U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
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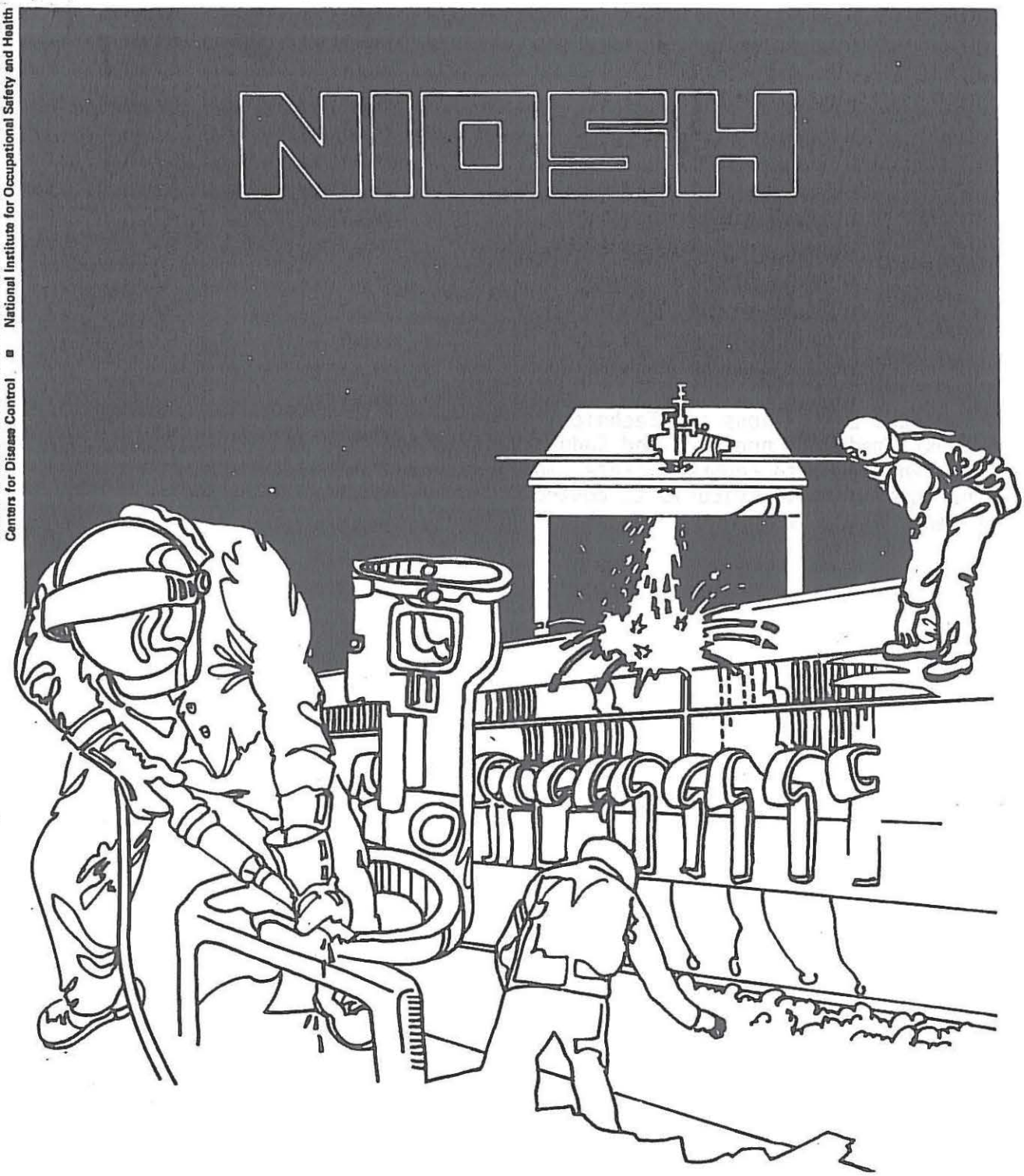
NIOSH



Health Hazard Evaluation Report

HETA 77-011-1338
INLAND DIVISION, GMC
DAYTON, OHIO

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from 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 Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

HETA 77-011-1338
JULY 1983
INLAND DIVISION, GMC
DAYTON, OHIO

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I. SUMMARY

In October 1976, NIOSH received a request from United Rubber Workers Local 87 to evaluate skin and respiratory problems believed related to chemical exposures resulting from working in the wet rubber processes at General Motors Corporation's Inland Division, Dayton, Ohio. The wet rubber process involves the manufacturing of weather strips for automobile doors and trunk lids from a combined synthetic styrene-butadiene and natural rubber latex formulation. NIOSH conducted environmental and medical investigations in February, July, and October 1977. The study was resumed in 1982 after a legal challenge to NIOSH's right of access to employee medical records was resolved in NIOSH's favor.

Personal breathing zone and general area air samples for organic vapors were obtained from the departments that composed the wet rubber manufacturing process. Exposure to vapors of n-butyl acetate, 2-ethoxyethanol, ethyl benzene, isopropanol, toluene, xylene, 1,1,1-trichloroethane, and trichloroethylene were evaluated. Neither the airborne concentrations of these compounds individually nor their combined equivalent exposure concentrations exceeded the respective evaluation criteria. Exposures to airborne ammonia were evaluated in the foam rubber mixing department; all were well below the evaluation criteria.

One hundred sixty-two employees then working in one of the seven departments involved in wet rubber production, 24% of the eligible population, participated in the medical survey. Twenty-two (14%) employees reported a current rash involving the hands or arms. Nine (10%) of the 88 first-shift participants (the only ones routinely to receive a skin examination and pulmonary function test) had such a rash on examination; most rashes were described as eczematous or contact dermatitis. In all five cases where one of these workers had recently made a medical department visit, the employee's work with wet rubber was noted on the medical record, and treatment recommendations included a barrier cream and use of gloves or sleeves. Seven (25%) of 28 foam molders reported a current rash, but only one (6%) of 17 first-shift foam molders had a rash by examination. (The 25% prevalence is not statistically significantly different from the overall target department rate of 14% [$X^2 = 2.68$, $p>0.1$].) Eight (9%) of the 88 first-shift participants had a one-second forced expiratory volume/forced vital capacity ratio of less than 0.75, but in five of the eight cases there was either an acute respiratory illness or a technically inadequate (by current criteria) test.

The environmental survey found no apparent health hazard from inhalation of the identified chemical agents. The medical survey revealed a substantial prevalence of work-related dermatitis. No specific job title was found to pose a significantly greater risk, but the relatively low participation rate resulted in some jobs of interest being represented by only a few employees. The spirometry survey did not document any pattern of work-related respiratory impairment, but this does not exclude the possibility of individual cases of respiratory dysfunction resulting from or aggravated by working in the wet rubber process.

KEYWORDS: SIC 3060 (Fabricated Rubber), dermatitis, wet rubber process, organic solvents.

II. INTRODUCTION

In November 1976, NIOSH received a request for a health hazard evaluation from an authorized representative of the United Rubber, Cork, and Linoleum Workers, Local 87, regarding worker exposures in the "wet rubber processes" at the Hill Plant of General Motors Corporation's Inland Division, Dayton, Ohio. The request indicated that employees were experiencing skin and respiratory problems. NIOSH conducted environmental and medical surveys in February, July, and October 1977.

As part of the October medical survey, NIOSH intended to review certain employee medical records. Inland challenged NIOSH's right of access to these records, and the study's progress was delayed until 1982, when the issue was judicially resolved.

