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. 78-27-551

BOMBER BAIT COMPANY
GAINESVILLE, TEXAS

DECEMBER, 1978

I. TOXICITY DETERMINATION

The following determinations have been based upon the: (a) results of environmental air samples collected on December 7, 1977; (b) evaluation of local exhaust ventilation for painting operations; (c) medical interviews with eighteen (18) paint room employees; (d) personal observation by investigators; (e) available toxicity information and (f) consultation with a local dermatologist who had evaluated a number of workers and obtained some environmental samples from the plant to determine fibrous glass content.

The onset of the skin problems in the fall of 1977 was caused by fibrous glass particles being blown directly onto workers in the warm air being discharged from the overhead ducts. This evidence is based on histories obtained from workers, some residual scarring found as a result of examining workers' skin, and findings of the previously-mentioned local dermatologist.

Following the removal of all fibrous glass particles from the ventilation system, complaints of skin problems continued probably because of: (1) increased worker awareness; (2) increased skin sensitivity caused by the warm, dry air; and (3) the low-level irritancy introduced by recirculating air in which solvent vapors are introduced from fishing lures on the drying racks located beneath the ceiling return air grills. This evidence is based on histories obtained from the workers, lack of specific physical findings; personal observation; and discussions with the local dermatologist.

Airborne concentrations of solvent vapors (toluene, xylene, methy ethyl ketone, acetone and ethylene glycol monoethyl ether acetate) were not found at levels sufficient to be causing the problems being reported by workers in the paint room.

II. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this Determination Report are currently available upon request from the National Institute for Occupational Safety and Health (NIOSH),

Division of Technical Services, Information and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio, 45226. After ninety (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, Ohio, address. Copies have been sent to:

(a) Bomber Bait Company
(b) U. S. Department of Labor, Region VI
(c) NIOSH, Region VI.

For the purpose of informing the approximately nineteen (19) "affected employees", the employer shall promptly "post" the Determination Report in a prominent place near where exposed employees work, for a period of thirty (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 receipt of a written request from 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.

NIOSH received such a request from the employer regarding the exposure of workers to paints/solvents in the dip/paint rooms of the plant, which reportedly resulted in various skin irritation problems.

IV. HEALTH HAZARD EVALUATION

A. Description of Process - Conditions of Use

This plant, commencing operations in 1946, currently employs a total of fifty-five (55) persons, and is involved in the production of fishing lures. Approximately nineteen (19) persons are employed in the area(s) concerned with the dipping/painting operations.

B. Evaluation Design

1. Preliminary Survey

On December 6, 1977, an initial survey of the facility was conducted by NIOSH representative, Mr. H. L. Markel, Jr., Regional Industrial Hygienist, in company with Mr. John A. Hulla, Regional Industrial Hygienist, Texas State Department of Health.

Considerable information was gathered on the characterization of all substances used in the area(s) of concern, as well as conditions of their use. All areas within the plant where possibly

significant exposure to applicable paints/solvents might occur were identified. Chemicals such as toluene, xylene, acetone, methyl ethyl ketone and ethylene glycol monoethyl ether acetate--used either directly or as an ingredient of other products utilized within the plant--were considered applicable to the evaluation.

In order to more fully and adequately evaluate employee exposure to the previously mentioned chemicals, it was deemed appropriate and necessary to collect environmental air samples in the bushwhacker dip room and the paint room.

From a medical standpoint, eighteen (18) workers in the major paint room were initially interviewed on December 14, 1977, by Theodore W. Thoburn, M. D., NIOSH Medical Officer. In addition to evaluating their complaints, an examination of the exposed skin of those employees was also performed.

c. Evaluation Methods

1. Environmental

a. Toluene, Xylene, Acetone, Methyl Ethyl Ketone and Ethylene Glycol Monoethyl Ether Acetate

Ten (10) personal breathing-zone samples were collected by using low-flow SIPIN*, Model SP-1 personal sampling pumps with standard charcoal tubes at a rate of approximately 200 cubic centimeters per minute.

