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DELL-RUBE CHENILLES
DALTON, GEORGIA

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I. SUMMARY

In February, 1980, the National Institute for Occupational Safety and Health (NIOSH) received a request from the management of Dell-Rube Chenilles, Inc., for a health hazard evaluation of their bath rug manufacturing plant in Dalton, Georgia. The request stated that during the preceding months two workers had experienced respiratory symptoms requiring medical attention. Management expressed concern that the environment in the plant may have been a contributing factor.

On February 21, 1980, NIOSH conducted an initial environmental and medical survey. Approximately one-third of the 70 employees working in the "Small Machine Department" and "stamping area" were interviewed regarding the prevalence of respiratory tract symptoms and disease as well as other work-related health complaints. The medical records of two former employees who had experienced respiratory problems during their employment were reviewed. They had been diagnosed as probably having industrial asthma and one of them possibly allergic alveolitis. Definite diagnosis and identification of the offending agent would have required provocation testing by inhalation. However, due to the risks involved in such diagnostic procedures it was not performed. Air samples were collected to determine the concentration of an aerosol (Arrolube PBO) used as a needle lubricant on sewing machines in the Small Machine Department. The identity and concentration of organic vapors present in the stamping area and Small Machine Department were determined. The toxicity of a blue dye (acid blue No. 1) used in the stamping area was also investigated. On February 25, 1981, a follow-up environmental survey was conducted to further evaluate organic vapor exposures in the stamping area and to collect microbial aerosols such as fungi and bacteria in the Small Machine Department. Additional sampling for Arrolube aerosol was also conducted.

Organic vapors specifically identified in air samples included ethyl alcohol, ethyl acetate, methyl isobutyl ketone (MIBK), and biphenyl. Concentrations detected were less than 5% of levels that would be expected to cause adverse health effects. Arrolube aerosol is mostly water with a trace (less than 1.25 percent) of an emulsifier identified as butyloleate sulfanate. Butyloleate sulfanate was detected in 4 out of 8 personal air samples collected. Sampling for airborne microorganisms and fungi detected several species of fungi, and the Arrolube spray was found to contain bacteria. However, fungi and bacteria are common in the environment and since a definite diagnosis had not been made in the ill employees, it was not possible to determine whether their disease had been caused by exposure to the plant environment. Other than occasional slight upper respiratory tract irritation, there have been no further reports of breathing difficulties among the employees in the sewing-machine area.

Based on the results of environmental sampling, employee interviews and available toxicological information, there does not appear to have been a health hazard present in the Small Machine Department or stamping area at the time of this investigation. No reports of serious work related health complaints were received during interviews with the employees. The cause of the respiratory problems that two employees had experienced was not determined. Recommendations relating to this evaluation are presented in Section VII of this report.

KEYWORDS: SIC 2272, butyloleate sulfanate, biphenyl, ethanol, allergic alveolitis, industrial asthma, acid blue dye No. 1, rug mfg.

II. INTRODUCTION

On February 13, 1980, the Office Manager for Dell-Rube Chenilles, Inc. requested a NIOSH health hazard evaluation of their Small Machine Department and "stamping area". The requester was concerned that during the preceding months two employees had become acutely ill with severe respiratory symptoms. Both employees had been treated by a local pulmonary specialist who suspected that the respiratory symptoms may have been the result of an allergic reaction to something in their work environment.

An initial environmental and medical survey was conducted by two NIOSH industrial hygienists and a medical officer on February 21, 1980. The purpose of the site visit was to conduct environmental sampling in the Small Machine Department and stamping area, to determine what chemical substances were likely to be present in these work areas, and to interview employees who might also have been affected by the work environment. A follow-up environmental survey was conducted on February 25, 1981 to further evaluate the work environment by collecting additional air samples for suspected organic vapors and airborne fungi and bacteria.