NIOSH had originally requested access to employee medical records for three purposes: 1) to verify information concerning the diagnosis and treatment of medical problems reported to the NIOSH investigators, 2) to determine whether the participants in the NIOSH survey were representative of all wet rubber process employees, and 3) to determine (together with the medical survey data) whether there were other health problems associated with the wet rubber process. Inland refused NIOSH access to medical records without written employee consent. NIOSH issued a subpoena for the medical records all wet rubber process employees, and Inland challenged NIOSH's authority in federal court. The U.S. Court of Appeals for the Sixth Circuit upheld both NIOSH's right of access and subpoena power, and the U.S. Supreme Court declined to review Inland's appeal of that decision.

In March 1982, the U.S. District Court for the Southern District of Ohio ordered Inland to provide NIOSH the requested records. After arranging for compliance with court-ordered special conditions, NIOSH and Inland agreed to an October 1982 delivery date. By that time, however, two of the three uses NIOSH had intended to make of the medical records were no longer timely. (NIOSH argued in court that it's right of access required only the "relevance" of the records to the investigation, not a "compelling need" for them.) In the five years since the medical survey, improvements in plant facilities and availability of protective measures (barrier creams and arm covers) had - according to both company and union officials - reduced the occurrence of dermatitis. It, therefore, seemed an unwarranted effort to attempt to determine whether the participants in the NIOSH medical survey were representative of all wet rubber process employees (i.e., to confirm or refute, through a record review, the survey's epidemiologic findings), especially since this would require correlating medical records (which don't routinely contain job history information) with personnel records. Similarly, and because the environmental results had become available and showed no health hazard from airborne chemicals, a search for unspecified health problems

didn't seem justified. The primary reason for obtaining the records - documentation of specific cases of occupational medical problems - still seemed relevant.

III. BACKGROUND

A. Facility Description

Inland is a division of General Motors Corporation which produces numerous automotive parts including weather stripping, ball joints, motor mounts, brake shoe linings, brake hoses, steering wheels, instrument panels, and seat cushions. The Inland Division is composed of several plants located in Dayton and Vandalia, Ohio, and employs 7,000 to 8,000 workers. Plant No. 4 located in Dayton, Ohio, contains the weather strip operations of which the wet rubber process is a component. The facility is called the "Hill Plant" and includes Buildings 12, 25, and 27. The Hill Plant contains over 250,000 square feet and employs in excess of 600 people.

B. Process Description

The wet rubber process involves the manufacturing of weather strips for automobile doors and trunk lids ("decks") from a combined synthetic styrene butadiene and natural rubber latex formulation.

1. Department 481 - Building 12 - "Cement House"

This department is involved in the formulation and batch production of rubber sealants, coatings, and adhesive cements used in the weather strip processes and also in other rubber processes within Inland Division. The building is physically removed from the main facility. It is a two-story cement block building with numerous storage/transfer tanks, mixers, and grinders. There are only a few employees (3 to 5/shift) assigned to this area. One of the main items formulated in this area is a water-based neoprene coating.

2. Department 480 - Building 25 - "Foam Rubber Mixing"

Department 480 is the chemical compounding area for the rubber latex and chemical additives (accelerators, antioxidants, fillers, cross-linkers, and inhibitors) used in the weather strip formulation. The area is three floors high; the third floor processes the chemical additives (sub-batches) used the latex. This floor contains some storage of raw materials, grinders, separators, and mixing tanks.

Within Department 480, there is an eye wash and emergency shower and local exhaust ventilation on the grinders. Heated general air ventilation is also provided. The mixing/supply

tanks on the third floor are inset such that their conical bottoms are located on the second floor. Sub-batched materials are transferred from the supply tank via a drain spout into a weight-measuring transfer vessel on the second floor, which is manually pushed along rails recessed into the floor. This transfer vessel dispenses the appropriate measured amount of each additive into latex formulator/stirring tanks located on the opposite side of the aisle. The stirring tanks (2,500 gallons each) are sunken into the floor and have hinged cover lids and local exhaust ventilation. The natural and synthetic latexes are blended at approximately 65°F for a specified time and the pH is maintained alkaline with periodic additions (via an open container) of ammonia. The weighed additives are added at the appropriate time and the master batch is sampled by the process laboratory (Department 05) at periodic intervals. When the prescribed formulation criteria are achieved, the master batch is pumped from the latex stirring tanks to storage/feed tanks ("use" tanks) via a closed system.

Approximately five employees per shift operate the compounding area. The first floor contains transfer piping, several 12,000-gallon latex bulk storage tanks and the process laboratory. The laboratory has two chemical fume hoods and there are approximately 24 employees, most of whom work on day shift.

3. Departments 452, 453, 475 - Building 25 - "Mold Lines"

There are four mold lines (Lines 1 and 5 are Department 452) which produces weather strips for doors and trunk lids. Line 5 has two formulation types referred to by the workers as "High Mod" and "Low Mod", or "Super Marshmallow Foam". Line 2 is Department 453 and it produces "roof rails". Line 3 is Department 475 which produces "pinch welds".

The primary differences in the lines besides the foam formulation and densities is the type of insert backing molded into the strip during the running process. Lines 1 and 5 have a hard rubber insert backing; Line 2 has a wire insert; and Line 3 has a metal ladder-type insert to form the pinch weld.

The master batched foam is pumped from the use tanks to a mezzanine area above the mold line. Here a gel agent and carbon black or zinc oxide mixture is added and foam is aerated for 2 to 3 minutes. The foam is then poured, via a foamer pouring head, into channels in an aluminum mold (110 to 206 inches long with multiple channels) passing underneath the foamer head. The foamer operator controls the rate of pouring and density of application at this station by metering pump controls. Simultaneously, the backing material (hard rubber,

wire, or metal ladder) is continuously fed into the mold channel with the latex and then a continuous "cork" cap is overlaid on the channel to prevent the curing foam from expanding out of the channel. (The "cork" cap is not really cork, but a continuous silicone coated rubber strip.) The mold proceeds through a steam-curing oven (212°F+) which polymerizes the latex rubber. Near the exit end of the oven, there is a flash removal station where the excess cured foam is stripped from the outer mold as the "cork" returns to the front of line. Next, there is a lift station where the strips are lifted out of the mold channel and fed into a wringer. The wringer reduces the water content and the weather strip proceeds up to an elevated bench area over the end of the mold line. The molds automatically transfer to the return line, which returns the empty mold to the front of the mold line. A silicone anti-stick agent is automatically applied to the mold ends at the transfer point.

The strip is inspected by a data clerk, in voice contact with a process computer, rated according to defects, marked with colored crayons, grouped in sets, and hung vertically on a high line for transfer to a storage bank which feeds into a drier.

The mold lines operate 3 shifts per day, five days per week. The area employs over 193 employees. The data clerks are actually assigned to Department 429, and there are approximately 7 total for Shifts 1 and 2.

4. Departments 473, 474 - "High Lines, Driers, Flow Coaters"

After the strips have been hung on the high lines (which is over 1 mile long and runs throughout the facility), weights are added to the bottoms to keep them from swinging and sticking to each other. They then proceed through a drier (260 to 275°F for approximately 1 hour) which dries out the excess moisture. Strips from Line 2 with the wire insert are then bent with pliers and glued to form an angle. The strips then proceed through a flow coater which applies three successive coats with a pre- and post-bake cycle. There are two neoprene coats applied and a coat of "Hypolon". Each cycle requires a solvent drying step before the next coat is applied. When the strips emerge from the flow coater, the weights are removed and the strips proceed on the high line to different areas for inspection, splicing, and repair. The strips are then bunched in groups of three and proceed to the "nail and drill" department. The high line, drier, and flow coater areas employ approximately 166 employees. The nail and drill department was not evaluated in this study; the process consists of inserting nylon tips ("nails") into the weather strip backing of strips

from Lines 1 and 5. This provides a means of attaching the strip to the metal body frame of the automobile.

