HEALTH HAZARD EVALUATION REPORT 72-22, 31, 34 -ay

HAZARD EVALUATION SERVICES BRANCH
DIVISION OF TECHNICAL SERVICES

Establishment: Bendix Corporation
Kansas City, Missouri

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

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BENDIX CORPORATION
KANSAS CITY, MISSOURI

DECEMBER 1972

I. SUMMARY DETERMINATION

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 receipt of a written request from an employee 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 three such requests from authorized representatives of employees regarding exposure to plastic agent 2 ketone ether (area 48D), epoxies, plastic fabrication (area 34A), freon, teflon, alcohol, and MS 1,4,3-fluorocarbon (area 70), at the Bendix Corporation plant in Kansas City, Missouri.

NIOSH investigators conducted an initial observational survey of these areas on May 22 and performed the necessary follow-up environmental-medical evaluation survey on July 21-22, 1972.

The concentration of toluene diisocyanate (TDI) in the hand mixing and molding operation of Department 34 exceeded the ceiling exposure standard of 0.02 ppm* (Federal Register, Volume 37, §1910.93, October 18, 1972) as determined by analysis of two air samples. The two concentrations were 0.036 and 0.023 ppm. These concentration levels are considered toxic, and control measures must be taken. At the time of the measurements, there were only two individuals working on this operation per shift.

Also in Department 34, samples were taken in the automatic mixing and pouring operations using polymethylene polyphenylisocyanate (PAPI). Levels measured were considered to be well below the standard (using the TDI standard for PAPI), and, therefore, should not present a hazard to employees.

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*ppm--parts of vapor or gas per million parts of contaminated air.

In area 48, the methyl ethyl ketone (MEK) used to clean the impregnator, yielded exposure levels more than twice the 200 ppm standard for an 8-hour exposure. Since the cleaning operation occurs for only 20-30 minutes per shift, the time weighted average for a 7-8-hour work day was not exceeded but the short term excursion limit of 250 ppm recommended by the American Conference of Governmental Industrial Hygienists was exceeded. This level is considered toxic and corrective action is required.

No samples were taken in area 70 due to the nature of the handling procedures in effect. The hood is almost completely enclosed with plexiglass and no noticeable vapors were escaping to the work area. The workers were no longer complaining about the work environment.

Several employees have been sensitized to epoxy resins and recurrent dermatitis occurs in these individuals. Good personal hygiene, protective clothing and housekeeping should alleviate the problem. Three of the ten employees interviewed reported respiratory tract irritation but none of them were symptomatic at the time of the visit.

Recommendations for improved ventilation control for the weighing and molding operations in Department 34, and the impregnators in Department 48 have been made in the full report. Until improved control can be achieved the wearing of appropriate respirators in these areas is recommended.

Copies of this Summary Determination as well as the Full Report of the evaluation are available from the Hazard Evaluation Services Branch, NIOSH, U.S. Post Office Bldg., Room 508, 5th & Walnut Streets, Cincinnati, Ohio 45202. Copies of both have been sent to:

a) The Bendix Corporation, Kansas City, Missouri
b) Authorized Representatives of Employees
c) U.S. Department of Labor - Region VII
d) U.S. Atomic Energy Commission, Kansas City, Missouri

For the purposes of informing "affected employees," the employer will "post" the Summary Determination in a prominent place(s) near where affected employees work for a period of 30 calendar days.

II. INTRODUCTION

The International Association of Machinists and Aerospace Workers, Local Lodge 314, at 1113 E. 47th Street, Kansas City, Missouri 64110 represents employees at the Bendix Corporation plant at 95th Banister Road, Kansas City, Missouri 64141.

This plant is a prime contractor for the Atomic Energy Commission and manufactures non-nuclear hardware for weapons systems. There are in excess of 6,000 personnel overall, but only 159 on three shifts in areas of interest (34, 48, and 70). Three separate health hazard evaluation requests came from these departments. Not all the employees are involved in work practices relative to the hazard evaluation requests.

III. BACKGROUND HAZARD INFORMATION

A. Standards

The Occupational Health Standards as promulgated by the U.S. Department of Labor, (Federal Register, Volume 37, §1910.93, October 18, 1972) applicable to the substances found on this evaluation are as shown in Table I.

TABLE I

OCCUPATIONAL HEALTH STANDARDS FOR AIRBORNE CONTAMINANTS

Substance	Standards
Toluene-2, 4-diisocyanate	0.02 ppm* C**
Polymethylene Polyphenylisocyanate (PAPI)	See note below
Polytetrafluoroethylene decomposition products	No standard (see Toxic Effects, next section)
Phenylenediamine-skin	0.1 mg/m^3***
2-Butanone (methyl ethyl ketone, MEK)	200 ppm
Acetone	1000 ppm
Hexone	100 ppm
Ethyl Butyl Ketone	50 ppm

*ppm--parts of vapor or gas per million parts of contaminated air.
**C--refers to ceiling concentration. An employee's exposure to this compound should at no time exceed the ceiling value.
***mg/m^3--milligrams of substance per cubic meter of air.

