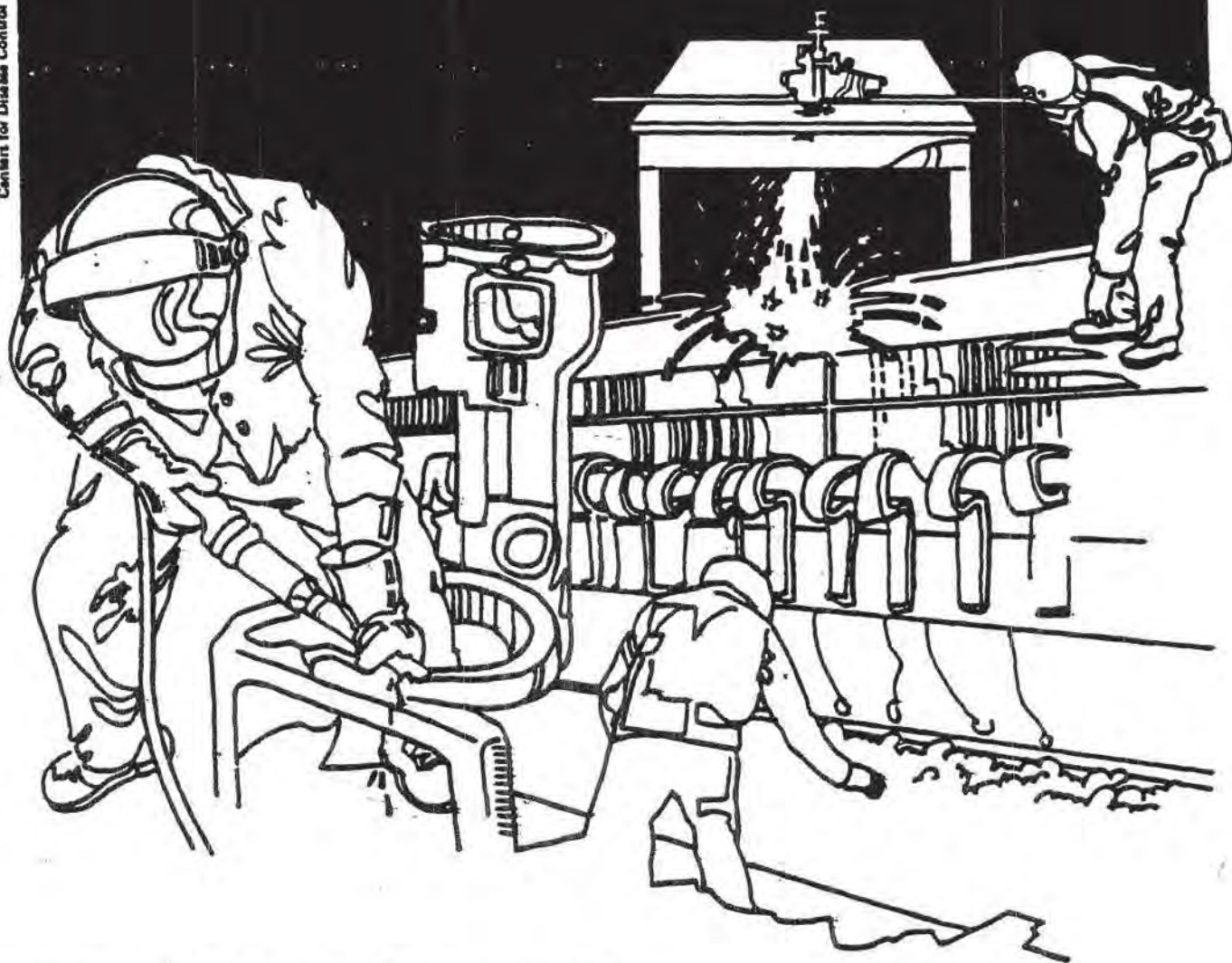


# NIOSH



## Health Hazard Evaluation Report

HETA 84-371-1729  
ORBITRON PRODUCTS  
DELPHOS, 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 84-371-1729  
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DELPHOS, OHIO

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## I. SUMMARY

In June 1984, the National Institute for Occupational Safety and Health (NIOSH) received a request from the United Auto Workers Union (UAW) to investigate respiratory symptoms at Orbitron Products, Delphos, Ohio. The plant employs approximately 80 workers in the manufacture of a wide range of industrial, home, and automotive products. The primary chemical exposure of concern was ethyl cyanoacrylate (CA).

