resin kettle hoods are somewhat below recommended flows (1000 to 2000 fpm compared with a 2000 fpm suggested minimum), this ventilation system would appear to be adequate since the concentration of contaminants is low and air flow above the loading ports is good. General area ventilation throughout the plant usually was in the range from 50 to 150 fpm (any movement less than 50 fpm is considered negligible or "quiet air").

2. Medical

The number of positive and negative replies on history, findings on physical examination, and normal or abnormal lab test results in each worker group are shown in Table 3. In examining Table 3 it should be noted that in all cases where the percentage of positive replies or abnormal results to an item in Group I was far less than the percentage of positive replies or abnormal results in Group III, the item is not shown in Table 3. This is due to the statistical treatment of the data.

The actual percentages of the workers in the exposed group responding positively to medical history questions concerning symptoms attributable to exposure to the agents in question as well as the percentage of abnormal physical findings and laboratory values largely support the statistical analysis of this data. The symptoms most often reported (other than wearing eyeglasses, a natural concomitant of the aging process reported equally in all three groups) was skin rash in 30% of the workers in Group I and eye burning and eye watering in 25% of the workers in Group I. These are common complaints in other workers exposed to the agents noted above. The fact that there is no statistically significant relationship between these symptoms and the exposure category of the worker groups in the study does not belie the large percentage of workers with these complaints. The percentage of workers with inflammation of the nasal mucosa in Group I (30.5%), diastolic hypertension -- greater than 90 mm Hg -- (30.5%) and systolic hypertension -- greater than 140 mm Hg -- only (25%) on physical examination are the most common physical findings noted. The highest diastolic pressure noted was in a worker with a reading of 180/110, one worker had a blood pressure of 190/92 and three diastolic pressures above 100 mm Hg were noted in all in Group I. Of those workers in Group I with systolic hypertension only, the highest value noted was 160/80 in one worker. Four systolic pressures above 150 mm Hg were noted in the systolic hypertension only group in Group I. In comparing these observations to those in controls there is no statistical relationship demonstrated between exposure category and these findings.

The highest number of abnormal laboratory tests in Group I were found in the urinalyses. 55% of the workers in Group I had white blood cells in the urine and 42.5% of these workers had bacteriuria. However, these values compared to 40% and 50% respectively in the control group, Group III/ The lack of the statistically significant relationship between the two groups is understandable given the similar percentage of these abnormal results. 20% of the workers in Group I, 15 1/2% of the workers in Group II and 40% of the workers in Group III had red blood cells in the urine. Of the workers in Group I only 2 had more than 5 R.B.C./h.p.f. (8-10 R.B.C./h.p.f. and 20-30 R.B.C./h.p.f.) on microscopic examination of the urine. These

findings of high percentages of urinary abnormalities in all three groups may possibly be explained by poor collection or analysis technique, but the actual explanation, though unrelated statistically to the exposures in question, is unclear. The only other laboratory test showing greater than 10% abnormal results in Group I was the hemoglobin on the complete blood count. In this case 20% of the workers in Group I had slightly decreased hemoglobin values while 10% of the workers in Group III had slightly decreased hemoglobin values. All decreases in hemoglobin values were noted among male workers in Group I, the lowest recorded hemoglobin (12.4 g) was within 1.6 grams of normal for male workers in Group I. A student's pooled t-test comparing the hemoglobin values of males in Group I and males in Group III showed no significant difference between the mean hemoglobin in Group I (14.65 g) and the mean hemoglobin in Group III (14.92 g). Such decreased hemoglobin values as were noted in Group I were not in a range where significant clinical manifestations or impairment to health would be expected.

Thus, there is no statistically significant relationship demonstrated between exposure to the agents in question and adverse health effects as manifested by symptoms, signs or abnormal lab tests.