III. BACKGROUND

Dell-Rube Chenilles is a manufacturer of throw rugs and bath sets used to cover toilet lids and tank tops. Nylon or polyester yarn is locked into a plastic backing using large tufting machines to form a long length of rug material 5 feet wide. A latex rubber backing is applied to the plastic backing, after which the rug is sent through a 3-pass drying oven. The latex backed rug material is then laid out in layers on long tables. Using a pattern, outlines are drawn on top of the stack and electric cutter saws are used to cut out a stack of rugs. The rugs are then trimmed, bound, and sent to the dye house. Plant employees and management refer to the dye house as the "laundry". After dyeing some of the rugs are sent to the stamping area where 3-4 employees, known as "stampers", place a stack of rugs face down on a table. A blue dye (acid blue No. 1) dissolved in denatured alcohol (Synasol PBS) is brushed over a metal stencil. Holes in the stencil allow a series of blue dots to be printed on the back of the rug. The rugs are then sent to the Small Machine Department where the sewing machine operators sew overlays into the rugs according to the blue dot pattern on the back. Twelve lines of sewing machines with 12 machines per line are located in the Small Machine Department. Eighty-four sewing machines were equipped with a spray nozzle which sprayed a special lubricant (Arrolube PBO, formulated by Arrow Engineering, Dalton, Georgia) on the sewing needle to permit ease of penetration of the needle through the latex backing. Sixty to seventy women work in the Small Machine Department on 1st shift, 20 on 2nd shift. Eight women work in the stamping area on 1st shift only. The company's total employment is approximately 275 workers, of which 75% are female. The company has a high rate of worker turnover.

One employee developed breathing difficulties after working for 3-4 months in the stamping area and reported that she was allergic to substances present in her work area. She also informed the company that before starting work at Dell-Rube she had experienced allergic respiratory problems.

A few months later an employee from the Small Machine Department (adjacent to the stamping area) developed acute respiratory problems that required a short period of hospitalization. Her physician, who had also treated the other ill employee, considered it possible that she was suffering from an allergic reaction to substances in her work environment.

Both employees are still under medical care, but their status has improved after terminating their employment at the plant. Their attending physician, a pulmonary specialist, has made a diagnosis of industrial asthma in both individuals, in one of them possibly complicated by allergic alveolitis. However, since no sensitization testing was performed, the diagnoses could not be confirmed.

The spray lubricant used in the Small Machine Department is supplied to Dell-Rube under the trade name Arrolube PBO. This product is 97% water and 2.5% Protowet XL, a wetting agent manufactured by the Proctor Chemical Company of Salisbury, North Carolina. According to information provided by Proctor, Protowet XL is 50% water and 50% butyloleate sulfanate. Butyloleate sulfanate is an ester of oleic acid and butyl alcohol which has been sulfanated with sulfuric acid and pH adjusted (to pH 6) with sodium hydroxide. According to Proctor, Protowet XL has been marketed for 15-20 years; they were not aware of any reports of respiratory problems or sensitivity reaction associated with this product.

The solvent used in the stamping area is supplied by the PBS Chemical Company under the trade name Synasol PBS. This product is 97% special denatured 190 proof alcohol (ethanol denatured with wood alcohol or with methanol and methyl isobutyl ketone). The product also contains trace amounts of ethyl acetate and other unidentified hydrocarbons.

An odor noted in the polyester rugs stacked in the stamping area which had recently been received from the laundry was traced to a carrier liquid (Caracar LBC, manufactured by Custo Chem, LaFayette, Georgia) used by the laundry to facilitate dyeing. This liquid is not needed when dyeing nylon. The liquid was found to be 80-90% xylene, 10% biphenyl, and 3-5% emulsifier.

IV. EVALUATION DESIGN AND METHODS

A. Initial Survey (February 21-22, 1980)

During an initial site visit, a walk-through survey was conducted, and representatives of management were interviewed. Information

was obtained concerning the manufacturing processes, work practices and schedules, chemical substances handled or used, and number of workers assigned to each department.