During an initial survey conducted July 31 - August 1, 1984, NIOSH investigators obtained personal breathing zone air samples for methyl ethyl ketone (MEK) and area air samples for CA. MEK vapor levels ranged from 17 to 430 mg/m<sup>3</sup>; the NIOSH recommended exposure limit for MEK is 590 mg/m<sup>3</sup>. Airborne CA levels ranged up to 1.6 mg/m<sup>3</sup>; the American Conference of Governmental Industrial Hygienists (ACGIH) recommends an exposure limit of 8 mg/m<sup>3</sup> for a similar compound, methyl cyanoacrylate. There are currently no NIOSH or OSHA recommended exposure limits for CA.

During this same visit, a total of 73 questionnaires were administered to all available employees. Information was obtained which included a work history, the occurrence of symptoms which may be indicative of asthma, and a brief medical history.

On November 5-8, 1984, NIOSH conducted a follow-up visit consisting of a medical survey offered to all workers who reported shortness of breath, chest tightness, or wheezing on the initial questionnaire, and to a nearly equal number of asymptomatic individuals. A total of 43 workers participated; 23 who were among the symptomatic group and 20 who had been asymptomatic. This survey included: pre- and post-shift spirometry; measurement of peak expiratory flow (PEF) every three hours (while awake) for seven days; and medical examinations performed independently by two physicians. Five participants were diagnosed by both physicians as probably having occupational asthma. An additional eight participants received that diagnosis (probable occupational asthma) from one or the other of the physicians. Seven participants had evidence of symptomatic bronchial lability, based upon variability in peak expiratory flow (PEF) determinations exceeding 20% on at least one day's testing. One or the other physician diagnosed probable occupational asthma in five of these seven participants. Three of these five diagnosed occupational asthmatics with significant bronchial lability were former glue operators, from which we infer CA exposure. Two of the five had never been glue operators.

After receiving the preliminary results from NIOSH, the company redesigned the work stations and ventilation system for the CA operation. Subsequently, on May 14, 1985, NIOSH conducted follow-up CA vapor sampling to evaluate the performance of the new system. Analysis showed that work station CA vapor concentrations ranged from 0.1 to 0.3 mg/m<sup>3</sup> with a mean of 0.2 mg/m<sup>3</sup>.

On the basis of the data collected in this evaluation, it was not possible to determine conclusively whether exposure to ethyl cyanoacrylate (CA) resulted in asthmatic reactions among workers. Given the prevalence of respiratory symptoms which were reported, recommendations for reduced exposure to CA were made, and subsequently adopted. Additional recommendations are presented in Section VII.

Keywords: SIC 3714 (Motor Vehicle Parts), ethyl cyanoacrylate, methyl ethyl ketone, asthma, respiratory symptoms, spirometry, peak expiratory flow.

## II. INTRODUCTION

In June 1984, the National Institute for Occupational Safety and Health (NIOSH) received a request from the United Auto Workers Union, Region 2-B, for a health hazard evaluation at Orbitron Products, Delphos, Ohio. The primary concern was exposure to ethyl cyanoacrylate among a number of production workers. There was secondary concern about exposure to methyl ethyl ketone.

On July 30 - August 1, 1984, NIOSH conducted an initial visit during which environmental sampling for ethyl cyanoacrylate and for methyl ethyl ketone was conducted. Additionally, a medical questionnaire was administered to each employee.

On November 5-8, 1984, NIOSH conducted a follow-up visit, consisting of a medical survey offered to all workers who reported symptoms on the initial questionnaire, and of an equal number of asymptomatic controls. A letter summarizing this visit was distributed on November 28, 1984.