E. Summary and Conclusions

The relatively high percentages of symptoms and signs of eye, skin and mucous membrane irritation, though not statistically significant, may indicate some acute irritant effect under certain conditions from these chemicals, possibly acting in combination, even though singly their concentrations are below levels where one would expect irritant effects. It is also conceivable that certain sensitive individuals may experience irritant effects even though air concentrations of the substances in question are below the levels where irritation has been reported in other populations. Although there were several cases of acute irritation, the evidence does not indicate chronic health effects due to exposure to any of the materials investigated. The number of abnormal urinalyses in the exposed group was not significantly different from that of the control group, indicating that if there is a problem it is not due to occupational exposure. Furthermore, the medical survey was not conducted at the same time the environmental sampling was performed and thus acute irritant effects observed in this medical survey do not necessarily reflect the same air concentrations of the substances in question as were measured in the environmental sampling.

The findings of dermatitis and irritation were the only findings consistent with the literature reported effects of these substances and though these findings were not statistically related to the exposure category of the workers studied, the relatively high percentage of clinical findings of irritation in Group I suggest that exposure to the agents in question may be causing eye, skin and mucous membrane irritant effects.

V. RECOMMENDATIONS

1. Maintain and utilize the existing ventilation and air conditioning systems.

2. Encourage use of gloves and coveralls in workers in areas where contact with these substances is unavoidable.

3. Allow stacks of treated paper to cure before processing to minimize volatilization of uncured residues into the working areas.

4. Continue environmental monitoring of these chemicals to maintain implant air concentrations at acceptable levels.

VI. REFERENCES

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Table 1

RESULTS OF ENVIRONMENTAL AREA SAMPLING FOR PHENOL

February 18 and 19, 1976

Formica Corporation
Cincinnati, Ohio

Location	Time Period	mg. Phenol/M^3 Air
Resin Plant, on writing stands	Feb. 18, 8 hour sample	ND*
	Feb. 18, 8 hour sample	ND
	Feb. 19, 8 hour sample	ND
	Feb. 19, 8 hour sample	ND
Filler Treating, near paper entry and exit	Feb. 18, 8 hour sample	9.6
	Feb. 18, 8 hour sample	2.9
	Feb. 19, 8 hour sample	1.5
	Feb. 19, 8 hour sample	1.7
Filler Sorting, by foreman's desk and on lockers	Feb. 18, 8 hour sample	3.5
	Feb. 18, 8 hour sample	4.5
	Feb. 19, 8 hour sample	5.7
	Feb. 19, 8 hour sample	3.7
Series B Collating, banks 2 and 3	Feb. 18, 8 hour sample	6.4
	Feb. 18, 8 hour sample	8.4
	Feb. 19, 8 hour sample	4.0
	Feb. 19, 8 hour sample	6.6
Press Rooms, near build-up areas	Feb. 18, 8 hour sample	3.3
	Feb. 18, 8 hour sample	ND
	Feb. 18, 8 hour sample	ND

Environmental Criteria 19 mg/M^3

* Indicates concentration is not detectable by currently available methods.