1. Environmental Sampling

Personal breathing zone air samples were collected from two sewing machine operators and one stamper to determine the airborne concentrations of aerosol generated from the sewing needle lubricating spray systems. The aerosol was collected on membrane filters mounted in 2 piece plastic cassettes. A measured volume of air was pulled through the filters using battery powered air sampling pumps set at a calibrated flow rate of 2 liters of air per minute (lpm). Personal samples were collected by attaching the filter cassette to the worker's shirt collar. A bulk liquid sample of Arrolube PBO was also sent to the NIOSH laboratory to aid in the analysis of the air samples. The filters were analyzed for butyoleate sulfanate by extracting the filter with carbon disulfide. The carbon disulfide/butyoleate sulfanate solution was evaporated to dryness and redissolved in one milliliter of carbon disulfide to increase sensitivity of the analytical method. The amount of butyloleate sulfanate extracted from the filter was determined by infrared spectroscopy and quantitated by comparison with standard concentrations prepared from a bulk liquid residue of Arrolube PBO.

Organic vapors in the Small Machine Department and the stamping area were sampled by collecting vapors on activated charcoal organic vapor adsorber tubes. A measured volume of air was pulled through the tubes using battery operated air sampling pumps set for a flow rate of 100 cc/min. Personal samples were collected by attaching charcoal tubes to the worker's shirt collar. Bulk air samples were collected in the stamping area to identify suspected organic vapors. The vapors were concentrated in the bulk air samples by pulling a large volume of air through the tubes. Vapors collected in bulk air samples were specifically identified by the NIOSH laboratory using a gas chromatograph/mass spectrometer (GC/MS). Based on the analysis of bulk air samples, the charcoal tube personal samples were analyzed for ethyl alcohol, ethyl acetate, and methyl isobutyl ketone (MIBK). These organic vapors are components of Synasol PBS solvent. Bulk liquid samples of Synasol PBS and the carrier liquid, Caracar LBC, were also sent to the NIOSH laboratory for analysis of toxic components.

2. Medical

Interviews were conducted with one-third of the employees present in the work areas indicated in the request at the time of the survey. All respondents were asked whether they had experienced breathing difficulties, respiratory tract irritation, or other health problems during the time they had been employed at the plant. During the interviews information was also sought concerning former employees that had experienced health problems.

The hospital and other medical records of two former employees were reviewed, and their attending physician was interviewed. The employment records of these two employees were also reviewed. Because of the the lack of definite diagnosis in these individuals, and due to the risks involved with performing sensitization testing, and the paucity of allergic problems among other employees, immunologic evaluation of current employees in the plant was not considered warranted.

B. Follow-up Environmental Survey (February 25, 1981)

Based on findings from the initial survey, NIOSH believed that the potential for biphenyl exposure in the stamping area justified air sampling for this substance. Several employees in the stamping area had complained of headaches when handling polyester rugs that had been dyed with the aid of the carrier liquid (Caracar LBC) which contained approximately 10% biphenyl. Because symptoms were experienced mostly during the winter months, the follow-up visit was postponed until cool weather required closing of doors and windows, thereby reducing natural ventilation and increasing the potential for exposure. One area and three full shift personal samples for biphenyl were taken in the stamping area. The samples were collected on Tenex GC adsorber tubes and analyzed for biphenyl by gas chromatography according to NIOSH method S-24.[1]

Airborne microorganisms (microbial aerosols) were also sampled as a possible environmental factor which may have caused the two previously reported cases of industrial asthma. Microbial aerosols were collected using a multi-stage Anderson air sampler; 14-28 liters of air per minute were pulled through the sampler for 30 minutes. Microorganisms were collected on Petri plates by impaction onto a nutrient media. One 30-minute sample was taken using a nutrient which contained an anti-bacterial agent (chloroamphenicol) and one 30-minute sample was taken which did not contain this agent. Two sets of nutrient plates, one set with chloroamphenicol and one set without, were placed and exposed to the air in various locations throughout the Small Machine Department. A small amount (1-2 drops) was taken from a 55 gallon drum of Arrolube PBO and placed directly on a nutrient plate with and without chloroamphenicol. The plates were sent to the Fungus Reference Branch, Center for Infectious Diseases, Centers for Disease Control, Atlanta, Georgia, for counting and identification of microbe colonies grown on the collection plates.