All samples were analyzed in accordance with NIOSH Physical and Chemical Analysis Branch Analytical Method #127--namely, absorption on charcoal, desorption with carbon disulfide, and use of a gas chromatograph with a flame ionization detector. The limit of detection was calculated to be 0.01 milligrams of each compound per tube.

A SIERRA* Instruments Air Velocity Meter, Model 1555, Thermo Anemometer, was used to measure face velocities at all existing booths in the paint room.

2. Medical

The medical evaluation consisted of a tour of the plant, including the roof; individual interviews, including an examination of exposed skin of 18 of the 19 workers from the major paint room; and a telephone discussion with a local dermatologist who had evaluated a number of workers and directed some tests at the plant.

*Mention of commercial names does not constitute a NIOSH endorsement

D. Evaluation Criteria

1. Environmental Standards or Criteria

The evaluation standards and criteria considered to be applicable to this evaluation are as follows:

a. The Occupational Health Standards as promulgated by the U. S. Department of Labor, Federal Register, May 28, 1975, Title 29, Chapter XVII, Subpart G, Table Z-1 (29 CFR Part 1910.1000).

b. American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV)Committee, 1977, and

c. NIOSH Criteria Documents recommending occupational standards.

Substance	*8-hr. TWA, ACGIH TLV Committee (mg/M^3)	NIOSH 8 or 10-hr. TWA Recommended Standard (mg/M^3)	OSHA 8-hr. TWA Standard (mg/M^3)
Toluene	375	375	750
Xylene	435	435	435
Acetone	2400	---	2400
Methyl Ethyl Ketone	590	590	590
Ethylene Glycol Monoethyl Ether Acetate (2-Ethoxyethyl acetate/ cellosolve acetate)	540	---	540
Fibrous Glass	15	5	15

*Eight-hour time-weighted average concentrations in milligrams of substance per cubic meter of air sampled.

Note: Occupational Health exposure limits for individual substances have generally been established at levels designed to protect workers occupationally exposed on an eight (8) hours per day, forty (40) hours per week basis over a normal working lifetime.

2. Toxic Effects

a. Toluene

Toluene vapors can be a direct cause of narcosis. Controlled exposure of human subjects to 200 parts per million (p.p.m.) for eight hours has produced mild fatigue, weakness, confusion, lacrimation, and paresthesia of the skin; at 600 p.p.m. for eight hours, there was also euphoria, headache, dizziness, dilated pupils and nausea; at 800 p.p.m. for eight hours,

symptoms were more pronounced, and after-effects included nervousness, muscular fatigue, and insomnia persisting for several days.[1]

Most of the toluene absorbed from inhalation is metabolized to benzoic acid, conjugated with glycerine in the liver to form hippuric acid, and excreted in the urine. Repeated or prolonged skin contact with liquid toluene has a defatting action, causing drying, fissuring and dermatitis.[2,3]

b. Xylene

Xylene vapor is an irritant to the eyes, mucous membranes and skin; at high concentrations it causes narcosis. In animals, xylene causes blood changes reflecting mild toxicity to the hematopoietic system.

In humans, exposure to undetermined but high concentrations caused dizziness, excitement, drowsiness, incoordination and a staggering gait. Workers exposed to concentrations above 200 p.p.m. complain of anorexia, nausea, vomiting and abdominal pain. Brief exposure of humans to 200 p.p.m. caused irritation of the eyes, nose and throat.[4]

There are reports of corneal vacuolization in workers exposed to xylene, or to xylene plus other volatile solvents. The liquid is a skin irritant and causes erythema, dryness and defatting; prolonged contact may cause the formation of vesicles.[5]

c. Acetone

Overexposures to high concentrations of acetone--well above the levels where it can be smelled--may result in irritation to the eyes, nose and throat. Other sysptoms may also be an upset stomach, vomiting, headache, sleepiness, dizziness, weakness, incoordination and in extreme cases, unconsciousness. Repeated and prolonged skin contact with acetone can cause dryness and irritation of the skin.[6]

d. Methyl Ethyl Ketone (MEK)