Table 2

Results of Environmental Sampling for Formaldehyde

February 18 and 19, 1976

Formica Corporation
Cincinnati, Ohio

Location	Type of* Sample	Time Period	mg. Formaldehyde/ M^3 Air
Resin Plant, on writing stands	A	Feb. 18 AM	0.38
	A	Feb. 18 PM	0.61
	A	Feb. 18 AM	0.13
	A	Feb. 18 PM	0.06
	A	Feb. 19 AM	0.46
	A	Feb. 19 PM	0.35
	A	Feb. 19 PM	0.18
	A	Feb. 19 AM	0.17
Filter Treating, area samples near paper entry and exit	A	Feb. 18 AM	0.04
	P	Feb. 18 AM	0.05
	P	Feb. 18 AM	0.07
	A	Feb. 18 PM	0.06
	P	Feb. 18 PM	0.07
	P	Feb. 18 AM	0.11
	P	Feb. 18 AM	0.05
	A	Feb. 18 AM	0.08
	P	Feb. 18 PM	0.14
	P	Feb. 18 PM	0.05
	A	Feb. 18 PM	0.09
	P	Feb. 19 AM	0.13
	P	Feb. 19 AM	0.07
	A	Feb. 19 AM	0.06
	P	Feb. 19 PM	0.06
	P	Feb. 19 PM	0.09
	A	Feb. 19 PM	0.07
	P	Feb. 19 AM	0.20
	P	Feb. 19 AM	0.07
	A	Feb. 19 AM	0.09
	P	Feb. 19 PM	0.17
	P	Feb. 19 PM	0.09
	A	Feb. 19 PM	0.09
Filler Sorting	P	Feb. 18 AM	0.05
	P	Feb. 18 PM	0.09
	P	Feb. 18 AM	0.04
	P	Feb. 18 PM	0.13
	P	Feb. 18 AM	0.04
	P	Feb. 18 PM	0.04
	P	Feb. 18 AM	0.06
	P	Feb. 18 PM	0.11
	P	Feb. 19 AM	0.04
	P	Feb. 19 PM	0.13
	P	Feb. 19 AM	0.04
	P	Feb. 19 PM	0.01
	P	Feb. 19 AM	0.04
	P	Feb. 19 PM	0.02
	P	Feb. 19 AM	0.06
	P	Feb. 19 PM	0.02
Series B Collating	P	Feb. 18 AM	0.27
	P	Feb. 18 AM	0.11
	P	Feb. 18 AM	0.14
	P	Feb. 18 PM	0.28
	P	Feb. 18 PM	0.12
	P	Feb. 18 PM	0.09
	P	Feb. 18 AM	0.06
	P	Feb. 18 AM	0.05
	P	Feb. 18 PM	0.07
	P	Feb. 18 PM	0.09
	P	Feb. 18 PM	0.03
	P	Feb. 18 AM	0.05
	P	Feb. 18 AM	0.04

Table 2 (contd)

Results of Environmental Sampling for Formaldehyde
February 18 and 19, 1975
Formica Corporation
Cincinnati, Ohio

Location	Type of Sample	Time Period	mg. Formaldehyde/ M^3 Air
Series 8 Collating	P	Feb. 18 AM	0.05
	P	Feb. 18 PM	0.07
	P	Feb. 18 PM	0.05
	P	Feb. 18 PM	0.05
	P	Feb. 18 PM	0.04
	P	Feb. 18 PM	0.19
	P	Feb. 19 AM	0.02
	P	Feb. 19 PM	0.03
	P	Feb. 19 AM	0.09
	P	Feb. 19 PM	0.03
	P	Feb. 19 AM	0.10
	P	Feb. 19 PM	0.03
	P	Feb. 19 AM	0.07
	P	Feb. 19 PM	0.04
	P	Feb. 19 AM	0.03
	P	Feb. 19 PM	0.06
	P	Feb. 19 AM	0.05
	P	Feb. 19 PM	0.04
	P	Feb. 19 AM	0.03
	P	Feb. 19 PM	0.01
	P	Feb. 19 AM	0.05
	P	Feb. 19 PM	0.03
	P	Feb. 19 AM	0.04
	P	Feb. 19 PM	0.04
	P	Feb. 19 AM	0.04
	P	Feb. 19 PM	0.04
	P	Feb. 19 AM	0.03
	P	Feb. 19 PM	0.03
	P	Feb. 19 AM	0.05
	P	Feb. 19 PM	0.04
Press Build-up	P	Feb. 18 AM	0.05
	P	Feb. 18 PM	0.34
	P	Feb. 18 AM	0.05
	P	Feb. 18 AM	0.04
	P	Feb. 18 AM	0.04
	P	Feb. 19 AM	0.03
	P	Feb. 19 AM	0.04
	P	Feb. 19 AM	0.04
	P	Feb. 19 AM	0.02
	P	Feb. 19 AM	0.02
Environmental Criteria			3 mg/M^3

* "A" indicates an area sample
"P" indicates a personal sample

Table 3

Responses to Medical History Questions, Physical Examination Findings and Laboratory Test Results*