Note: There is no standard for this compound. It is recommended that it be evaluated as TDI on an equivalent Isocyanate basis.

B. Toxic Effects

Toluene Diisocyanate: The most serious toxicologic action and the one which determines the magnitude of the standard is the capacity of TDI to produce allergic sensitization of the respiratory tract in man. Even below the ceiling standard of 0.02 ppm[1] slight changes in vital capacities are noted at the end of each work shift, and over a period of time a permanent detriment in pulmonary function results. No limit has been set for PAPI and it is the opinion of NIOSH toxicological advisors that the limit for TDI on an equivalent isocyanate basis would be approximately appropriate.

Teflon Decomposition Products: Polymer fume fever, a condition characterized by chills, fever, tightness of the chest, and other influenza-like symptoms, occurs in workers exposed to fumes of heated polytetrafluoroethylene. In a few cases, symptoms suggestive of pulmonary edema occur. Frequently, the exposure apparently has resulted from smoking cigarettes contaminated with particles of teflon.

Phenylenediamine: Exposed workmen suffer from an allergic asthma and frequently show inflammatory reactions of the larynx and pharynx evidently caused by direct irritation. The standard for this compound is believed to be sufficiently low to minimize the number of persons who become sensitized, but it is recognized that it is not low enough to prevent exacerbation of asthma in those already sensitized.[1]

Ketones: Exposure to the ketones at levels in the vicinity of their standards may produce slight nose and throat irritation and in excess of their standards, a mild eye irritation. Higher exposures may produce a low grade intoxication. In some cases, it is suspected that certain ketones are capable of initiating narcosis at several orders of magnitude in excess of the standard.

IV. HEALTH HAZARD EVALUATION

A. Initial Visit - Observational Survey

An initial hazard evaluation of Bendix, 95th Banister Road, Kansas City, Missouri, was performed on May 22, 1972, by NIOSH representative, Mr. Gerald J. Karches. The function of NIOSH, its relation to Section 20(a)(6) of the Occupational Safety and Health Act of 1970, and the purpose of the visit was explained to Mr. James H. Sund, Assistant Area Manager for Operations of the AEC, and Mr. William Sharpe, Director of Industrial Relations and Security, Bendix Corporation. Other representatives of AEC and Bendix included: William Newberry, AEC, Counsel to the Area Manager; Robert Foster, Manager Health Services; John Schiltz, Supervisor, Industrial Hygiene and Health Services; and Carl Mounier, Senior Industrial Hygienist; and Andrew Johnson, Committeeman for Employee Grievances. All of the above representatives accompanied the NIOSH representative on the survey.

The purpose of this walk-through survey was to assess potential health hazards in the workplace due to either faulty work practices or lack of proper ventilating and safety equipment and to determine the appropriate sampling equipment necessary to evaluate concentrations of, and exposures to, various epoxies, hardeners, mold release agents and solvents.

Symptoms were reported by employees that could be attributable to the substances observed in the workplace and therefore a follow-up visit was recommended to: (1) evaluate employee exposures; and (2) interview and examine the effected employees.

B. Environmental Survey

On July 20 and 21, 1972 a follow-up environmental survey was conducted by NIOSH representatives, Jeremiah Lynch, Gerald Karches, to determine the environmental exposures to isocyanates used in polyurethane foam production, teflon or its decomposition products used as a mold release agent, and aliphatic amines used as epoxy curing agents. Prior to the survey and after the survey, we reported to Mr. James H. Sund, Assistant Area Manager for Operations, Atomic Energy Commission. During most of the survey we were accompanied by Mr. John O. Schiltz, Supervisor of Industrial Hygiene and Health Physics of the Bendix Corporation, and Mr. Andrew Johnson, Committeeman International Association of Machinists and Aerospace Workers.

Urethane Foam Operations

Pairs of side-by-side simultaneous samples were collected in the breathing zones of the workers mixing toluene diisocyanate prior to producing molded foam products. These samples were of 17 to 19 minutes in length and covered the entire mixing operation. Since the limit for TDI is a ceiling concentration, these samples may be evaluated directly against that limit.

Teflon Mold Release Operations

Since this operation was idle during the period of the survey, the effectiveness of control was evaluated by measuring the face velocity of the modified hood in which the mold release compound was applied. Since the hood afforded virtually complete enclosure except for the small space through which the worker handled the product, and since the face velocity averaged 100 ft./min., it was concluded that the low velocity emission process conducted in the hood would not produce significant air contamination in the workplace.

Epoxy Impregnating Area

Two pairs of simultaneous breathing zone impinger samples were collected to measure the exposure to epoxy curing agents used in this operation. Samples which varied in length from 20 to 30 minutes were collected in the mixing area and in the impregnating area. In the mixing area, the sample is representative of the entire period of mixing during which a worker is exposed for about 40 minutes. The 30-minute duration sample collected in the impregnating area covered one complete cycle of the work operation which occurred three times per day. In addition to samples for epoxy curing agents, five charcoal tube samples were collected using MSA type G sampling pumps operating at 1 liter per minute to collect solvent vapors which were present during the clean-up preparations in the mixing room and in the impregnating area. Each sample was of 10 minutes duration, and the sets of samples collected covered the entire operation period. It was observed that impervious gloves and skin protective clothing were used to minimize the skin exposures to the irritant amine hardeners.