As related to acute overexposure, the vapors of MEK cause irritation of the eyes, nose and throat and may result in headache(s), dizziness, upset stomach and vomiting. At very high levels, MEK vapors may cause unconsciousness within a short period of time. Prolonged or repeated skin contact may cause dryness and irritation of the skin.[7]

e. Ethylene Glycol Monoethyl Ether Acetate

High concentrations of ethylene glycol monoethyl ether acetate vapor are irritating to the eyes and mucous membranes. This agent is readily absorbed through the skin.

From animal exposures, it may be predicted that irritation of the eyes, nose and throat may occur from exposure to high concentrations of vapor. Prolonged heavy exposure might possibly cause both narcosis and dermatitis.[8,9]

f. Fibrous Glass

Even though observed adverse effects of fibrous glass on humans has been confined primarily to skin irritation due to mechanical action, concern over possible long-term injury arising from inhaled fibers was evident from the earliest use of fibrous glass. However, an evaluation of the available information has resulted in the NIOSH conclusion that occupational exposure to fibrous glass has not resulted in the development of cancer.

E. Evaluation Results and Discussion

1. Environmental

The results of ten (10) personal breathing-zone samples, resulting in thirty-six analyses (8 each for toluene, xylene and ethylene glycol monoethyl ether acetate; 6 each for acetone and methyl ethyl ketone),showed all workroom concentrations to be below both the ACGIH TLV's and the OSHA standards.

Two (2) of the above mentioned ten (10) samples were chosen for qualitative analysis by gas chromatography/mass spectrometer. No peaks other than those mentioned above could be identified on the chromatogram.

Face velocities of all existing booths in the paint room were measured and found to be adequate (125-250 feet per minute)---as compared to generally recommended velocities for the operation(s) in question.

Heating and air conditioning is provided by two (2) roof-mounted "central" units. During the winter months, return air enters the units through an opening in the ceiling, passes through metal air filters, blows through a gas-heated plenum, returns to the building through metal duct work, and ultimately distributes warm air to each work station.

During the summer months, refrigeration coils in the plenum cool and dehumidify air returning to the building ducts. In reality, there are two (2) separate systems--one which vents over each air brush sprayer, and one which vents over each "eyer". Make-up air for local exhaust ventilation is drawn from the remainder of the building through a door leading into the paint room. As a result of the considerable amount of air being exhausted through the spray booths, the paint room is under a slight negative pressure. Because of the considerable air exchange brought about by the air utilized from other parts of the plant, it has been the practice to keep the fresh air vents for the heating/cooling systems closed.

During the course of the evaluation, it was observed that racks of freshly-painted lures were being placed directly beneath the ceiling air intakes for the heating/cooling unit system.

2. Medical

Results of employee interviews and examinations of the exposed skin of workers revealed the following information:

a. Although there had been some earlier indication of skin irritation, the major problem involving most of the workers appeared to have occurred during the fall of 1977--particularly since the heat phase of the heating/cooling ventilation system had been used.

The major areas affected were reported to be the face, neck, shoulders, upper back, chest and arms. Involvement varied from an itching or burning sensation to redness, perhaps with some swelling, and in a few cases, small blisters which healed with small scars failing to "tan" upon being exposed to the sun. This also rendered the skin more sensitive to sunlight (a burning sensation). Eye irritation was also a complaint.

At the time of the examination(s), scars from the blistering were visible. Although some of the women showed reddening of the skin in the affected areas, there was no appreciable induration. Some women also showed telangiectases in the exposed areas. After the lunch hour, five (5) women complained that the problem had started during the late morning and early afternoon hours. In most cases, it was before the aluminizer operation had been conducted. Findings at that time were not appreciably different from those seen earlier in the day.