5. Department 464 - "End Detail"

The strips leave the "nail-drill" area and proceed to the end detail/end join area. Here the ends of the strips are placed into molds with nylon inserts and prebatched foam from Department 480 is injected into the mold. After a prescribed time at temperatures ranging from 180 to 210°F, the mold is cammed open and the end detail has been formed. The end detail helps attach the strip to the car door. The end detail process has automated round tables (30), manual round tables (24), and straight tables (27). Each table has several molds (12 per table) on it for continuous operation. (There are 12 different mold types.) Some strips that don't get end details are end-joined, which means that the ends are "glued/molded" together forming a "loop".

The strips with end-details then proceed to dip tanks where successive coatings are applied. The neoprene in this step is water-based and the coatings have a slightly different formulation than the regular strip. The Hypolon coating is solvent-based. The strips are finally reinspected, repaired, and sliced, and a sealant is applied. They are then bundled and packaged for shipment to an automotive assembly plant.

Department 464 employs over 291 workers and operates 3 shifts per day, 5 to 6 days per week.

IV. STUDY DESIGN AND METHODS

NIOSH conducted an initial site visit of the Hill Plant in January 1977. In February 1977, NIOSH investigators visited the local union to interview and examine self-selected employees who felt they had health problems. In all 20 cases, the findings suggested occupational dermatitis or dermatitis exacerbated by occupational exposure. In some cases, the dermatitis seemed to be allergic. Employees tended to associate the dermatitis with working with wet rubber.

A second site visit was conducted in July 1977 to 1) gather bulk samples of material used, 2) obtain general area environmental screening samples to characterize airborne contaminants, and 3) request additional information about the facility and processes. In October 1977, an extensive environmental and medical evaluation was performed at the facility. Because of the legal challenge to NIOSH's right of access to employee medical records, the resumption of the study was delayed until 1982, when the records were finally obtained.

A. Environmental Evaluation

1. July 1977 Survey

The July survey involved collection of general area bulk air samples for organic vapors in Departments 452 and 464. The organic vapors were collected on standard (150 milligram) charcoal and silica gel adsorbents using personal sampling pumps calibrated at 0.20 liters per minute (lpm). Relative humidity and temperature measurements were taken using a battery-operated psychrometer.

2. October 1977 Survey

The October survey involved collection of personal breathing zone and general area samples for organic vapors in Departments 429, 452, 464, 473, 474, 475, 480, and 481. The organic vapors were collected on standard (150 mg) charcoal and silica gel adsorbents using personal sampling pumps operating at 0.05 to 0.20 lpm for the personal breathing zone samples and 0.20 to 1.0 lpm for the general area samples. Personal breathing zone and general area samples also were collected for airborne ammonia in Department 480. The airborne ammonia was collected in 15 milliliters of Nesslers reagent contained in a midget impinger at a flow rate of 1.0 lpm and analyzed using a colorimetric procedure.

B. Medical Evaluation

All past and present employees performing certain operations in the wet rubber process were invited to participate in the study. These operations included mixing rubber compounds; operating and maintaining molding machines; removing rubber strips from molds; handling, hanging, and trimming freshly molded rubber; patching and repairing; and operating end detail machines. (These operations were performed by Departments 452, 453, 464, 473, 474, 475, and 480.) NIOSH interviewers administered a questionnaire covering occupational history and eye, nose, throat, and skin symptoms. In addition, day shift workers and some workers from other shifts who had symptoms, received an examination of the skin, a respiratory symptom questionnaire, and basic pulmonary function tests [measurement of one-second forced expiratory volume (FEV_1) and forced vital capacity (FVC)]. Finally, company medical records were reviewed to 1) determine the extent to which they reflected the cases of dermatitis found in the NIOSH survey, and 2) help determine the extent of work-related skin and respiratory problems.

V. EVALUATION CRITERIA

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for assessment of a number of chemical and physical agents. These criteria are intended to suggest levels of exposure to which most workers may be exposed up to 10 hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is, however, important to note that not all workers will be protected from adverse health effects if their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and/or a hypersensitivity (allergy).

In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the evaluation criterion. These combined effects are often not considered in the evaluation criteria. Also, some substances are absorbed by direct contact with the skin and mucous membranes, and thus potentially increase the overall exposure. Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent become available.

The primary sources of environmental evaluation criteria for the workplace are: 1) NIOSH Criteria Documents and recommendations, 2) the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLV's), and 3) the U.S. Department of Labor (OSHA) occupational health standards. Often, the NIOSH recommendations and ACGIH TLV's are lower than the corresponding OSHA standards. Both NIOSH recommendations and ACGIH TLV's usually are based on more recent information than are the OSHA standards. The OSHA standards also may be required to take into account the feasibility of controlling exposures in various industries where the agents are used; the NIOSH-recommended standards, by contrast, are based solely on concerns relating to the prevention of occupational disease. In evaluating the exposure levels and the recommendations for reducing these levels found in this report, it should be noted that industry is legally required to meet only those levels specified by an OSHA standard.

A time-weighted average (TWA) exposure refers to the average airborne concentration of a substance during a normal 8- to 10-hour workday. Some substances have recommended short-term exposure limits or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from high short-term exposures.

Appendix A presents the environmental evaluation criteria and principal health effects associated with the airborne contaminants identified during this evaluation.

Multiple concurrent chemical exposures were experienced by the workers in this plant. Thus, in addition to evaluating the contaminants individually, their combined effect must also be considered. Equivalent total exposure from a mixture of solvent vapors was calculated as follows:

$$E_m = (C_1 \text{ divided by } L_1 + C_2 \text{ divided by } L_2) + \ldots (C_n \text{ divided by } L_n)$$

Where:

E_m is the equivalent exposure for the mixture.

C is the airborne concentration of the particular contaminant.

L is the exposure limit for that contaminant.

The concentration is unacceptable if E_m is greater than 1.0.

VI. RESULTS AND DISCUSSION

A. Environmental

The analyses of the preliminary screening bulk air samples obtained in Departments 464 and 452 in July 1977 show the presence of five organic compounds including 1,1,1-trichloroethane, toluene, trichloroethylene, and para- and ortho-isomers of xylene (Table I). Neither the airborne concentrations of any of these compounds individually nor of their combined equivalent exposure exceeded the evaluation criteria.

The personal breathing zone and general area concentrations of airborne ammonia measured at the first, second, and third floors of Department 480 (foam rubber mixing). Although the airborne exposure concentrations were generally well below the environmental evaluation criteria (Table II), exposure concentrations were considerably higher when open buckets of ammonia were dumped. During one such dumping operation, the airborne ammonia concentration was found to be 9.6 mg/m^3 over a 7-minute sampling period. NIOSH recommends that maximum short-term exposure to ammonia vapor not exceed 35 mg/m^3 over a 5-minute sampling period. Although environmental samples failed to document exposures above that criterion during the open dumping of ammonia, the operators reported instances when they would have to leave the immediate area until the irritant ammonia fumes dissipated.

The operators in Department 480 also complained of becoming dizzy and lightheaded when they cleaned the weighing transfer vessel with an organic solvent. This operation, however, was not performed during the NIOSH evaluation. Thus, the identity and concentration of the chemicals used to clean the vessel were not determined. The

same operators also reported that sodium fluoride compounds were very irritating when dumped into reaction vessels. NIOSH did not conduct any sampling to document airborne exposure concentrations during that operation.

