

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45202

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 74-121-203

HILLERICH & BRADSBY COMPANY
JEFFERSONVILLE, INDIANA

JUNE 1975

I. TOXICITY DETERMINATION

It has been determined that lacquer vapor concentrations (naphtha, toluene, xylene, ethyl benzene, n-butyl acetate, and methyl ethyl ketone) as measured on December 10, 1974 in department B-4 of the Hillerich & Bradsbay Company do produce transient episodes of mucous membrane irritation. Such episodes were verified in three of the six cases reported during this evaluation.

However, it has also been determined that such transient episodes of mucous membrane irritation do not constitute a chronic intoxication health hazard. This is supported by the finding that such mucous membrane irritation is common among most workers in this department and yet no symptoms of chronic lacquer vapor intoxication were detected.

In addition, it has been determined that a potential for contact dermatitis, due to lacquer constituents, was present during this evaluation.

These determinations are based on area and breathing zone samples, evaluation of work practices and local exhaust ventilation, employee interviews and physical examinations, and information regarding the toxicity of substances used throughout department B-4.

Recommendations to ameliorate the transient mucous membrane irritations and the potential for contact dermatitis are incorporated within the body of this report.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are available upon request from the Hazard Evaluation Services Branch, NIOSH, U.S. Post Office Building, Room 508, 5th and Walnut Streets, Cincinnati, Ohio 45202. Copies have been sent to:

- a) Hillerich and Bradsbay Company, Jeffersonville, Indiana
- b) Authorized Representative of Employees
- c) U.S. Department of Labor - Region V
- d) NIOSH - Region V

For the purposes of informing the approximately 22 "affected employees", the employer shall promptly "post" the Determination Report in a prominent place(s) near where exposed employees work for a period of 30 calendar days.

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 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 National Institute for Occupational Safety and Health (NIOSH) received such a request from an authorized representative of employees regarding exposure of employees to lacquer via both skin contact and inhalation of vapors.

IV. HEALTH HAZARD EVALUATION

A. Description of Process - Conditions of use

The Hillerich and Bradsby Company located in Jeffersonville, Indiana manufactures golf clubs and baseball bats. Approximately 46,000 baseball bats are manufactured each week. Each of these baseball bats must be processed through department B-4 by twenty-two employees. This department has been set up for the purpose of applying fillers and various lacquers to the bats. In addition to this, most bats are "branded" in this work area.

The process mentioned above will differ slightly for each of the four types of bats manufactured and is dependent upon the quality of the bat.

The "pigment bats" are dipped manually in a lacquer base pigment, hung on a slow moving chain to drip dry and then branded twice.

The "filler bats" are dipped manually in naphtha, belt rubbed, end buffed, dried over night, end stamped, dipped in lacquer, placed on a slow moving chain to drip dry, and then branded twice.

The "colored bats" are dipped manually in stain, placed on a short slow moving chain to drip dry, dipped in lacquer, placed on a second chain to drip dry, and then branded twice.

The "flame-burned bats" are dipped manually in a clear sealer (this may be done outside of this work area), belt rubbed, end buffed, end stamped, and then dipped in lacquer.

The twenty-two employees in this department have the following job classification: branders (8), dippers and off-bearers (8), and belt rubbers (6).

Dippers perform their job by submerging the baseball bats in a small tank containing the required material and then hanging them on a slow moving chain. The small tank is located directly in front of the dipper and under a drain-board positioned at approximately three feet above the floor. This drain board has been constructed with a 6" hole at its lowest point; this allows excess materials (from the bat) to drain back into the tank plus easy access for dipping the bat. The bats are dipped individually after attaching a clip to the handle end. This dipping process is done under the following conditions: an adequate local exhaust system is present, no gloves are worn, improvised paper aprons were worn.

The bats, which feel dry to the touch, are then removed at the opposite end of the chain by one of the three off-bearers (one off-bearer per dipping process). These bats are then stacked on a low flat-cart and wheeled to the center of the room where they remain until they are "branded." The elapsed time (between dipping and branding) may be as short as 1 1/2 hours.