Butyoleate sulfanate concentrations in the Small Machine Department were re-evaluated to determine the effectiveness of newly installed local exhaust systems designed to capture the aerosol generated from the sewing needle lubricant spray.

V. EVALUATION CRITERIA

A. Environmental Criteria

The environmental criteria described below are intended to represent airborne concentrations of substances to which workers may be exposed for eight to ten hours a day, 40 hours per week for a working lifetime without adverse health effects. Because of wide variation in individual susceptibility, a small percentage of workers may experience discomfort from some substances at concentrations at or below the recommended criteria. A smaller percentage may be more seriously affected by aggravation of a pre-existing condition or by a hypersensitivity reaction. The time-weighted average (TWA) exposure refers to the average concentration during a normal 8-hour workday. The Short-Term Exposure Limit is the maximum allowable concentration, or ceiling, to which workers can be exposed during a period of up to 15 minutes, provided that no more than four excursions per day are permitted, with at least 60 minutes between exposure periods.

The primary sources of environmental evaluation criteria considered for this study were: 1) NIOSH criteria documents and recommendations, 2) the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV's)[2], and 3) the U.S. Department of Labor (OSHA) federal occupational health standards.[3] The criteria judged most appropriate for this study are as follows:

Substance	Short Term Exposure Limits (15 Min.)	8-Hour Time Weighted Average	Source
Biphenyl	0.6 ppm	0.2 ppm	ACGIH
	-	0.2 ppm	OSHA
Ethyl alcohol	-	1000 ppm	ACGIH
		1000 ppm	OSHA
Ethyl acetate	-	400 ppm	ACGIH
	-	400 ppm	OSHA
Methyl isobutyl ketone	-	50 ppm	NIOSH
	75 ppm	50 ppm	ACGIH
	-	100 ppm	OSHA

NOTE: ppm = parts per million parts of air

1. Butyloleate sulfanate

There is no OSHA standard, ACGIH TLV, or recommended exposure limit for butyloleate sulfanate. The NIOSH Registry of Toxic Effects of Chemical Substances (RTECS) classifies butyloleate sulfanate as a primary irritant. In a study published in the Journal of the American Pharmaceutical Association in 1949, a 1%

solution of butyloleate sulfanate was found to cause mild eye irritation in rabbits. The lethal dose in mice was reported to be 63 milligrams per kilogram of body weight.[4] No other toxicity data were available.

2. Acid Blue No. 1

This is a triphenyl methane dye and is currently considered a suspect carcinogen based on studies with laboratory rats. A monograph, prepared by the International Agency for Research on Cancer (IARC), reported that tumor production (sarcomas) was found in several studies where the dye was repeatedly injected subcutaneously or intramuscularly into laboratory rats. No cases of carcinogenic effects from ingestion were reported in the literature, and no human studies appear to have been conducted.[9]

B. Toxicity

The adverse health effects from excess exposure (exposures to airborne concentrations above the evaluation criteria) are summarized below:

1. Biphenyl (diphenyl)

Biphenyl has a characteristic potent odor which is detectable at 0.01-0.05 ppm. Short-term exposure to biphenyl may cause irritation of the eyes and throat. Repeated exposures to high concentrations of biphenyl may cause headache, nausea, indigestion, abdominal pain, fatigue, numbness, aching of the limbs (nervous system damage), and liver damage. Because of its low vapor pressure, biphenyl usually does not present a major problem in industry. Biphenyl does appear on the Environmental Protection Agency's (EPA) Chemical Assessment Group "List of Chemicals" having substantial evidence of carcinogenicity.[5]