Table III presents the latex process operators' total airborne exposures to particulate and organic vapors in Department 480. The total particulate concentrations (2.7 mg/m^3 maximum) were less than 28% of the environmental evaluation criterion of 10 mg/m^3. The organic vapors identified included 1,1,1-trichloroethane, toluene, and ethyl benzene. Neither the airborne concentrations of any of these compounds individually nor of their combined equivalent concentrations exceeded the evaluation criteria.

The organic vapors identified in Departments 481 (cement house) and 464 (end detail) included 2-ethoxyethanol, isopropanol, n-butylacetate, isobutylbutyrate, 1,1,1-trichloroethane, toluene, and xylene (Table IV). Neither the airborne concentrations of any of these compounds individually nor of their combined equivalent concentrations exceeded the evaluation criteria.

On Mold Lines 1 and 5 in Department 452, Mold Line 2 in Department 453, and Mold Line 3 in Department 475, the organic vapors identified included 2-ethoxyethanol, ethyl benzene, isopropanol, 1,1,1-trichloroethane, toluene, and xylene (Tables V to IX). Neither the airborne concentrations of any of these compounds individually nor of their combined equivalent concentrations exceeded the evaluation criteria.

In Departments 473, 474, and 429, the organic vapors identified included n-butyl acetate, 2-ethoxyethanol, isopropanol, ethyl benzene, 1,1,1-trichloroethane, toluene, and xylene (Tables X to XII). Neither the airborne concentrations of any of these compounds individually nor of their combined equivalent concentrations exceeded the evaluation criteria.

In Department 464 (end detail), the organic vapors identified included n-butyl acetate, isopropanol, ethyl benzene, 1,1,1-trichloroethane, toluene, and xylene (Tables XIII to XVI). Neither the airborne concentrations of any of these compounds individually nor of their combined equivalent concentrations exceeded the evaluation criteria.

B. Medical

1. Participation

One hundred ninety-nine current employees participated in the NIOSH medical survey; 162 currently worked in one of the seven departments that included the target operations. (One retired

worker also participated, but was excluded from the statistical analyses.) Company job rosters listed 677 production workers in these departments, so the participation rate was 24%. Overall, 116 (58%) of the participants received the skin examination and pulmonary function tests; 85 (52%) of the 162 participants from the target departments received them.

2. Dermatitis

Of the 162 participants from target departments, 52 (32%) reported a rash within the preceding year. ("Rash" refers to any reported skin problem or skin finding on examination that involves at least one hand or arm.) Twenty-two (14%) reported a current rash, but 13 had no skin examination, apparently because they were not first-shift workers. Of the remaining nine, eight had a rash on examination; the ninth had recurrent urticaria (hives), but had no lesions at the time of the examination. Of the eight rashes seen on examination, two had obvious non-occupational etiologies. Ten other target department participants, whose questionnaires indicated no current rash, also had a rash on examination. In four cases, the discrepancy apparently resulted because the worker perceived (as did the examiner) the skin finding to be something other than an occupational contact dermatitis. The cause of the discrepancy in the other cases is not apparent, but in some it may have been confusion by the participant over whether to identify a healing rash as a "rash still present".

Among target department participants, then, there were 12 observed cases of active, healing, or healed (with residual hyperpigmentation) rashes of the hands or arms, most of which were described by the examiner as eczematous or contact dermatitis and were thus potentially of occupational etiology. Nine of the 12 cases were in first-shift employees. Since 88 first-shift target department employees participated in the study, the prevalence of observed rash of the hands or arms was 10%. Since only seven first-shift target department employees participants reported a current rash on the questionnaire, it does not appear that the 14% prevalence calculated from the questionnaire data for all shifts combined would overestimate the prevalence of current rash as determined by examination.

Seven job titles were represented by more than five target department participants (Table XVII). Only one job, foam molder, had a prevalence (25%) of current rash appreciably greater than the overall target department rate of 14%, but this difference was not statistically significant (foam molders versus all other target department participants: $X^2 = 2.68$, $p>0.1$). Nine (75%) of the 12 observed rashes among first-shift target department participants occurred among workers who held

one of the seven job titles described above, a proportion similar to the 78% of first-shift target department employees represented by the seven job titles. Two job titles, strip hanger and trucker/sweeper, had an observed rash prevalence (50%) greater than the overall first-shift target department rate of 10%, but they had only four first-shift participants each, and the trucker/sweeper did not have obvious hand or arm contact with wet rubber. Curiously, only one of the 17 first-shift foam molders had an observed rash; the other six who reported a current rash were all on other shifts.

The company medical records of nine of the 12 target department employees with a NIOSH-observed rash were located. Seven of the nine rashes had been noted in the company medical records; the other two employees said they had not brought the rash to the attention of the medical department. In all five cases where there had been a recent visit the employee's work with wet rubber was noted, and treatment recommendations included a barrier cream and use of gloves or sleeves.

Of the 37 participants from non-target departments, 16 (43%) had previously worked in a target department. Eighteen of the 37 reported a rash involving the hands or arms within the preceding year; 10 (56%) of them had worked in a target department, six (33%) in the preceding year. Ten persons reported a current rash; four (40%) of them previously worked in a target department. On examination, eight persons had a rash, including three whose questionnaire indicated no current rash; three (38%) had previously worked in a target department. The data from this small self-selected group thus does not suggest any association between current rash (by either self-report or examination) and previous work in the wet rubber process.

Since the participation rate in the NIOSH study was relatively low, one might presume that the calculated rash prevalence rate of 14% is inflated because workers with a rash might have been more likely to participate. On the other hand, overall (or even department-specific) prevalence rates don't fully describe the risk of getting a rash since the risk is presumably related more to specific jobs than to department. Unfortunately, because of the low participation rate, many jobs of interest were represented by too few people to yield epidemiologically meaningful job-specific rates. Furthermore, employees were not specifically asked whether they handled wet rubber or whether they used barrier cream, gloves, or sleeves, so we could not categorize workers according to degree of exposure in order to better quantitate the risk of dermatitis in workers who handle wet rubber and to evaluate the effectiveness of the personal protective measures. Since the medical records do not

systematically contain past or present job information, it was not feasible to do a dermatitis prevalence survey that would provide any meaningful support or refutation of the NIOSH questionnaire and examination findings.

3. Respiratory Problems

Eight (9%) of 88 first-shift target department participants had an FEV_1/FVC ratio of less than 0.75 (suggesting airways obstruction); five of them had a ratio of less than 0.70. This may be an overestimate, however, since the pulmonary function tests of four of the eight were technically inadequate by currently accepted criteria,[1] and a fifth, though technically adequate, may have been affected by the participant having an acute respiratory illness.

Four of the eight "cases" of apparent airways obstruction were in Department 464, which had 34 participants, and there were two each in Departments 452 and 473 (which had 22 and 13 participants, respectively). (The other four target departments each had fewer than seven first-shift participants.) Four of eight cases were in miscellaneous bench workers; no other job title had more than one case. Three of the miscellaneous bench workers with cases reported chronic respiratory disorders prior to working in the wet rubber process, two of them prior to working at Inland. Two of the four other workers with cases reported chronic respiratory disorders prior to working at Inland. In each of the remaining three cases, wheezing and/or shortness of breath developed after the employee began work in the wet rubber process.

In summary, then, while there may be individual cases of respiratory dysfunction resulting from or aggravated by working in the wet rubber process, the data from this study are insufficient to identify any department or job title as a risk factor. Since the study did not include an unbiased comparison group, it cannot answer the question of whether working with wet rubber is a risk factor for respiratory problems. Nor can this question be answered by a survey of the company's medical records since they do not routinely contain job history information.