The process identified as "branding" is performed in the center of the room by the eight branders. This process (trade mark application) is more of a stamping process than a branding process. However, there is some heat applied; the branding iron is held at a temperature of approximately 200°F and is used for less than three seconds per brand.

Each brander's exposure to vapors is approximately the same, due to the location of the branding machine; all machines are located in the center of the room. Vapors sources are the bats on the adjacently parked carts, the bats on the slow moving chains, and vapors from the belt rub operation. Portable fans have been provided to move the air in the branders' immediate vicinity but were not being used during this evaluation.

The belt rub operation consists of temporarily placing several bats in an open trough-like tank which contains a filler (naphtha). These bats are then removed and permitted to stand until excess naphtha runs off. The bats are then belt rubbed on a lathe-like machine and then end buffed on adjacent buffers. Only the "filler bats" are dipped in naphtha and belt rubbed before being dipped in topcoat (lacquer).

The following conditions and work practices were observed during the belt rub process: 1) the belt-rubbers submerge their hands into naphtha to remove the bats; this is done without the use of gloves, 2) the efficiency of the local exhaust system is questionable, due to the movement of the belt (which is partly hooded), 3) the local exhaust control on the buffer is quite adequate.

B. Evaluation Design

The environmental and medical evaluation was conducted on December 9-10, 1974. The environmental evaluation was conducted by NIOSH industrial hygienists Raymond Rivera and Robert Rosensteel. The medical evaluation was conducted by Robert Rostand, M.D. of the Medical Services Branch.

On December 9th a brief meeting was held for the purpose of obtaining background information. This meeting was attended by labor and management representatives as well as the NIOSH personnel.

Following this meeting a walk-through survey of the work site was conducted. This included: 1) obtaining process descriptions and 2) observing work practices. As a result of this walk-through survey a sampling protocol was established for the following day. During the latter portion of the walk-through Dr. Rostand met with the company nurse and reviewed both their OSHA Form 102, plus medical records of those employees in Department B-4.

On December 10, 1974 Mr. Rivera and Mr. Rosensteel conducted the remainder of the environmental evaluation. This consisted of collecting area and breathing zone samples as well as bulk samples, evaluating local exhaust controls and work practices, and taking photographs for record purposes. During this time Dr. Rostand conducted confidential employee interviews plus physical examinations.

C. Evaluation Methods

1. Environmental

In addition to obtaining process descriptions and observing work practices, area and breathing zone samples were collected by utilizing charcoal tubes. The area samples were actually bulk-air samples and were collected for qualitative purpose. There were 16 different substances used in department B-4.

These sixteen substances were: petroleum naphtha, toluene, xylene, n-butyl acetate, ethyl benzene, methyl ethyl ketone, n-butanol, isopropanol, isobutyl acetate, isobutanol, methyl amyl ketone, ethanol, methanol, butyl cellulose, mineral spirits and lactol spirits. Of these, only petroleum naphtha, toluene, xylene, ethyl benzene, n-butyl acetate, and methyl ethyl ketone were present in quantities sufficiently high enough to report.

A representative number of breathing zone samples were collected for each job classification (dippers and off-bearers, branders, and belt rubbers). samples were collected for approximately six hours and are essentially time weighted averages.

The samples collected were analyzed by gas chromatography after vapor desorption from the charcoal with carbon disulfide.

2. Medical

Twenty-one persons, out of a total of 22 employed in the work area under evaluation, were interviewed and examined. There were 20 males and one female. The interviews and limited physical examinations focused on possible work-related illness and especially the acute or chronic symptoms of lacquer vapor intoxication. The acute symptoms and/or signs of lacquer vapor intoxication that were sought included: acute dermatitis, irritation of mucous membranes of eyes, nose and throat; intense lacrimation and/or rhinorrhea, headache, dizziness, fatigue, unconsciousness, nausea and vomiting; cough and wheezing. The chronic symptoms or signs of lacquer vapor intoxication sought included: anorexia, weight loss, weakness, fatigue, muscle weakness, paresthesias, vertigo, headache and respiratory tract irritation.