February 20 and 22, 1976

Formica Corporation
Cincinnati, Ohio

Item and Desc.		Group I **	Group II***	Group III****
8b- Chest Tightness	+	1	1	0
	-	39	12	10
8e- Sputum Production	+	3	1	0
	-	37	12	10
9a-Dysuria	+	3	2	0
	-	37	11	10
9b- Dark Urine	+	1	1	0
	-	39	12	10
9c- Freq. Urin. During Day	+	1	1	0
	-	39	12	10
9d- Freq. Urin. During Night	+	1	2	0
	-	39	11	10
9e- Plank Pain	+	4	2	1
	-	36	11	9
9f- Swelling of Face	+	2	0	0
	-	38	13	10
9h- Chronic Weakness	+	1	0	0
	-	39	13	10
9i-Ankle Swelling	+	2	1	0
	-	38	12	10
9j- Loss of Appetite	+	1	0	0
	-	39	13	10
9k- Nausea	+	1	0	0
	-	39	13	10
9l- Metallic Taste	+	3	0	0
	-	37	13	10
9m- Burning Sens. of Feet	+	6	1	0
	-	34	12	10
11- Skin Rash	+	12	2	2
	-	28	11	8
12a-Dizziness	+	6	3	1
	-	34	10	9
12c- Headache	+	7	4	1
	-	33	9	9
12d- Numbness of Limbs	+	3	3	0
	-	37	10	10
12f- Crying Spells	+	1	0	0
	-	39	13	10
12h- Shakiness	+	3	0	0
	-	37	13	10
12i- Nervousness	+	1	0	0
	-	39	13	10

Table 3

Formica Corporation
Cincinnati, Ohio

Item and Desc.		Group I	Group II	Group III
12j- Tingling of Limbs	+	3	3	0
	-	37	10	10
12k- Trouble Talking	+	2	0	0
	-	38	13	10
121- Depression	+	3	1	0
	-	37	12	10
12m- Memory Loss	+	2	0	0
	-	38	13	10
13a- Blurred Vision	+	5	1	1
	-	35	12	9
13b- Eye Irritation	+	6	0	1
	-	34	13	9
13c- Eye Burning	+	10	1	1
	-	30	12	9
13d- Eye Watering	+	10	2	1
	-	30	11	9
13e- Wear Glasses	+	25	7	5
	-	15	6	5
F1- Conj. Inflamm.	+	5	3	0
	-	35	10	10
F4- Nasal Mucosa Inflam.	+	13	2	3
	-	27	11	7
F6- Pharyng. Inflamm.	+	1	0	0
	-	39	13	10
F8- Irreg. Heart Beat	+	1	0	0
	-	39	13	10
F9- Liver Palpable	+	2	0	0
	-	38	13	10
F10- Spleen Palpable	+	1	0	0
	-	39	13	10
F11- Abd. Tenderness	+	1	0	0
	-	39	13	10
F13- Nystagmus	+	1	0	0
	-	39	13	10
F15- Skin Lesions	+	4	2	0
	-	36	11	10
F16- Syst. Hypertension Only	+	10	1	0
	-	30	12	10
F17- Dias. Hypertension	+	13	3	1
	-	27	10	9
U/A- Alb.	+	1	0	0
	-	39	13	10
U/A- Glu.	+	1	2	0
	-	39	11	10

Table 3

Formica Corporation
Cincinnati, Ohio

Item and Desc.		Group I	Group II	Group III
U/A- Bile	+	1	0	0
	-	39	13	10
U/A- WBC	+	22	7	4
	-	18	5	6
U/A- RBC	+	8	2	4
	-	32	11	6
U/A- Bacteria	+	17	8	5
	-	23	5	5
CBC- Hemoglobin Decreased	+	8	3	1
	-	32	10	9
CBC- W.B.C. Decreased	+	4	1	0
	-	36	12	10
CBC- Platelets Decreased	+	1	1	0
	-	39	12	10
CBC- Platelets Increased	+	3	0	0
	-	37	13	10
U/A- Uric Acid Cyrstals	+	2	0	0
	-	38	13	10
U/A- Ca. Ox. Crystals	+	3	2	1
	-	37	11	9