VII. RECOMMENDATIONS

1. All employees should adhere to strict personal hygiene and good work practices to help reduce the potential for contamination. Eating, drinking, and smoking must only be done in designated areas after hands have been thoroughly washed.

2. Management is encouraged to continue development of employee health and safety educational programs. The programs should be designed for each work area with common substance usage.

3. A program outlining procedures to assure safe vessel entry should be established for Department 480. Guidelines for establishing such a program are contained in NIOSH publication "Working in Confined Spaces" (Publication No. 80-106).

4. An enclosed metering system should be considered for ammonia addition in Department 480.

5. The chromic acid transfer lines should not be left on the floor unguarded. If it is necessary for them to be placed across traffic areas, then the areas must be cordened off to traffic while acid is transferred. Appropriate spill clean-up materials to neutralize and absorb spilled acid should be available nearby with appropriate personal protective equipment.

VIII. REFERENCES

1. Ferris BG. Epidemiology standardization project. Am Rev Respiratory Dis 118 (suppl.);55-58;1978.

IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

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X. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), 5285 Port Royal, Springfield, Virginia 22161. Information regarding its availability through NTIS can be obtained from NIOSH Publications Office at the Cincinnati address. Copies of this report have been sent to:

1. Health and Safety Representative, U.R.W. Local 87, 21 Abbey Avenue, Dayton, Ohio 45417
2. President, U.R.W. Local 87, 21 Abbey Avenue, Dayton, Ohio 45417
3. Plant Manager, Inland Division, GMC, P.O. Box 1224, Dayton, Ohio 45401
4. NIOSH, Region V
5. OSHA, Region V

For the purpose of informing affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

APPENDIX A

Environmental Evaluation Criteria*

and Principal Health Effects for Identified Airborne Contaminants

Inland Division, GMC
Dayton, Ohio
HETA 77-011

Contaminant	Environmental Criteria - mg/m^3**			Principal Health Effects
	NIOSH	ACGIH	OSHA	
Ammonia	35 C-5 min	18	35	Eye and respiratory tract irritation
n-Butyl Acetate	-	710	710	Eye and respiratory tract irritation
2-Ethoxyethanol	-	19	19	Eye and respiratory irritation, potential reproductive effects
Ethyl Benzene	-	435	435	Eye and skin irritation
Isopropanol	980	980	980	Eye and respiratory tract irritation
Toluene	375	751	375	Central nervous system (CNS) effects
1,1,1-Trichloroethane	1910	1900	1900	Nervous system, liver, and heart effects
Trichloroethylene	134	270	537	CNS effects, possible carcinogen
Xylenes	434	435	434	CNS effects, eye and respiratory tract irritation

* NIOSH Time-Weighted Average (TWA) criteria are based on up to a 10-hour per workday exposure for all substances listed except ammonia. Ammonia has a ceiling criteria expressed for a 5-minute period. The ACGIH and OSHA criteria are based on a 8-hour workday.

** Milligrams of chemical substance per cubic meter of air sampled.

TABLE I

Preliminary Screening Bulk Air Sample Analyses

Inland Division, GMC
Dayton, Ohio
HETA 77-011

July 1977

Sample Description	Sample Period	Airborne Concentration - ppm[1]					Combined Exposure
		1,1,1-TCE	Toluene	TCE	p-Xylene	o-Xylene	
Dept. 464 Round Table No. 8	1139-1538	-	-	-	2.8	0.7	-
Dept. 464 Round Table No. 10	1144-1543	2.6	1.4	17	-	0.2	0.70
Dept. 452 Line No. 1 behind mold operator on electrical box	1126-1551	-	0.2	0.2	0.4	0.1	0.02
Dept. 452 Line No. 5 above mold foamer station	1500-1556	0.4	0.8	0.4	2.8	0.8	0.07
NIOSH TWA Evaluation Criteria		350	100	25	100[2]	100[2]	1.0

1. Parts of substance per million parts of air sampled by volume (1,1,1-TCE/1,1,1-trichloroethane; TCE/trichloroethylene).

2. The NIOSH criteria represents a summation of the xylene isomers (para, ortho, and meta).

TABLE II

Airborne Ammonia Concentrations in Department 480

Inland Division, GMC
Dayton, Ohio
HETA 77-011

October 1977

Sample Type[1]	Sample Description	Sample Period	Concentration mg/m^3
GA	1st Floor Near Tank No. 21	0820-1005	0.30
"	1st Floor Near Tank No. 21	1005-1100	0.34
"	1st Floor Near Tank No. 21	1220-1350	0.38
"	1st Floor	0855-1008	0.35
"	1st Floor Between Tank Nos. 24 and 25	0730-0840	0.24
GA	2nd Floor	0850-1025	0.79
"	2nd Floor	0750-0950	4.5
"	2nd Floor	0950-1055	3.2
"	2nd Floor Between Tank Nos. 3 and 4	0735-0835	1.3
PBZ	2nd Floor Operator	0915-0922	3.8
GA	3rd Floor Center of Room	0800-1000	5.0
"	3rd Floor Center of Room	1000-1100	0.88
"	3rd Floor Center of Room	1230-1350	0.73
"	3rd Floor Between Tank Nos. 1 and 2	0740-0835	3.6
"	3rd Floor Between Tank Nos. 1 and 2	0814-0827	2.3
"	3rd Floor	0845-0920	2.3
"	3rd Floor	0920-1005	2.1
"	3rd Floor	0920-1005	4.2
"	3rd Floor on Control Box	1007-1024	7.0
"	3rd Floor on Control Box	1223-1250	3.9
PBZ	3rd Floor Operator Dumping of Material	0828-0835	9.6
ACGIH TWA Evaluation Criteria			18

1. GA/general area; PBZ/personal breathing zone.

TABLE III

Airborne Total Particulate and Organic Vapor Concentrations in Department 480

Inland Division, GMC
Dayton, Ohio
HETA 77-011

October 1977

Sample Type[1]	Sample Description	Sample Period	Concentration - mg/m^3				
			Particulates	1,1,1-TCE[2]	Toluene	Ethyl Benzene	Combined Exposure
PBZ	2nd Floor - Latex Process Operator	0758-1030/1210-1225	2.7	-	-	-	-
"	2nd Floor - Latex Process Operator	0740-1445	0.09	-	-	-	-
"	2nd Floor - Latex Process Operator	0740-1445	-	-	1.3	19	0.04
GA	2nd Floor - Scale Area	1025-1430	-	-	0.38	22	0.05
"	2nd Floor - Control Panel	0905-1325	-	0.42	0.65	16	0.04
PBZ	3rd Floor - Latex Process Operator/Mixer	0810-1045	0.04	-	-	-	-
"	3rd Floor - Latex Process Operator	0810-1045	-	-	0.94	8.1	0.02
GA	3rd Floor - Writing Stand	1025-1430	-	-	0.19	5.3	0.01
TWA Evaluation Criteria			10[3]	1910[4]	375[4]	435[3]	1.0

1. PBZ/personal breathing zone; GA/general area
2. 1,1,1-TCE/1,1,1-trichloroethane
3. ACGIH evaluation criteria
4. NIOSH evaluation criteria