On May 14, 1985, NIOSH conducted additional environmental monitoring to assess the efficacy of the new ventilation system and work practices which had been implemented by the company.

Notification letters, including results and interpretation of individual medical testing, were distributed on July 8, 1985.

## III. BACKGROUND

This seven year old plant employs about 80 workers to manufacture a wide range of industrial, home, and automotive products.

### Methyl Ethyl Ketone

Methyl ethyl ketone (MEK) is used by one to three workers per shift to clean various rubber and plastic parts. The parts are simply wiped clean with an MEK-dampened cloth. Rubber gloves are worn to prevent skin contact with MEK.

### Ethyl Cyanoacrylate

In late 1983, Orbitron Products began using ethyl cyanoacrylate (CA) to assemble automobile gear shift boots. At the time of NIOSH's initial two visits, the adhesive process was performed at eight tables where a total of 4-8 workers per shift assembled the boots. The molded polyvinylchloride boots were glued to a steel insert using 2-ounce squeeze bottles of "Hot Stuff", manufactured by Satellite City, Simi,



California. This adhesive is a "superglue-type" product that contains ethyl cyanoacrylate as the primary component. About 10 boots per worker per hour were glued and placed to dry on pegboard exhaust hoods at the rear of each table.

At the time of our May 1985 visit, substantial modifications of the adhesive process had occurred. A new ventilation system was used to enclose as much of the process as possible. The freshly glued boots are now placed on a conveyor belt which travels through an 18 inch-diameter exhaust duct that is 20 feet long. The conveyor is timed (about 8 minutes) so that the glue is dry when the parts emerge from the other end of the duct.

#### IV. EVALUATION DESIGN AND METHODS

##### A. Environmental

On July 31 through August 1, 1984, five personal breathing-zone air samples for MEK were collected on ambersorb tubes at a flow rate of 0.05 liters per minute. The samples were desorbed with carbon disulfide and analyzed by gas chromatography according to NIOSH Method 2500.

During the July/August 1984 survey, ten air samples for ethyl cyanoacrylate were collected. These were collected at a flow rate of 1.0 liters per minute for seven hours through midjet impingers containing 15 ml of 0.5N sodium hydroxide. Due to the corrosive nature of the impinger solution, personal breathing-zone samples could not safely be collected. Therefore, the impingers were suspended over the work tables within one or two feet of the workers' breathing zones. The samples were analyzed for ethyl cyanoacrylate by visible spectroscopy.<sup>1</sup> During the May 1985 survey, five area air samples were collected to help assess the performance of the new ventilation system. A process air sample was collected at the opening of the exhaust duct. The other four samples were collected near work stations. The performance of local exhaust ventilation systems was assessed by smoke tube observations and linear air velocity measurements using a Kurz Model 441.©

##### B. Medical/Epidemiologic

In July/August 1984, a questionnaire was administered to 73 individuals. Included in the group were all 69 current employees and 4 of the 10 people who were either on vacation or on medical leave of absence at that time. The questionnaire consisted of a work history, smoking history, personal and family medical histories, and questions concerning respiratory symptoms. These

questions attempted to determine temporally the onset and occurrence of the following symptoms: wheezing or whistling breath, shortness of breath, chest tightness, cough, and mucous membrane irritation.

Using information obtained from the questionnaires, people were classified as symptomatic if they reported either wheezing or whistling breath, chest tightness, or shortness of breath during the previous month.

The follow-up survey in November 1984 sought to include all 26 people so classified, and a random selection of 26 of the 48 people who were asymptomatic. Due to refusals and people otherwise unavailable, the population for the follow-up survey numbered 43: 23 people with symptoms and 20 people without.

The protocol for the follow-up survey, conducted November 5-8, 1984, consisted of: pre- and post-shift spirometry using an Ohio Medical Model 822 dry rolling seal spirometer; measurement of peak expiratory flow rate, performed every 3 hours (while awake) for 7 days, using a mini-Wright Peak Flow Meter; and medical examinations performed independently by two physicians trained in occupational medicine.