The physical examination included a limited cutaneous examination, an examination of the mucous membranes of the eyes, nose and throat, and a brief neurologic examination including muscle strength and deep tendon reflexes. At the end of the work shift most workers were interviewed again and reexamined when it was thought necessary.

D. Evaluation Criteria

1. Environmental

The three primary sources of environmental evaluation criteria considered in this report are: (1) NIOSH criteria documents recommending occupational health standards, (2) American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values and (3) Federal occupational health standards. Since this criteria was used only as a guide and listing the NIOSH recommended standards and the ACGIH Threshold Limit Values would not change any of the determinations made as a result of this evaluation, only the Occupational Health Standards promulgated by the U.S. Department of Labor (Federal Register, June 27, 1974, Vol. 39, No. 125; Title 29, Chapter XVIII, Part 1910, Subpart G, Table G1) applicable to the substances of concern in this evaluation are listed below.

8 hr. time weighted average (TWA)
in parts per million (PPM)

Toluene	200
Petroleum Naphtha	500
Methyl Ethyl Ketone	200
Ethyl Benzene	100
N-butyl acetate	150
Xylene	100

Evaluation of the local exhaust system was done by generating smoke in the workers normal breathing zone and observing the air flow patterns. In addition to this, slot velocities were measured with an Alnor Velometer Jr.

2. Medical

The medical criteria used to determine a toxic response to lacquer vapors under investigation consist of signs and symptoms which each substance contained in the lacquer formulations produces when toxic exposure occurs. A brief review of the substances of primary concern follows:

Toluene: Prolonged excessive exposure to this agent may acutely cause headache, weakness, fatigue, unconsciousness, loss of coordination, nausea, vomiting, anorexia, acute dermatitis and irritation of skin and mucous membranes. Industrial grade toluene or xylene may contain significant amounts (3% or more) of benzene.

Xylene: Excessive exposure to xylene may cause dermatitis, irritation of mucous membranes, nausea, vomiting, anorexia and heart burn. Dizziness, incoordination and a staggering gait may also occur.

Methyl Ethyl Ketone (MEK): Prolonged exposure to MEK may result in mucous membrane irritation, nausea, vomiting, dermatitis, headache and paresthesias.

Exempt VM+P Naphtha and Lactol Spirits: Prolonged exposure to these two petroleum naphthas may produce dermatitis, photosensitivity, headache, nausea, lassitude, anorexia and extreme nervousness.

N-Butyl Acetate and Isobutyl Acetate: N-butyl acetate is primarily an irritant but also possesses some narcotic effect. Symptoms of intoxication include irritation of mucous membranes followed by incoordination, fatigue, weight loss and narcosis.

Ethyl Acetate: Prolonged and excessive exposure to this agent may result in dermatitis, mucous membrane irritation and respiratory tract irritation and narcosis.

Methyl Isobutyl Ketone (MIBK): MIBK is primarily an irritant but also possesses a narcotic effect. Acute intoxication may result in mucous membrane irritation, nausea, vomiting, dermatitis, headache and paresthesias.

Methyl-n-Amyl Ketone (2-Heptanone): Exposure to high concentrations of this agent may produce irritation of mucous membranes and narcosis.

Methyl iso-Amyl Ketone: Compared to MIBK, this agent produces similar toxic effects at identical exposure levels. At levels above the existing TLV of 100 ppm, irritation of mucous membranes may occur.

Butyl Cellosolve: Prolonged exposure to this agent may produce irritation of mucous membranes. Systemic absorption through the skin may produce hemolytic anemia.

Isobutanol: Exposure to high concentrations of isobutanol may produce mucous membrane irritation and narcosis.

Ethyl Benzene: Ethyl benzene is a primary skin irritant and less markedly a narcotic. Prolonged exposure may produce severe irritation of mucous membranes and dermatitis.