TABLE IV

Personal Breathing Zone Exposures to Organic Vapors in Departments 481 and 464

Inland Division, GMC
Dayton, Ohio
HETA 77-011

October 1977

Sample Description	Sample Period	Air[1] Concentration - mg/m^3							Combined Exposure
		2-EE	IPA	IBIB	nBA	1,1,1-TCE	Toluene	Xylene	
Dept. 481: Compound Control Leader	0955-1350	-	-	-	-	-	3.3	7.5	0.03
Dept. 481: Compound Control Leader	0955-1350	0.6	-	1.2	1.8	-	-	-	0.03
Dept. 481: Compounder	1115-1415	-	-	-	-	-	3.3	14	0.04
Dept. 481: Compounder	1124-1415	2.1	-	0.9	1.6	-	-	-	0.11
Dept. 464: End Detail Dauber	1029-1435	-	19	-	-	3.1	12	11	0.08
Dept. 464: End Detail Dauber	1029-1435	-	18	-	-	2.5	12	11	0.08
Dept. 464: End Joiner	1017-1440	-	15	3.3	3.8	75	35	99	0.39
Dept. 464: End Joiner	1017-1440	0.23	-	0.95	0.72	-	-	-	0.01
Dept. 464: Foamer Operator	1037-1126	-	12	0.48	0.77	27	6.6	11	0.07
TWA Evaluation Criteria		19[2]	980[3]	*	710[2]	1910[3]	375[3]	434[3]	1.0

1. 2-EE/2-ethoxyethanol; IPA/isopropanol; IBIB/isobutylbutyrate; nBA/n-butylacetate; 1,1,1-TCE/1,1,1-trichloroethane.
2. ACGIH evaluation criteria
3. NIOSH evaluation criteria

* There is presently no environmental evaluation criteria.

TABLE V

Personal Exposures to Organic Vapors on Mold Line No. 5 in Department 452

Inland Division, GMC
Dayton, Ohio
HETA 77-011

October 1977

Sample Description	Sample Period	Air[1] Concentration - mg/m^3						Combined Exposure
		2-Ethoxyethanol	Ethyl Benzene	IPA	1,1,1-TCE	Toluene	Xylene	
Foam Press Helper	0817-1440	-	18	3.3	24	3.2	51	0.18
Foam Press Helper	0817-1440	0.29	-	-	-	-	-	-
Foam Press Helper	1000-1440	-	20	2.6	12	7.2	54	0.21
Foam Press Helper	1000-1440	0.35	-	-	-	-	-	-
Mold Cleaner	0814-1448	-	15	4.9	32	6.9	42	0.18
Mold Cleaner	0814-1448	0.27	-	-	-	-	-	-
Backing Man Attendant	0902-1445	-	23	4.6	37	4.6	64	0.23
Backing Man Attendant	0902-1445	0.44	-	-	-	-	-	-
Foam Strips Attendant	0933-1448	-	12	4.9	6.8	5.7	32	0.14
Foam Strips Attendant	0933-1448	0.16	-	-	-	-	-	-
Lifter Foam Station	0930-1455	-	5.2	2.7	33	6.4	14	0.09
Lifter Foam Station	0930-1455	ND[2]	-	-	-	-	-	-
TWA Evaluation Criteria		19[3]	435[3]	980[4]	1910[4]	375[4]	435[4]	1.0

1. IPA/isopropanol; 1,1,1-TCE/1,1,1-trichloroethane.
2. Denotes none detected at a detection limit of 0.01 mg per sample.
3. ACGIH evaluation criteria.
4. NIOSH evaluation criteria.

TABLE VI

Personal Exposures to Organic Vapors on Mold Line No. 5 Department 452

Inland Division, GMC
Dayton, Ohio
HETA 77-011

October 1977

Sample Description	Sample Period	Air[1] Concentration - mg/m^3 2-Ethoxyethanol	Ethyl Benzene	IPA	1,1,1-TCE	Toluene	Xylene	Combined Exposure
Foam Strips Attendant	0830-1445	-	4.4	2.7	12	6.4	12	0.07
Foam Strips Attendant	0830-1445	ND[2]	-	-	-	-	-	-
Foam Strips Attendant	2050-2215	-	10	13	96	16	29	0.19
Foam Strips Attendant		ND	-	-	-	-	-	-
Backing Man Attendant	0737-1500	-	14	1.5	ND	6.0	41	0.16
Backing Man Attendant	0737-1500	ND	-	-	-	-	-	-
Bench Painter	1335-1445	-	4.7	5.3	ND	3.3	13	0.06
Bench Painter	0820-1300	ND	3.5	2.3	26	5.8	8.8	0.07
TWA Evaluation Criteria		19[3]	435[3]	980[4]	1910[4]	375[4]	435[4]	1.0

1. IPA/isopropanol; 1,1,1-TCE/1,1,1-trichloroethane
2. Denotes none detected at a detection limit of 0.01 mg per sample
3. ACGIH evaluation criteria
4. NIOSH evaluation criteria

TABLE VII

Personal Exposures to Organic Vapors on Mold Line No. 1 Department 452

Inland Division, GMC
Dayton, Ohio
HETA 77-011

October 1977

Sample Description	Sample Period	Air[1] Concentration - mg/m^3 2-Ethoxyethanol	Ethyl Benzene	IPA	1,1,1-TCE	Toluene	Xylene	Combined Exposure
Foam Strips Attendant	0705-1433	-	7.7	2.9	1.3	3.1	22	0.08
Foam Strips Attendant	0707-1433	ND[2]	-	-	-	-	-	-
Foam Process Helper	0712-1231	-	2.1	12	2.1	5.6	6.1	0.03
Foam Process Helper	0712-1231	ND	-	-	-	-	-	-
Backing Man Attendant	0720-1431	-	2.3	16	ND	2.9	6.5	0.05
Backing Man Attendant	0720-1431	ND	-	-	-	-	-	-
Stock Attendant	0728-1230	-	2.7	34	ND	7.3	7.3	0.08
Stock Attendant	0728-1230	ND	-	-	-	-	-	-
Deflashing - Cork Lift Attendant	0735-1455	-	2.7	8.6	ND	3.8	7.6	0.05
Deflashing - Cork Lift Attendant	0734-1455	0.01	-	-	-	-	-	-
TWA Evaluation Criteria		19[3]	435[3]	980[4]	1910[4]	375[4]	435[4]	1.0

1. IPA/isopropanol; 1,1,1-TCE/1,1,1-trichloroethane
2. Denotes none detected at a detection limit of 0.01 mg per sample
3. ACGIH evaluation criteria
4. NIOSH evaluation criteria

TABLE VIII

Personal Exposures to Organic Vapors on Mold Line No. 2 Department 453

Inland Division, GMC
Dayton, Ohio
HETA 77-011

October 1977

Sample Description	Sample Period	Air[1] Concentration - mg/m^3 2-Ethoxyethanol	Ethyl Benzene	IPA	1,1,1-TCE	Toluene	Xylene	Combined Exposure
Notch Former	0825-1437	-	6.5	20	ND	4.1	18	0.08
Notch Former	0825-1437	ND	-	-	-	-	-	-
Miscellaneous Bench	0900-1412	-	7.6	0.66	1.0	2.5	21	0.09
Miscellaneous Bench	0900-1412	ND	-	-	-	-	-	-
Stock Attendant: Roof Rails	0845-1415	-	2.5	0.75	15	1.0	6.7	0.05
Stock Attendant: Roof Rails	0845-1415	ND	-	-	-	-	-	-
Foam Strips Attendant	0855-1415	-	7.8	1.7	0.87	1.7	21	0.08
Foam Strips Attendant	0855-1415	ND	-	-	-	-	-	-
Foam Operator - Set-Up	0917-1415	-	2.2	1.5	11	0.67	6.0	0.04
TWA Evaluation Criteria		-	435[3]	980[4]	1910[4]	375[4]	435[4]	1.0