In addition, blood was drawn from 13 individuals, 7 who had reported one or more symptoms on the initial questionnaire, and 6 who had not. The sera were sent to the University of Cincinnati where they were analysed for specific IgE antibodies to four chemicals (phthalic anhydride, p-tolyl isocyanate, hexamethylene diisocyanate, and methylene di-p-phenyldiisocyanate) conjugated to human serum albumin (AZ-HSA) by the radioallergosorbent test (RAST).<sup>2, 3</sup> Ethyl-2-cyanoacrylate was too volatile to be used successfully for this test. Therefore, these four chemicals were used as surrogates.

## V. EVALUATION CRITERIA

### A. Environmental 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. OSHA is empowered to set and enforce exposure limits for the workplace while NIOSH's mandate is to conduct research and forward recommendations to all concerned parties.

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.

#### 1. Methyl Ethyl Ketone

Methyl ethyl ketone (MEK) can produce a dry, scaly, and fissured dermatitis after repeated exposure. High vapor concentrations may irritate the conjunctiva and mucous membranes of the nose and throat, producing eye and throat symptoms. Narcosis is also possible at high concentrations, with headache, nausea, light headedness, incoordination, and unconsciousness<sup>4, 5</sup>. The OSHA standard, NIOSH recommendation, and ACGIH TLV for MEK are each 590 mg/m<sup>3</sup>. ACGIH also has a short-term exposure limit (15 minutes) of 885 mg/m<sup>3</sup>.



## 2. Ethyl-2-cyanoacrylate

Ethyl-2-cyanoacrylate (CA) is a substance for which little toxicity information exists. Alkyl-2-cyanoacrylate adhesives, as a group, are described as strong irritants, affecting the eyes, nose and throat.<sup>1</sup> Of these substances, most of the reports concern methyl-2-cyanoacrylate. Studies have indicated an odor threshold for methyl-2-cyanoacrylate ranging from 4 to 20 milligrams per cubic meter ( $\text{mg}/\text{m}^3$ ). The threshold for throat and nose irritation is reported at 8 to 12  $\text{mg}/\text{m}^3$ , followed by eye irritation and burning at about 16  $\text{mg}/\text{m}^3$ .<sup>1</sup> There is an assumption that the other cyanoacrylates (ethyl and butyl) are equally irritating, but they are somewhat less volatile and therefore evaporate more slowly.<sup>1</sup> The ACGIH TLV for methyl cyanoacrylate is 8  $\text{mg}/\text{m}^3$ .

Though most articles only describe acute irritative effects, recently there was a report of CA causing asthma as well in a hobbyist.<sup>6</sup> Additionally, NIOSH recently investigated another workplace where pulmonary sensitization, due probably to CA exposure, seemed to have occurred.<sup>7</sup> An individual can react to minute concentrations of an asthmagen once sensitization has occurred.

### B. Medical Criteria

#### Asthma

The American Thoracic Society has defined asthma as "a disease characterized by the increased responsiveness of the trachea and bronchi to various stimuli and manifested by widespread narrowing of the airways that changes in severity either spontaneously or as a result of therapy."<sup>8</sup> Scadding defines asthma as "a disease characterized by wide variations over short periods of time in resistance to flow in intrapulmonary airways."<sup>9</sup> From either definition, it is clear that the key concepts are "widespread narrowing of the airways", "changes in severity", and "various stimuli."

In these definitions, symptoms are not mentioned. However, a medical diagnosis clearly is prompted by an individual's symptoms. Asthma is usually diagnosed in a person for whom episodes of wheezing and shortness of breath, with demonstrable increases in resistance to airflow in the pulmonary airways, are interspersed between symptom-free (or relatively symptom-free) intervals.

To diagnose asthma, it is desirable to have some objective measure of airways lability, i.e., physiologically significant fluctuations in airways resistance. We have attempted to obtain evidence of the

latter by (1) performing pre- and post-shift spirometry, and (2) by serial measurements of peak expiratory flow rate (PEF) over a seven day period.