* Only those items in which the percentage of positive or abnormal responses in Group I was greater than or approximately equal to that of Group III are included.
** Number of Workers = 40
*** Number of Workers = 13
**** Number of workers = 10

APPENDIX I

CONSENT FORM, QUESTIONNAIRE, AND MEDICAL EXAM FORM

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
518 POST OFFICE BUILDING
CINCINNATI, OHIO 45202

CONSENT

I voluntarily agree to participate in a study at Formica Corporation, Evendale, Ohio, conducted by the Public Health Service, to evaluate possible health effects from substances used in the production of formica. I understand that the medical evaluation will consist of answering questions about my health, a physical examination and collection of a blood sample and a urine sample.

I understand that my participation in this study is voluntary and that all information obtained will be considered confidential in accordance with U.S. Public Health Service Regulation (42 CFR Part 1). The information will be utilized statistically, but I will not be identified as an individual without my express consent. I am free to withdraw from the study at any time.

Date _____ Name _____
(printed or typed)

Signature _____

Witness _____

AUTHORITY TO GIVE MEDICAL REPORT

In addition to notifying me whether my tests are normal or need further study, I request that the Public Health Service infrom:

A. My Personal Physician Yes_____ No_____

Name _____

Address _____ _____
(signature)

City _____

B. Plant Physician Yes_____ No_____

Address _____ _____
(signature)

City _____

of any significant results of this study.

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

Medical Questionnaire Date _____

A. Identification

1. Name _____
2. Address _____
3. Phone Number _____
4. Social Security Number _____
5. Birthdate _____ 6. Age _____
7. Sex _____ 8. Race ____W ____B ____ other
9. Standing Height _____ in. 10. Weight _____ lbs.

B. Occupational History

1. In what year did you start working here? _____
2. What exactly is your main job? (describe it) _____

_____

_____

3. On the average how many days per week do you work? _____
4. On the average how many hours per day do you work? _____
5. How many years have you worked at this job? _____
6. Have you had any medical problems you feel are related to your work?(if so describe) _____

_____

_____

C. Environmental Exposures

Have you had prolonged or repeated exposure to:	Yes	No
1. Asbestos (insulation, car undercoating, brake lining, fire proofing)		
2. Radioactive materials (uranium, radon gas ore)		
3. Arsenic (powder, insecticide, sheep dip, sprays)		
4. Iron or Silica (mining, foundry, sand blasting)		
5. Nickel or Chromium (manufacturing, refining)		
6. Petroleum Products (gas retorts, distillation)		
7. Carbon Monoxide (garage work)		
8. Very dusty environment		
9. Lead (storage battery, dyes, rubber, paint)		
10. Other significant exposure		

10a. (If yes to above describe) _____

_____

11. additional comments regarding exposures- _____

_____

D. Past History and Review of Systems

1. Have you ever been told by a doctor that you had any of the following problems?

	YES	NO	YEAR	Comment
Cancer				
Diabetes				
Kidney Trouble				
Mental Illness				
Rheumatic Fever				
High Blood Pressure				
Arthritis				
Drug Allergies				
Cirrhosis				
Serious Injury or Accident				
Epilepsy, Convulsions				
Heart Disease or Attack				
Emphysema				
Tuberculosis				
Hay Fever				
Asthma				
Sinusitis				
Peptic Ulcer				
Fractured Bones				
Glaucoma or Cataract				
SKIN DISEASE				

D. Review of Systems (cont.)

2. Operations: Types _____

3. Hospitalizations and years _____

_____

4. Medical problems not mentioned above- (describe) _____

_____

5. Allergies (describe) _____

6. Medications (describe) _____

7. Use of Alcohol (describe) _____

7a. Smoking History (describe) _____

8. Respiratory
Have you had any of the following problems-

	No	Prior To working here	Begun or made worse on working here	worsened during each shift
a. Wheezing	____	_____	_____	_____
b. Chest Tightness	____	_____	_____	_____
c. Episodes of S.O.B.	____	_____	_____	_____
d. Cough (for more than three months)	____	_____	_____	_____
e. sputum production (for more than three mos.)	____	_____	_____	_____