Results:

The measured concentration of TDI in the hand mixing and molding operation of Department 34, as shown in Table II, exceeded the ceiling standard of 0.02 ppm, while the concentration in the auto mix and mold operation using PAPI did not exceed the ceiling limit for TDI.

Methyl ethyl ketone exposures in cleaning the impregnator in Department 38 (Table III) over the total 20-minute sampling period were in excess of the 200 ppm standard. However, since this standard is for an 8-hour average and the operation which causes the exposure occurs not more than once per shift for about 30 minutes, the 8-hour average standard is not exceeded. Although Part 1910.93 does not prescribe an excursion standard, an appropriate excursion, as recommended by the American Conference of Governmental Industrial Hygienists, would be 250 ppm for a short period sample and this limit was exceeded.

C. Medical Evaluation

This plant has a full-time medical director who is assisted by three full-time physicians, nine nurses, and a medical technician. Pre-employment physicals are given routinely and offered on a voluntary basis annually to all employees 45 years of age or older.

Those men who had complaints on the initial visit were interviewed and examined in the personnel department. Men were also queried concerning other individuals thought to have problems and these men were also interviewed and examined. Two men were not available and were contacted and interviewed by telephone. A total of ten individuals were interviewed from the affected departments by James B. Lucas, M.D. Another woman was working the night shift and was contacted by telephone regarding her complaint. She no longer had symptoms since she transferred from one of the departments in question and had no further complaints.

Dermatitis due to the highly irritant hardeners used with epoxy resin materials has been and continues to be a problem in the plastics fabricating department. This has been recognized for at least the past five or six years and has been amply docu-

mented by cutaneous patch tests performed on several individuals by competent consultant dermatologists. Several sensitized individuals are continuing to work in these areas. Recurrent dermatitis can be expected to occur in such individuals unless scrupulous personal hygiene is practiced and protective clothing is conscientiously worn. In addition, other individuals working in this area may develop contact dermatitis from exposure to the uncured resins, since a majority of normal persons can be expected to develop sensitization on repeated skin exposure. Prevention is a matter of personal hygiene, protective clothing, and housekeeping.

Several individuals reported experiencing symptoms of respiratory tract irritation. These symptoms could have resulted from exposure to uncured epoxy compounds, various solvents, or toluene diisocyanate (TDI). The extremely low humidity (<10%) maintained in the controlled areas of the plastics fabrication section probably contributes to or aggravates such symptoms. Persons with respiratory sensitization to TDI cannot tolerate exposure to levels far below the presently established standard. No cases suggesting sensitization to TDI were encountered. The substance(s) responsible for these symptoms could not be ascertained from the historical information obtained and because of limitations imposed on the physician by security regulations.

V. RECOMMENDATIONS

1. Local exhaust ventilation as described in "Industrial Ventilation"[2] should be provided for the weighing and molding operation in Department 34. Until control is obtained by means of ventilation, a respirator program in accordance with ANSI Z88.2 (1969) should be established. Cartridge type respirators, approved by NIOSH under 30CFR11 for organic vapors, are recommended for the individuals doing this mixing and molding.

2. In Department 48, the impregnators should be provided with exhaust ventilation to protect the worker from MEK during cleaning operations. Until such time, a respirator program as described in (1) above should be initiated.

3. Any individual sensitized to any of the uncured epoxy compounds should be shifted to a new assignment wherever possible.

4. To prevent recurring dermatitis, good personal hygiene practices should be rigidly enforced. This includes protective gloves, clothing, and generally good housekeeping.

VI. REFERENCES

1. Documentation of Threshold Limit Values for Substances in Workroom Air, Third Edition 1971, American Conference of Governmental Industrial Hygienists.

2. Industrial Ventilation, A Manual of Recommended Practices. American Conference of Governmental Industrial Hygienists, Tenth Edition, 1968.

TABLE II

POLYURETHANE FOAM OPERATIONS - DEPARTMENT 34

July 20, 1972

Operation	Period (Minutes)	Isocyanate Concentration PPM as TDI
Hand mixing and pouring with TDI	17 17	.036 .023
Auto mixing and pouring with PAPI	19 19	<.005 <.005
O.S.H.A. Standard (Ceiling Concentration)		0.02

TABLE III

EPOXY IMPREGNATING - DEPARTMENT 48

July 21, 1972

Operation	Period (Minutes)	Methyl Ethyl Ketone Concentration PPM
Cleaning Impregnator	10 10	>435 >415
Cleaning in Mixing Room	10 10 10	38 47 59
O.S.H.A. Standard (8-hr. time weighted)		200