E. Evaluation Results and Discussions

1. Environmental

The average petroleum naphtha concentrations in the belt-rubbers' breathing zone were the highest concentrations found throughout the department. These concentrations were within OSHA Standards and ranged from 145 to 190 parts per million. Average concentrations of petroleum naphtha for all other employees were below 35 ppm. Also, all other chemicals were present in very low concentrations throughout the department; the highest average concentration for toluene was 8 ppm, for xylene it was 14 ppm, for ethyl benzene it was 5 ppm, for n-butyl acetate it was 3 ppm, and for methyl ethyl ketone it was 5 ppm (see Table I).

Only the local exhaust provided for the belt rubbing operation was judged to be questionable. The movement of the belt disturbed the air flow pattern. The local exhaust at the dipping stations were judged to be adequate. Slot velocities measured were in excess of 800 feet per minute.

During the NIOSH visit we observed the belt rubbing operation which required the workers to submerge their hands into the petroleum naphtha in order to remove the bats.

2. Medical

The following table summarizes the epidemiologic data of the cohort studied:

<u>Operation</u>	<u>No.</u>	<u>Av. Age (Range)</u>	<u>Av. Length of Employ at Hillerich Bradsby (Range)</u>	<u>Av. Time in Present Job (Range)</u>
Brander	8	40.5 yrs. (21-57 yrs.)	11.6 yrs. (3.37 yrs.)	5.8 yrs. (3 mo. - 25 yrs.)
Dipper and Off Bearer	8	33.8 yrs. (22-48 yrs.)	8.0 yrs. (3-14 yrs.)	2.6 yrs. (3 mo. - 12 yrs.)
Belt Rubber	6	37.0 yrs. (25-27 yrs.)	13.8 yrs. (3-27 yrs.)	6.5 yrs. (2 - 20 yrs.)

Only one worker gave a history of medical illness that he specifically related to his occupation as a dipper. This individual gave a history of dermatitis involving the face and arms that he related to the lacquer involved in the dipping process. He also admitted to using VM+P naphtha to clean lacquer from his hands and forearms. At the time of the NIOSH visit, he was free of dermatitis.

The results of the histories and physical examinations have been tabulated and are found in Table II. It can be seen that a history of mucous membrane irritation is common. Such irritation was reported by 71% of workers. It should again be stressed that individual worker exposures are not necessarily the same in extent or duration. The most frequent cause of irritation noted by the branders was attributed to insufficient time for the bats to dry before labeling. Other individuals noted certain particular areas where lacquer vapors were bothersome and irritating. Specifically noted were the aisle between two adjacent dipping operations and the area adjacent to the pallets where the bats are placed to dry before and after branding. No particular preparation was singled out for producing symptoms.

On the day of the NIOSH visit, which was judged by employees to be a usual day, 6 out of 21 individuals noted the transient occurrence of mucous membrane irritation lasting 10-15 minutes. (The NIOSH medical officer also developed two such episodes while standing beside a pallet of freshly dipped bats. He noted eye and nose irritation that abated after leaving the general area.) Physical examination confirmed the presence of mucous membrane irritation in three. It should be noted that four of the six individuals who noted such irritation were branders.

The prevalence of occupational dermatitis is low. Review of OSHA Form 102 revealed that from January 1973 to the time of the NIOSH visit, there were two cases of dermatitis in the B-4 area (included in the general area under investigation in this study) out of a total of 96 visits to the plant nurse. In addition, the results of our investigation revealed only one individual with minimal dermatitis and the one individual previously noted above who gave a history of dermatitis.

Our survey also revealed the frequent use of naphtha by the workers for removing lacquer from the skin. Eight of 21 persons admitted to such use. These individuals were dippers, off bearers, and belt rubbers. In addition, only a few employees wore gloves or aprons. Improvised paper aprons were worn by some dippers. Two branders gave a past history of symptoms that they related to vapors from the "wet" bats. One individual related occasional headache and the other related an occasional lightheaded sensation. No person noted any other neurologic complaints in the past or present, and all neurologic examinations were within normal limits.

In no instance did the history or physical examination suggest chronic lacquer vapor intoxication.