The degree of involvement was related to whether the heating vents located above the work stations were open or closed, and whether or not they were arranged so as to maximally blow on the worker(s). Each worker usually performed work in the

same spray booth, and had thus adjusted the vent to meet her own needs.

Various workers speculated on whether the problem related to: (1) how often the aluminizer operation was conducted; or (2) a change to a different white base coat used in the painting operations.

b. During his visit to the plant, and by mid-afternoon, the medical investigator personally noted that the atmosphere in the paint room had become slightly irritating. At that time, a tingling sensation of the scalp was felt while standing under one of the heating vents by a spray booth.

c. On March 28, 1978, the medical investigator contacted a local dermatologist to share findings and impressions of problems at the plant. According to statements made by the dermatologist, the problem appeared when the plant heating system was activated in the fall of 1977. At that time, he used sticky tape to collect specimens of air at the duct outlets. Results showed these specimens to be heavily loaded with particles of fibrous glass.

As a result of later concentrated efforts on the part of the plant to: (1) remove fibrous glass bats previously used as "stuffing" between wall/roof openings and as insulating material in ducts leading to the paint/assembly area heaters, and (2) clean and wash ductwork, subsequent "tape tests" of air from the ducts have shown the presence of little or no fibrous glass particles.

F. Conclusions

Ventilation appeared to be adequate, and airborne workroom concentrations of solvents were below recommended levels/appropriate standards.

The practice of stacking freshly-painted lures beneath the ceiling air intakes, however, could lead to some concentration and heat degradation of solvent vapors, producing ill-defined but irritating substances which would then be blown directly onto workers from conditioned air supply diffusers at each work station.

It appears that the initial episode in the fall of 1977 was caused by fibrous glass being discharged from the heating ducts. The local dermatologist's findings, as well as those of the NIOSH medical officer relative to the scarring about the shoulders of a few workers, would support this theory. Since that episode, the work force had been much more aware of any skin sensations occurring at their workplace--more noticeable also, perhaps, because of the warmth from the heating ducts.

Thus, it appears that the ongoing problem was "triggered" by a specific episode, but was sustained by an increased worker awareness of minor irritations which would probably be ignored under other circumstances. Air conditioning, perhaps because of the blowing of cold air, was not as much of a problem.

V. RECOMMENDATIONS

1. Cease the current practice of placing painted lures--for drying purposes--beneath the ceiling return air grills for the heating/cooling system.

2. Have workers wear protective clothing where possible. A tightly-woven fabric is recommended, as opposed to a knit fabric.

3. Insure that thinners/solvents used at the various work stations are maintained in containers with self-closing lids.

VI. REFERENCES

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Table 1
Toluene, Xylene, Acetone, Methyl Ethyl Ketone (MEK),
Ethylene Glycol Monoethyl Ether Acetate Concentrations

Bomber Bait Company
Gainesville, Texas

December 7, 1977

Sample Number	Location	*Type of Sample	Sampling Period	**Concentration (mg/M^3)				
				Toluene	Xylene	MEK	Acetone	Ethylene Glycol Monoethyl Ether Acetate
1	Dip Room	P	1:12P-2:17P	78	5	--	--	41
2	Paint Room	P	1:46P-2:40P	10	3	--	--	3
***3	"	P	1:14P-2:29P	--	--	--	--	--
4	"	P	1:40P-2:39P	30	<1	1	77	<1
***5	"	P	1:19P-2:38P	--	--	--	--	--
6	"	P	1:40P-2:41P	19	<1	5	<1	<1
7	"	P	1:34P-2:42P	25	2	1	66	<1
8	"	P	1:20P-2:37P	8	<1	3	8	<1
9	"	P	1:30P-2:36P	17	1	5	<1	<1
10	"	P	1:34P-2:35P	15	<1	8	1	<1

*P = Personal
**mg/M^3 = milligrams of substance per cubic meter of air sampled
*** = Qualitative analysis by gas chromatography/mass spectrometer