1. IPA/isopropanol; 1,1,1-TCE/1,1,1-trichloroethane
2. Denotes none detected at a detection limit of 0.01 mg per sample
3. ACGIH evaluation criteria
4. NIOSH evaluation criteria

TABLE IX

Personal and General Area Exposures to Organic Vapors on Mold Line No. 3 Department 475

Inland Division, GMC
Dayton, Ohio
HETA 77-011

October 1977

Sample Type[2]	Sample Description	Sample Period	Air[1] Concentration - mg/m^3							Combined Exposure
			nBA	2-EE	IPA	EB	1,1,1-TCE	Toluene	Xylene	
P	Foam Strips Attendant	0745-1440	-	-	21	7.2	-	ND	3.1	0.05
"	Foam Strips Attendant	0745-1440	ND[3]	0.12	-	-	-	-	-	0.12
P	Stock Attendant	0755-1430	-	-	4.1	2.5	ND	1.6	6.7	0.03
"	Stock Attendant	0755-1430	ND	ND	-	-	ND	-	-	-
P	Foam Process Operator	0810-1425	ND	-	11	2.6	ND	1.6	7.0	0.04
"	Foam Process Operator	0810-1425	ND	ND	-	-	-	-	-	-
P	Foam Process Helper	0820-1430	-	-	18	5.8	ND	1.6	16	0.07
"	Foam Process Helper	0814-1430	ND	ND	-	-	-	-	-	-
GA	Elevated Bench Area	0755-1434	-	-	-	-	3.5	3.8	-	0.01
"	Elevated Bench Area	0755-1434	ND	0.28	-	-	-	-	-	-
"	Operators Panel Area	0912-1330	-	-	-	-	-	.78	-	-
TWA Evaluation Criteria			-	19[4]	980[5]	435[5]	1910[5]	375[5]	435[5]	1.0

1. nBA/n-butylacetate; 2-EE/2-ethoxyethanol; EB/ethyl benzene; 1,1,1-TCE/1,1,1-trichloroethane
2. P/personal; GA/general area
3. Denote none detected at a detection limit of 0.01 mg per sample
4. ACGIH evaluation criteria
5. NIOSH evaluation criteria

TABLE X

Personal Exposures to Organic Vapors in Department 473

Inland Division, GMC
Dayton, Ohio
HETA 77-011

October 1977

Sample Description	Sample Period	Air[1] Concentration - mg/m^3							Combined Exposure
		nBA	2-EE	IPA	EB	1,1,1-TCE	Toluene	Xylene	
Strip Hanger	0825-1450	-	-	2.9	4.2	2.1	6.6	12	0.06
Strip Hanger	0825-1450	0.26	ND[2]	-	-	-	-	-	-
Strip Hanger	0924-1450	-	-	3.3	7.4	73	3.3	21	0.12
Strip Hanger	0924-1450	ND	0.15	-	-	-	-	-	
Weight Hanger	2100-2300	-	-	3.6	1.6	0.4	3.6	4.0	0.03
Weight Hanger	2055-2300	-	ND	-	-	-	-	-	-
Weight Hanger	2055-2245	-	-	6.8	ND	ND	1.4	0.9	0.02
Weight Hanger	2100-2345	-	-	-	-	-	-	-	-
TWA Evaluation Criteria		710[3]	19[3]	980[4]	435[3]	1910[4]	375[4]	435[4]	1.0

1. nBA/n-butylacetate; 2-ethoxyethanol; ethyl benzene; 1,1,1-trichloroethane
2. Denotes none detected at a detection limit of 0.01 mg per sample
3. ACGIH evaluation criteria
4. NIOSH evaluation criteria

TABLE XI

Personal Exposures to Organic Vapors in Department 474

Inland Division, GMC
Dayton, Ohio
HETA 77-011

October 1977

Sample Description	Sample Period	Air[1] Concentration - mg/m^3							Combined Exposure
		nBA	2-EE	IPA	EB	1,1,1-TCE	Toluene	Xylene	
Group Attendant Flash Roller	0846-1446	-	-	10.6	-	13	7.3	-	0.04
Group Attendant Flash Roller	0846-1446	ND[2]	ND	8.5	-	-	-	-	-
Glue Machine Operator	2030-2245	-	-	24	0.69	ND	2.4	1.4	0.05
Glue Machine Operator	2030-2245	ND	ND	-	-	-	-	-	-
Glue Machine Operator	2030-2250	-	-	2.1	5.3	ND	6.3	15	0.04
Glue Machine Operator	2030-2250	ND	ND	-	-	-	-	-	-
TWA Evaluation Criteria		-	-	980[3]	435[4]	1910[3]	375[3]	435[3]	1.0

1. nBA/n-butylacetate; 2-EE/2-ethoxyethanol; IPA/isopropanol; 1,1,1-TCE/1,1,1-trichloroethane
2. Denotes none detected at a detection limit of 0.01 mg per sample
3. NIOSH evaluation criteria
4. ACGIH evaluation criteria

TABLE XII

Personal Exposures to Organic Vapors in Department 429

Inland Division, GMC
Dayton, Ohio
HETA 77-011

October 1977

Sample Description	Sample Period	Air[1] Concentration - mg/m^3 2-Ethoxyethanol	Ethyl Benzene	n-Butylacetate	IPA	1,1,1-TCE	Toluene	Xylene	Combined Exposure
Data Clerk	0905-1415	-	7.3	-	2.9	2.7	3.4	22	0.07
Data Clerk	0905-1416	-	-	0.61	-	-	-	-	-
Data Clerk	0721-1442	-	7.1	-	1.5	5.2	3.7	21	0.06
Data Clerk	0721-1442	0.23	-	-	-	-	-	-	-
TWA Evaluation Criteria		19[2]	435[2]	710[2]	980[3]	1910[3]	375[3]	435[3]	1.0

1. IPA/isopropanol; 1,1,1-TCE/1,1,1-trichloroethane
2. ACGIH evaluation criteria
3. NIOSH evaluation criteria

TABLE XIII

Personal Breathing Zone Exposures to Organic Vapors in Department 464

Inland Division, GMC
Dayton, Ohio
HETA 77-011

October 1977

Sample Description	Sample Period	Air[1] Concentration - mg/m^3						Combined Exposure
		nBA	IPA	Ethyl Benzene	1,1,1-TCE	Toluene	Xylene	
Straight Table Mold Oper.	0647-1541	-	0.75	6.7	1.6	27	19	0.13
Straight Table Mold Oper.	0647-1541	0.71	-	-	-	-	-	-
Straight Table Mold Oper.	0658-1548	-	3.2	6.1	37	40	17	0.18
Straight Table Mold Oper.	0658-1548	0.24	-	-	-	-	-	-
Straight Table Mold Oper.	0710-1551	-	2.5	6.7	35	24	19	0.14
Straight Table Mold Oper.	0710-1551	0.59	-	-	-	-	-	-
Straight Table Mold Oper.	0717-1545	-	1.9	6.6	39	24	18	0.14
Straight Table Mold Oper.	0717-1545	0.64	-	-	-	-	-	-
Straight Table Mold Oper.	0725-1553	-	1.3	8.1	1.8	21	18	0.12
Straight Table Mold Oper.	0725-1553	0.49	-	-	-	-	-	-
Rotary Table Foam Press Oper.	0700-1433	-	1.2	7.6	N.D.[2]	26	21	0.14
Rotary Table Foam Press Oper.	0748-1437	-	0.75	9.2	N.D.	22	26	0.14
Rotary Table Foam Press Oper.	0724-1437	0.47	-	-	-	-	-	-
Rotary Table Foam Press Oper.	0753-1100	-	0.20	9.6	N.D.	24	27	0.14
Rotary Table Foam Press Oper.	0748-1439	-	1.1	9.8	29	21	27	0.15
Rotary Table Foam Press Oper.	0726-1300	-	0.48	8.3	N.D.	14	-	0.06
Rotary Table Foam Press Oper.	0726-1435	0.14	-	-	-	-	-	-
TWA Evaluation Criteria		710[3]	980[4]	435[3]	1910[4]	375[4]	434[4]	1.0