2. Ethyl Alcohol (ethanol)

Ethyl alcohol irritates the eyes and mucous membranes of the upper respiratory tract and causes central nervous system depression. Exposure of 5000 to 10,000 ppm has caused transient eye and nose irritation and coughing. Human subjects exposed to 15,000 ppm experienced continuous eye watering and cough. At concentrations above 20,000 ppm, the effect was described as intolerable and suffocating for even brief exposure. Long-term exposure to the vapor may result in mucous membrane irritation, headeache, lack of concentration, and drowsiness. Ethanol vapor concentrations typically found in industry are not likely to cause systemic effects such as central nervous system depression. The TLV was set at a level to prevent eye and upper respiratory irritation.[6]

3. Ethyl Acetate

Ethyl acetate vapor is irritating to the eyes and respiratory passages of man at concentrations above 400 ppm. In animals it has a narcotic effect at concentrations of over 5000 ppm. Due to its irritating properties, employees will not voluntarily remain in such high concentrations. Animals exposed to lethal concentrations died with pulmonary edema and hemorrhage. This substance is a defatting agent, and prolonged skin contact with the liquid may cause irritation of the skin. Painful conjunctival irritation may occur from splashes in the eye. No chronic systemic effects have been reported in humans. Most reported effects of ethyl acetate are caused by its irritant properties.[7] The ACGIH TLV was established to prevent systemic effects but concentrations at this level may be mildly irritating for some workers unaccustomed to the exposure. The current OSHA permissible exposure limit is 400 ppm.[3]

4. Methyl Isobutyl Ketone (MIBK)

MIBK has a camphor-like odor detectable at 100 ppm. In humans, 400 ppm is quite objectionable causing eye and nasal irritation. Eye irritation is noted at a level of 200 ppm. Workers exposed to about 100 ppm complained of nausea and headache, but developed a tolerance after several days of repeated exposure. The OSHA standard of 100 ppm was set at a level believed to prevent eye irritation.[6] NIOSH believes the current standard is not adequate and has recommended the level be lowered to 50 ppm.[8]

C. Medical Criteria

1. Industrial Asthma

A variety of substances that occur in the environment can precipitate asthmatic attacks in sensitized individuals. Industrial asthma (IA) is a broad diagnosis used to indicate that the precipitating agent is found in the work place. Numerous occupations, especially those involving the processing of biological materials, such as cotton, grain, feathers, etc, have been shown to carry a risk of sensitization and attacks of asthma. Since the agents are most commonly inhaled, individuals in dusty occupations are obviously at greater risk.[10]

2. Allergic Alveolitis (10)

In IA the allergic component is strong, but the symptoms are restricted to the respiratory system. If the allergic reaction is generalized, with fever, chills, nausea, and radiographic evidence of pneumonitis, the disease is referred to as Allergic Alveolitis (AA).

The pathogenesis of AA is unclear. However, there is evidence of both an immune complex and a cell mediated hypersensitivity reaction. Repeated incidents of AA can cause irreversible changes and chronic disease. AA is caused by inhalation of microbial agents, more specifically airborne spores of fungi and thermophilic actinomyces. These organisms are common in the environment and the increased use of humidifiers, air conditioning, and wall-to-wall carpeting have created favorable conditions for their growth and spread in modern buildings.

Although the diagnosis is clinical, it is impossible to identify the specific causative agent without extensive immunological and sensitivity testing. Definite diagnosis of AA and identification of the causative agent requires cutaneous and inhalation testing with extracts of the various micobiological organisms present in the diseased persons environment and subsequent determination of levels of precipitating antibodies. Since all types of testing and especially inhalation testing can elicit an attack of AA, the extent to which the procedure can be performed is limited.

The incidence of AA is increasing. This may be due to more accurate diagnosis but may also be due to a more ubiquitous spread in the environment of causative agents.

VI. EVALUATION RESULTS

A. Environmental (initial survey)

Results of the analysis of the Synasol PBS solvent indicated the solvent was mostly ethyl alcohol, with trace amounts of ethyl acetate, and MIBK. The bulk air samples taken for solvent vapors in the stamping area contained ethyl acetate, ethyl alcohol, MIBK, xylene, and C_9-C_{12} aliphatic hydrocarbons. Biphenyl was not detected, but the charcoal tubes used for collecting the samples were not appropriate for biphenyl sampling.