The medical investigation revealed the frequent occurrence of transient mucous membrane irritation. Such irritation may be due to short exposures to high lacquer vapor concentrations emanating from the recently dipped bats and belt rubbing areas as well as from the bats on the pallets. It is not surprising therefore that mucous membrane irritation was the most prevalent complaint. Much less prevalent were dermatologic and neurologic complaints. There was no evidence of acute or chronic neurologic disease.

While the prevalence of occupational dermatitis in this area was low, it should be noted that almost all the constituents contained in the lacquer preparations can cause acute and chronic dermatitis. The use of barrier creams is of only limited value and is not a substitute for impervious gloves and long-sleeved garments to protect the forearms. In addition, VM+P naphtha which is frequently used as a cleaning agent can cause dermatitis. Moreover, naphtha can be readily absorbed through the skin and may therefore produce systemic toxicity and hemolytic anemia.

F. Recommendations

It is recommended that all dippers and off bearers wear impervious rubber gloves and smocks. In addition, the men should receive cotton inner gloves to absorb moisture. These inner gloves should be changed at least twice a day. Long-sleeved garments should be encouraged. The use of naphtha as a cutaneous cleaning agent should be prohibited. Belt rubbers should be encouraged to wear impervious rubber gloves.

In order to limit mucous membrane irritation, it is recommended that bats be permitted to dry in a well ventilated area other than the area adjacent to the branders where they are presently stored. The bats should be allowed to dry for approximately twenty-four hours prior to branding.

V. REFERENCES

Browning, Ethel, Toxicity and Metabolism of Industrial Solvents.
New York: Elsevier Publishing Company (1965).

Patty, Frank A., Ed., Industrial Hygiene and Toxicology, Vol. II.
New York: Interscience Publishers (1963).

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TABLE I
CONCENTRATION OF AIR CONTAMINANTS MEASURED IN DEPARTMENT B-4
December 10, 1974

Job Classification	Sample #	Time	Concentration in ppm						Fraction of Permissible Exposure
			Naptha	Toluene	Xylene	Ethyl Benzene	N-butyl Acetate	Methyl Ethyl Ketone	
Dipper (topcoat)	1 & 13	0740-1438	35	5	4	3	3	4	0.205
Dipper (topcoat)	2 & 12	0738-1436	13	7	2	2	2	4	0.134
Dipper (topcoat)	3 & 16	0751-1455	26	8	5	4	3	5	0.227
Dipper (gold stain)	4 & 14	0748-1455	13	4	4	4	3	5	0.171
Dipper (pigment, lacquer)	5 & 15	0754-1455	14	4	4	4	3	5	0.173
Belt rubber	6	0806-1446	186	5	13	4	1	2	0.584
Belt rubber	7	0802-1330	145	4	10	3	1	1	0.452
Belt rubber	8	0806-1446	190	6	14	4	2	1	0.608
Belt rubber	9	0804-1330	183	5	12	5	1	2	0.578
Brander	10	0816-1454	33	8	4	2	2	3	0.194
Brander	11	0814-1453	20	3	3	1	<1	1	0.107

TABLE II
HISTORY & PHYSICAL EXAMINATION RESULTS

JOB CATEGORY	MUCOUS MEMBRANE IRRITATION			NEUROLOGIC		DERMATITIS		Use of Lacquer Thinner to Clean Person
	Past History of Irritation	Acute Symptoms on the day of NIOSH visit	Irritation Present on Physical Exam	Symptoms (Past and Present)	Abnormal Physical Exam	History	Physical Exam	
Brander (n = 7)	5/7	4/7	2/7	2/7	0/7	0/7	0	0/7
Dipper and Off Bearer (n = 8)	4/8	1/8	0/8	0/8	0/8	1/8	1/8	5/8
Belt Rubber (n = 6)	6/6	1/6	1/6	0/6	0/6	0/6	0/6	3/6
TOTAL (n = 21)	15/21 (71%)	6/21 (29%)	3/21 (14%)	2/21 (9%)	0/21	1/21	1/21	8/21 (38%)