1. Spirometry (pulmonary function tests or PFTs)

Pulmonary function test (PFT) results for each individual were compared to age-, sex-, race-, and height- specific predicted values which have been compiled in large-scale studies.<sup>10</sup> Measurements obtained from an individual's test included: forced expiratory volume in one second ( $FEV_1$ ), forced vital capacity (FVC), and the ratio of those two measurements ( $FEV_1/FVC$ ). A result was considered abnormal if the  $FEV_1$  or the FVC is less than 80% of the predicted value, or if the  $FEV_1/FVC$  ratio is less than 70%.

Obstructive lung disease (asthma is a condition of reversible airways obstruction) can be indicated by reduced  $FEV_1$  or reduced  $FEV_1/FVC$  ratio. Restrictive lung disease can be indicated by reduced FVC. A combination of restrictive and obstructive disease may be indicated if both the FVC and the  $FEV_1/FVC$  ratio are reduced.

Reversible airways obstruction may be inferred if the forced expiratory volume in one second drops over the course of a workshift by a significant amount. Although we cannot necessarily define what a significant amount might be, we have taken a post-shift minus pre-shift difference in  $FEV_1$  percent of predicted of -5% or greater (in a negative direction) to be an amount that might possibly reflect reversible airways obstruction over the course of a workshift.

2. Peak Expiratory Flow Results

Each person's peak expiratory flow rate (PEFR) measurements were obtained every 3 hours (while awake) for 7 days. Each individual was asked to do the following. Every 3 hours, s/he would make three attempts at forcefully exhaling after maximal inspiration into the mini-Wright Peak Flow Meter. All three results were noted on a data sheet by the individual. At that time, s/he would also note whether or not, during the past 3 hours, s/he had: worked with ethyl cyanoacrylate (CA); been exposed to CA; been exposed to other chemicals; experienced shortness of breath; experienced wheezing; experienced chest tightness; or experienced coughing. For any one time interval, the maximum reading of the three trials was used in our subsequent analyses.

PEFRs vary throughout the day in normal persons. However, asthmatic persons are said "usually to show a difference of at least 15 percent between mean morning and evening values."<sup>11</sup> Along these lines, we have taken as evidence of a physiologically significant variation in airways resistance, a 20 percent difference on any one day's PEFR measurements, comparing maximum and minimum values. For example, in an individual whose maximum and minimum PEFRs on a particular day were 510 and 330 liters per second, respectively, then the variation in PEFR on that day would be  $(510-330)/510=35.2$  percent, and the individual would be taken to have evidence of physiologically significant (and reversible) airways obstruction on that day. If, at the time of the decrement in PEFR, the individual also had symptoms of wheezing, shortness of breath, or chest tightness, then he/she would be classified as having asthma.

This definition of asthma does not in itself impute cause. Neither do the definitions given above by the American Thoracic Society and by Scadding. Indeed, the "various stimuli" of the American Thoracic Society's definition are wide-ranging, and consist only in part of airborne allergens. To impute cause to the asthma, we must have additional evidence of some type. To impute an occupational cause to the asthma, that evidence might include a compatible temporal pattern to the asthmatic attacks. Such evidence of a compatible pattern might include symptoms of wheezing, shortness of breath, or chest tightness that occur in association with workplace exposures, that abate upon leaving the worksite, and that are less frequent (preferably non-existent) on days off and on vacation.

## VI. RESULTS, DISCUSSION, AND CONCLUSIONS

### A. Environmental

Airborne exposures to MEK ranged from 17 to 430 mg/m<sup>3</sup> (Table 1). The highest concentration was measured during a one-hour job of cleaning clock parts on July 31. The NIOSH recommended exposure limit for MEK is 590 mg/m<sup>3</sup> for up to a 10-hour workday, 40-hour work week.

At the time of the July/August 1984 survey, the glueing table ventilation system appeared to work well for exhausting ethyl cyanoacrylate vapors from parts that were placed to dry on the pegboard. However, the system did not appear to offer much control of vapors during the application of the adhesive, which was usually done at distances of one to two feet from the pegboard. Air concentrations of ethyl cyanoacrylate were non-detectable at tables 1, 2, 5, and 8. Air concentrations of 1.6 mg/m<sup>3</sup> and 0.1 mg/m<sup>3</sup>

were found at table 7. The air velocity through each of the pegboard units was 100 feet per minute (fpm). However, the capture velocity of this system dropped to less than 30 fpm within just several inches of the pegboard. Several instances were also noted where some glueing workers ran out of pegboard space for placing drying parts, thus causing them to leave freshly glued parts in areas outside the reach of local exhaust ventilation.