Results of the analysis of personal breathing zone samples collected in the stamping area are presented below:

SAMPLE NO.	TYPE OF SAMPLE	JOB/LOCATION	CONCENTRATION OF CONTAMINANT (in parts per million)		
			Ethyl Acetate	Ethyl Alcohol	MIBK
HC-1	Personal	Stamper	0.8	38.5	0.9
HC-2	Personal	Stamper	1.3	50.3	1.7
OH-1	Personal	Stamper	1.7	48.5	1.3
OH-2	Personal	Stamper	1.2	39.7	0.9
ACGIH Threshold Limit Value (TLV)			400	1000	50
NIOSH Recommended Limit					50
Current OSHA Standard			400	1000	100

Although the spray lubricant (Arrolube PBO) is 98.75% water, the NIOSH laboratory did detect very small amounts of butyloleate sulfanate in the personal breathing zone air samples. However, the quantity was less than 0.38 milligrams per sample, which computes to less than 0.5 milligrams per cubic meter (mg/M^3) as an airborne concentration.

B. Medical (Initial Survey)

Approximately 70 employees were active in the work area indicated in the request. Of these, 60 were on the sewing machine lines, and the rest were transporting finished goods and other materials. All but one of the employees were female. The age range was approximately 20-70 years with a median of approximately 50 years. The duration of employment ranged from 1 month to 20 years with a median of approximately 6 years. An attempt to randomize the interview sample was made by conducting interviews with every third person on the sewing machine lines.

None of the respondents stated they were experiencing health problems that they considered related to their occupation. However, approximately one-half of the respondents indicated that they sometimes, especially when ventilation was reduced due to low outside temperatures, experienced throat irritation and/or cough when working.

These symptoms were often attributed to the lubricating liquid sprayed on the rugs while sewing. None of the respondents considered their symptoms severe, and none of them had sought medical care during the periods when they had symptoms. When questioned about former employees who had developed health problems, only the names of the employees discussed below were given.

The hospital and other medical records of two former employees who had developed respiratory symptoms during their employment were reviewed. The were both above fifty years of age, and had experienced periods of respiratory distress with shortness of breath and chest pain during the last few months of employment. These employees believed their symptoms were caused by occupational exposure to various compounds in the area indicated in the request.

C. Environmental (follow-up survey)

Biphenyl vapor was not detectable in any of the 3 personal samples taken from the employees working in the stamping area. The area sample detected 0.02-0.03 ppm biphenyl which is approximately one tenth the evaluation criteria of 0.2 ppm.

Since the initial NIOSH survey (February, 1980), Dell-Rube had installed local exhaust ventilation systems on 5 of 7 small machine lines (line Nos. 2-6). Each small machine in these 5

lines was equipped with a freely suspended slot exhaust hood located as close as possible to sewing needle spray lube nozzle. The exhaust volumes were balanced by varying the size of the slot opening. The hoods were connected to a rectangular exhaust duct running the full length of the line between two rows of 12 machines each. Air flow measurements taken by NIOSH indicated that proper balancing had been achieved. Hoods located closest and furthest from the exhaust fan were both exhausting approximately 500 cubic feet of air per minute. Small machine operators on lines equipped with this system had no complaints and believed the exhaust system had definitely improved conditions in their work area.

Butyloleate sulfanate aerosol was not detected on 4 of 6 air samples collected during the follow-up survey. The results of these samples taken from 5 different small machine operators and one area sample are presented below:

Type Sample	Line No.	Position	Concentration
Area	4	6	Not Detected
Personal	4	12	Not Detected
Personal	5	1	1.4 mg/M^3
Personal	2	17	Not Detected
Personal	2	12	Not Detected
Personal	3	14	1.0 mg/M^3

Ninety-one fungal colonies were counted on the microbial aerosol collecting plates. The most common organisms found were Cladosporium sp, 49; Penicillium sp, 17; Aspergillus sp, 11; and Alternaria sp, 10. All of these fungi are commonly found in the environment. The plates inoculated with oil had heavy bacterial growth.