9. Renal

Have you had any of the following problems-

	No	Prior to working here	Begun or worse on working here	Wors duri shif
a. Pain or burning on urination?	____	____	____	____
b. Dark colored or bloody urine?	____	____	____	____
c. Freq. urination during day?	____	____	____	____
d. Freq. urination during night?	____	____	____	____
e. Freq. pain in flanks?	____	____	____	____
f. Swelling of eyelids or face?	____	____	____	____
g. Itching of skin?	____	____	____	____
h. Chronic weakness or fatigue?	____	____	____	____
i. Swelling of ankles?	____	____	____	____
j. Loss of appetite?	____	____	____	____
k. Freq. nausea and/or vomitting?	____	____	____	____
l. Mettalic taste in mouth?	____	____	____	____
m. Numbness or burning of feet?	____	____	____	____

n. additional comments concerning this information- _____

_____

_____

10. Gastrointestinal

Have you had any of the following problems-

a. Yellow skin(jaundice)?	____	____	____	____
b. Upper abdominal pain?	____	____	____	____
c. Selling of abdomen?	____	____	____	____
d. Light colored stool?	____	____	____	____
e. Heartburn or indigestion?	____	____	____	____

f. additional comments concerning this information- _____

_____

_____

11. Any rash or other skin lesion? ____ ____ ____ ____

11a. If yes to above describe- _____

_____

12. Neurological

Have you had any of the following problems-

	No	Prior to working here	Begun or worse on working here	worsene during shift
a. Dizziness?	___	_____	_____	_____
b. Fainting?	___	_____	_____	_____
c. Headache?	___	_____	_____	_____
d. Numbness?	___	_____	_____	_____
e. Blindness?	___	_____	_____	_____
f. Crying spells?	___	_____	_____	_____
g. Trouble walking?	___	_____	_____	_____
h. "Shakiness"?	___	_____	_____	_____
i. Nervousness?	___	_____	_____	_____
j. Tingling?	___	_____	_____	_____
k. Trouble talking?	___	_____	_____	_____
l. Feeling sad a lot?	___	_____	_____	_____
m. Problems with memory?	___	_____	_____	_____
n. Problems with coordination?	___	_____	_____	_____

o. additional comments concerning this information _____

_____

_____

13. Opthemological

Have you had any of the following problems-

a. Blurring of vision?	___	_____	_____	_____
b. Eye irritation?	___	_____	_____	_____
c. Eye burning?	___	_____	_____	_____
d. Eye watering?	___	_____	_____	_____
e. Wear glasses?	___	_____	_____	_____

f. additional comments concerning this information-_____

_____

_____

E. Protective Gear Used

1. What protective gear do you use(describe conditions,circumstances and duration of use)_____

_____

_____

F. Physical Examination

B.P. _____ Pulse _____ Resp. _____

		Yes	No	Comment
1.	Conjunctival Inflammation	___	___	_____
2.	Blepharitis	___	___	_____
3.	Corneal Ulceration	___	___	_____
4.	Inflammation of Nasal Mucosa	___	___	_____
5.	Inflammation of Oral Mucosa	___	___	_____
6.	Pharyngeal Inflammation	___	___	_____
7.	Lungs Clear	___	___	_____
8.	Regular rate and rhythmn	___	___	_____
9.	Liver Palpable	___	___	_____
10.	Spleen palpable	___	___	_____
11.	Abdominal tenderness	___	___	_____
12.	+ Rhomberg	___	___	_____
13.	Nystagmus	___	___	_____
14.	Normal finger coordination	___	___	_____
15.	Skin lesions	___	___	_____

16. Additional comments or observations- _____

G. Laboratory Studies

	Date Collected	Result
1. CBC		
. Urinalysis		