These low cyanoacrylate vapor levels were most likely not due to the efficiency of the local exhaust ventilation system, but rather the large amount of dilution ventilation provided by the powerful floor fans being used for cooling comfort in the open work area. Most of the work stations had air velocities up to 500 fpm being provided by these fans. Tables 7 and 8 did not have a fan directed toward them, which may explain why Table 7 was the only location where ethyl cyanoacrylate was detected.

It was concluded that further sampling should be conducted to determine if cyanoacrylate exposures would be higher during cooler weather when the floor fans are not used. Instead, the company decided to develop new local exhaust ventilation and they asked NIOSH to conduct a follow-up visit to assess the new system.

During the May 1985 follow-up visit, work station ethyl cyanoacrylate concentrations ranged from 0.1 to 0.3 mg/m<sup>3</sup> with a mean of 0.2 mg/m<sup>3</sup> (Table III). The ACGIH recommended exposure limit for a similar compound, methyl cyanoacrylate, is 8 mg/m<sup>3</sup>. The face velocity of the exhaust hood was found to be 900-1200 fpm. Smoke tube observations taken near the opening of the hood where the parts are glued, showed that the system provided ample capture efficiency, as long as care was taken to make sure that floor fans were not directed toward the glueing area, where they may interfere with capture efficiency. Also, the NIOSH investigator worked with each Glueing Operator to ensure that they understood that glueing should be done within proper capture range of the exhaust hood. It was concluded that the new process would provide year-round control of cyanoacrylate exposures well below what would be expected to cause adverse health effects among non-sensitized individuals.

#### B. Medical/Epidemiologic

##### 1. Questionnaire -- August 1984

The questionnaire was administered to 73 people. Of these 73, 19 (26%) reported that, in the previous month, they had experienced wheezing or whistling breath, 16 (22%) reported episodes of shortness of breath, and 15 (21%) reported chest tightness.

Twenty-one of the 73 (29%) stated that they worked with cyanoacrylate at least 1 day per week. Comparing the reporting of symptoms by those people who worked with cyanoacrylate at least once per week with those people who did not, cyanoacrylate workers were significantly ( $p < 0.01$ ) more likely to have experienced wheezing or whistling breath (Table IV). They were also more likely ( $p < 0.01$ ) to have experienced episodes of shortness of breath (Table V). However, they were not more likely ( $p > 0.05$ ) to have experienced chest tightness (Table VI).

People who worked with cyanoacrylate at least once per week were also significantly ( $p < 0.05$ ) more likely to report that they often had: itchy, watery, or tearing eyes at work; frequent sneezing at work; a stuffy nose while at work; and an itchy, runny nose at work (Table VII).

People who worked with cyanoacrylate were more likely to be female. They were also more likely to have worked less than one year at their current job (Table VIII).

Comparing, again, those who worked with cyanoacrylate at least once a week with those who did not, there were no significant differences as far as age, atopic status (personal or family history of allergic disease), or smoking history (Table IX).

## 2. Physicians' Examinations

Each of the 43 people who participated in the follow-up study was examined separately by 2 physicians (Table X). The evaluation consisted of the taking of a clinical history, and a chest examination. For 27 of the people, the 2 doctors arrived at the same diagnosis. Where they disagreed, it did not appear that one doctor was more likely than the other to diagnose an illness.

Both physicians were in agreement that five people had occupational asthma (asthma resulting from their work at Orbitron). An additional eight people were assessed by only one or the other doctor as having occupational asthma.

## 3. Pulmonary Function Tests

Thirty of the 43 people had normal results of both their pre-shift and post-shift pulmonary function testing.