1. nBA/n-butyl acetate; IPA/isopropanol; 1,1,1-TCE/1,1,1-trichloroethane
2. Denotes none detected at a detection limit of 0.01 mg per sample
3. ACGIH evaluation criteria
4. NIOSH evaluation criteria

TABLE XIV

Personal Breathing Zone Exposures to Organic Vapors in Department 464

Inland Division, GMC
Dayton, Ohio
HETA 77-011

October 1977

Sample Description	Sample Period	Air[1] Concentration - mg/m^3						Combined Exposure
		nBA	IPA	Ethyl Benzene	1,1,1-TCE	Toluene	Xylene	
Rotary Table Mold Oper.	0703-1438	-	6.8	8.1	83	24	22	0.16
Rotary Table Mold Oper.	0703-1438	0.5	-	-	-	-	-	-
Rotary Table Mold Oper.	0707-1435	-	7.4	8.1	35	23	22	0.10
Rotary Table Mold Oper.	0707-1435	0.37	-	-	-	-	-	-
Rotary Table Mold Oper.	0735-1440	-	1.7	7.4	33	12	20	0.09
Rotary Table Mold Oper.	0735-1440	ND	-	-	-	-	-	-
Rotary Table Mold Oper.	0736-1444	-	-	-	0.92	20	-	0.05
Rotary Table Mold Oper.	0743-1413	-	20	5.4	ND	13	14	0.09
Rotary Table Mold Oper.	0743-1413	ND[2]	-	-	-	-	-	-
Foam Ser. Rotary Attd. Table	0727-1433	-	-	-	23	20	-	0.06
Foamer Operator	0722-1349	-	4.9	8.3	14	25	22	0.15
Counter	0659-1434	-	1.9	9.7	1.0	29	26	0.16
Counter	1129-1434	0.42	-	-	-	-	-	-
Trim Line Misc. Bench	0720-1442	-	1.6	8.4	37	28	23	0.17
Trim Line Misc. Bench	0722-1201	0.69	-	-	-	-	-	-
Trim Line Misc. Bench	0712-1440	-	1.5	9.8	53	36	26	0.21
TWA Evaluation Criteria		710[3]	980[4]	435[3]	1910[4]	375[4]	434[4]	1.0

1. nBA/n-butyl acetate; IPA/isopropanol; 1,1,1-TCE/1,1,1-trichloroethane
2. Denotes none detected at a detection limit of 0.01 mg per sample
3. ACGIH evaluation criteria
4. NIOSH evaluation criteria

TABLE XV

Personal Breathing Zone Exposures to Organic Vapors in Department 464

Inland Division, GMC
Dayton, Ohio
HETA 77-011
October 1977

Sample Description	Sample Period	Air[1] Concentration - mg/m^3						
		nBA	IPA	Ethyl Benzene	1,1,1-TCE	Toluene	Xylene	Combined Exposure
Straight Table Foam Ser. Attd.	0648-1435	-	ND[2]	5.7	73	32	16	0.17
Straight Table Foam Ser. Attd.	0648-1345	0.35	-	-	-	-	-	-
Straight Table Foam Ser. Attd.	1223-1440	-	10	6.6	134	19	18	0.18
Straight Table Trim Line	0654-1307	-	2.5	4.1	43	31	12	0.14
Straight Table Trim Line	1134-1307	1.1	-	-	-	-	-	-
Straight Table Miscel. Bench	0659-1307	-	3.2	4.0	7.9	30	11	0.12
Straight Table Miscel. Bench	0705-1311	1.6	-	-	-	-	-	-
Rotary Table Foam Oper.	0722-1434	-	ND	5.2	ND	14	15	0.08
Rotary Table Foam Oper.	0722-1434	ND	-	-	-	-	-	-
Rotary Table Foam Oper.	0732-1427	-	2.6	8.3	27	47	8.3	0.18
Rotary Table Foam Oper.	0745-1300	-	ND	6.5	61	42	19	0.20
Rotary Table Miscel. Bench	0745-1300	ND	-	-	-	-	-	-
Foam Service Attd.	0806-1420	-	ND	6.1	31	34	17	0.16
Foam Service Attd.	0806-1420	ND	-	-	-	-	-	-
Foamer Operator	1108-1508	-	ND	5.1	49	20	15	0.12
Foamer Operator	1108-1508	ND						-
Miscel. Bench Mold Oper.	0725-1439	-	2.2	10	17	4.9	30	0.11
TWA Evaluation Criteria		710[3]	980[4]	435[3]	1910[4]	375[4]	434[4]	1.0

1. nBA/n-butyl acetate; IPA/isopropanol; 1,1,1-TCE/1,1,1-trichloroethane
2. Denotes none detected at a detection limit of 0.01 mg per sample
3. ACGIH evaluation criteria
4. NIOSH evaluation criteria

TABLE XVI

General Area Concentrations of Organic Vapors in Department 464

Inland Division, GMC
Dayton, Ohio
HETA 77-011

October 1977

Sample Description	Sample Period	Air[1] Concentration - mg/m^3						
		nBA	IPA	Ethyl Benzene	1,1,1-TCE	Toluene	Xylene	Combined Exposure
Straight Table Press Bench	1940-2225	-	-	-	-	29	-	-
Straight Table Press Bench	1940-2225	0.5	-	-	-	-	-	-
Straight Table Foamer Panel	1940-2230	-	-	-	-	32	-	-
Foamer Area	2015-0049	-	6.6	-	39	22	-	0.08
Foamer Area	2015-0049	-	6.5	-	-	-	-	-
Series Wash Basin Area	1930-2045	-	65	-	-	-	-	-
Series Wash Basin Area	0047-0147	-	140	-	-	-	-	-
Mixer Being Cleaned	0001-0148	-	-	-	9.1	8.6	-	0.01
TWA Evaluation Criteria		710[2]	980[3]	435[2]	1910[3]	375[3]	434[3]	1.0

1. nBA/n-butyl acetate; IPA/isopropanol; 1,1,1-TCE/1,1,1-trichloroethane
2. ACGIH evaluation criteria
3. NIOSH evaluation criteria

TABLE XVII

Rashes* Among Participants With Frequently Occurring Job Titles
in the Seven Target Departments

Inland Division, GMC
Dayton, Ohio
HETA 77-011

October 1977

Job Code and Title	All Shifts Combined		First Shift	
	Number of Participants	Number and (%) With Current Rash*	Number of Participants	Number and (%) With Rash* by Examination
271 Foam Operator	7	0 -	4	0 -
323 Group Attendant - Foam Strips	27	2 (7%)	17	2 (12%)
385 Strip Hanger	9	0 -	4	2 (50%)
706 Latex Process Operator	6	0 -	4	0 -
752 Miscellaneous Bench	38	6 (16%)	19	2 (11%)
762 Foam Molder	28	7 (25%)	17	1 (6%)
960/961 Trucker or Sweeper	8	1 (13%)	4	2 (50%)
Total	123	16 (13%)	69	9 (13%)

* See text for definitions and explanations