VII. DISCUSSION AND CONCLUSIONS

Based on the results of environmental sampling, employee interviews and available toxicological information, there does not appear to have been a health hazard present in the Small Machine Department or stamping area at the time of this investigation.

Results of the air sampling indicated organic vapor concentrations were below levels that would be expected to cause adverse health effects. The findings indicate that airborne concentrations of toxic substances identified in the samples are well below recommended exposure limits established by NIOSH, OSHA, and ACGIH.

Arrolube PBO is mostly water, containing a wetting agent (butyloleate sulfanate), which is considered relatively non-toxic even at higher concentrations. There are no reports in the literature indicating that butyloleate sulfanate could cause adverse respiratory effects or allergic sensitization. Results of the follow-up sampling for butyloleate sulfanate indicate that the

recently installed local exhaust ventilation system is effective in removing this aerosol except at positions affected by cross draft interferences.

Several species of fungi were identified in the work environment, and the Arrolube PBO was shown to contain bacteria. These microorganisms are frequently found in the environment, and although some of the fungi detected have been shown to cause allergic alveolitis, no association with the two known cases could be made without conducting sensitivity testing with suspected agents. Because of the risk of possible severe adverse reaction during such tests, further investigation was not considered. It is thus possible that their breathing problems may have been caused by microbial organisms in the plant environment, however, due to the lack of breathing problems in other persons with similar exposure this appears unlikely.

As stated previously sensitizing microbial agents are common in the general environment, however, since the concentration of such organisms may be higher in the plant environment, persons with genetic predisposition for allergic reactions may be at risk of developing health problems when exposed to the plant environment. As a consequence of this, persons with known allergies should be transferred to other departments within the company.

It is probably difficult to avoid the presence and growth of fungi and bacteria in the lubricating fluid (Arrolube PBO). The addition of presently available biocidal agents would most likely constitute a greater hazard to the employees than the microorganisms. Biocides could also encourage selective growth of highly resistant and possibly pathogenic organisms in the fluid and in the environment. The appropriate method of reducing the possible hazard due to organisms in the fluid is to minimize exposure by local exhaust ventilation.

VIII RECOMMENDATIONS

1. Because of the increased carcinogenic risk for employees exposed to acid blue No. 1 dye, NIOSH had recommended, following the initial survey in February, 1980, that a search be initiated by Dell-Rube for a less hazardous dye substitute. The dye selected was Nylosan Blue C-BRL, manufactured by the Sandoz Colors and Chemicals Company of East Hanover, New Jersey. Information received from Sandoz indicates there has not been a thorough test of this dye for its toxic properties. There is no published literature describing its toxicity. NIOSH recommends that employees using Nylosan Blue C-BRL continue to exercise caution and practice effective personal hygiene. Protective gloves should be used to prevent direct skin contact. At this time the toxic effects of Nylosan Blue C-BRL are unknown. It is possible that this dye may be more toxic than Acid Blue No. 1

2. Employees with a history of allergy problems should be identified in personnel and medical records. Special consideration should be given to these employees for reassignment to other jobs where exposures to environmental contaminants are less likely.

IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

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X. DISTRIBUTION AND AVAILABILITY

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, Information Resources 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 22161. Information regarding its availability through NTIS can be obtained from the NIOSH Publications Office at the Cincinnati, Ohio address.

Copies of this report have been sent to:

a) Dell-Rube Chenilles Inc.
b) U.S. Department of Labor (OSHA), Region IV
c) NIOSH Region IV
d) Designated State Agencies

For the purpose of informing the approximately 75 "affected employees", the employer will promptly "post" this report for a period of thirty (30) calendar days in a prominent place(s) near where the affected employees work.

XI. REFERENCES

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