When the group was divided according to status as an ethyl cyanoacrylate (CA) worker at the time of the testing (November 5-8, 1984), the following results were observed: seven current



CA workers had normal PFT results, two had a pattern (post-shift only) possibly indicative of restrictive lung disease, and two had a pattern possibly indicative of obstructive lung disease; seven of eleven former CA workers had normal PFT results, while two showed patterns of both obstructive lung disease and restrictive lung disease, and two showed a pattern consistent with possible obstructive lung disease; sixteen of 21 people who never worked with CA had normal PFT results, the results of four people were indicative of obstructive lung disease (two were marginal), and the results of one person were indicative of both obstructive and restrictive lung disease (Table XI).

Post-shift minus pre-shift percent of predicted FEV<sub>1</sub> was examined, to attempt to find physiological evidence to validate the diagnoses of asthma. Five participants had a post-shift minus pre-shift change of at least -5%. The physicians did not concur on the diagnosis in any individual. The diagnoses were:

- (1) occupational asthma, other respiratory symptoms
- (2) other respiratory symptoms, occupational asthma
- (3) non-occupational asthma, other respiratory symptoms
- (4) bronchitis/emphysema, other respiratory symptoms,
- (5) other respiratory symptoms, no respiratory disease.

Only three persons were considered to possibly have occupational asthma by one or the other of the physicians. Ten other participants, considered to have occupational asthma by one or the other of the physicians, had no significant drop in FEV<sub>1</sub> over the course of the workday.

#### 4. Peak Expiratory Flow Results

A total of 11 individuals had one or more days during which their peak expiratory flow results (PEFR) exhibited a variability ((best minus worst) divided by best) of at least 20% (Table XII).

Comparing the physicians' diagnoses with evidence of significant (greater than 20%) symptomatic bronchial lability, five of the 13 participants (38%) in whom one or the other physician diagnosed occupational asthma had significant symptomatic bronchial lability, suggestive of asthma. Two of 30 in whom occupational asthma was not diagnosed by either physician (7%) also had significant symptomatic bronchial lability. The PEF data was thus an imperfect validation ( $\chi^2=6.73$ ) of the physicians' diagnoses. All seven reported the onset of symptoms since beginning work at Orbitron. However, we were not able to demonstrate a temporal association

between exposure to CA and a decrement in the peak flow. Four of these workers were on medical leave of absence and had not been in the plant for a number of months.

Examining the total study population of 43 people, six of the 21 (28%) people who had never worked with ethyl cyanoacrylate (CA) showed a day's variability of at least 20%, one of eleven (9%) current CA workers exhibited variability at least 20%, and four of eleven (36%) former CA workers had that level of variability.

Looking at the mean daily PEF variation by status as a CA worker, current CA workers had a variation of 7.31%, former CA workers had a mean daily variation of 11.89% and those who never worked regularly with CA had a daily PEF variation of 9.64% (Table XIII). Comparing these differences using Duncan's multiple range test, it was found that the mean daily PEF variation for each group differed significantly ( $p < 0.05$ ) from the variation for each of the other two groups.

Comparing those who had never worked with CA with those who had, the daily PEF variability for the two groups were 9.605% and 9.596%, respectively. This difference was statistically insignificant ( $p = 0.99$ ).

We also compared people based upon whether they reported being exposed to CA on a particular day (Table XIV). Those who reported being exposed did not have a significantly greater PEF variability (9.20% vs 9.71%,  $p = 0.61$ ) than those who reported not being exposed.

We then assessed whether the symptoms reported at the time of PEF testing were indicative of a measurable drop in peak flow. This was done by comparing the daily PEF variability for those who reported a selected symptom versus those who did not report that symptom, on a day-by-day basis.

Those people who reported shortness of breath on a given day had statistically significantly greater PEF variability (Table XV) than did those who did not report that symptom (14.48% vs 7.93%,  $p = 0.0001$ ).

The same relationship obtained for: wheezing (Table XVI) (13.52% vs 8.34%,  $p = 0.0001$ ); chest tightness (Table XVII) (13.63% vs 7.80%,  $p = 0.0001$ ); and cough (Table XVIII) (11.88% vs 8.28%,  $p = 0.0001$ ).

5. Immunology (RAST)

None of the 13 participants in the immunologic testing exhibited elevated IgE antibodies to any of the four chemicals tested (Table XIX).

6. Medical/Epidemiologic Discussion and Conclusions

The determination of whether ethyl cyanoacrylate (CA) caused occupational asthma at Orbitron Products is difficult to make. As noted above, a diagnosis of occupational asthma is suspected when workers develop episodic chest tightness or shortness of breath associated with work and relieved by time away from work. However, the diagnosis of occupational asthma requires a compatible history, documentation of reversible airways obstruction and demonstration of temporal association between workplace exposure and decrements in lung function. Definitive diagnosis of occupational asthma may also require bronchial challenge testing. This testing which must be done in a clinic or hospital and involves subjecting an individual to measured concentrations of suspected asthmagen and then monitoring that person's biologic response. We did not propose performing challenge testing as part of our investigation. Consequently, it is impossible, on the basis of the data collected, to state with certainty that CA either did or did not cause asthma among selected workers at Orbitron. However, the clinical evidence strongly suggests that this did occur. There was agreement by both doctors that five people had a clinical presentation consistent with occupational related asthma. In addition, eight other workers were believed by one or the other of the two doctors to have a clinical presentation consistent with occupational asthma. It must be emphasized that this was a clinical diagnosis and the physicians did not have access to longitudinal evaluation and a repeat pulmonary function measurement except on the two study days.

Our case definition of asthma was PEFR = peak expiratory flow rate variability of at least 20% accompanied by wheezing or chest tightness or shortness of breath. Seven individuals met this case definition and all reported the onset of symptoms since beginning work at Orbitron. However, we were not able to demonstrate a temporal association between exposure to CA and a decrement in the peak flow. Four of the workers who met the case definition were on medical leave of absence and had not been in the plant for a number of months. The persistence of their PEFR variability does not exclude a diagnosis of occupational asthma, since it is well recognized that clinical asthma may persist after the inciting occupational stimulus has been removed. Five of the seven individuals who met the case

definition of asthma received a diagnosis of occupational asthma from at least one of the physicians. The other two cases received a diagnosis of bronchitis or emphysema from at least one of the physicians.

Exposure to CA may have caused symptoms through one of several mechanisms. It is known that CA is a highly irritating substance.<sup>1</sup> It is well-recognized that individuals with preexisting bronchial hyper-reactivity may develop broncho-spasm on exposure to irritants. It is possible, although unlikely, that all symptomatic workers had preexisting hyper-reactivity in the absence of specific sensitization. However, for the present, this syndrome is thought to be limited to individuals who develop bronchial hyper-reactivity after single episodes of unusually high levels of irritant exposure. Another possibility is that specific sensitization to CA has occurred. The failure to demonstrate elevated IGE antibodies to methylene di-p-phenyldiisocyanate, p-tolyl isocyanate, hexamethylene diisocyanate and phthalic anhydride should not be interpreted as excluding an immunologic mechanism. There is no evidence at present that CA cross-reacts with any of these substances. Related to this possibility, it is important to consider that having been sensitized to a specific agent (in this case, possibly CA), individuals can develop hyper-reactive airways to other stimuli, including cold air and exercise.<sup>12,13,14,15</sup>

In summary, the clinical presentation of a number of workers at Ortitron is suggestive of occupational asthma. However, on the basis of available information, it is impossible to state definitively that occupational asthma did, in fact, occur.

#### VII. RECOMMENDATIONS

1. Cyanoacrylate exposures should continue to be kept as low as possible by (a) periodically checking and maintaining the efficiency of the exhaust system, (b) ensuring that each Glueing Operator (especially new employees) understands that glueing should be done as close to the exhaust hood as possible, and (c) making sure that floor fans are not directed toward the glueing area, where they may interfere with the exhaust hood's capture efficiency.
2. Each worker who develops episodic wheezing, chest tightness, or shortness of breath should be evaluated for workplace related asthma, preferably by a specialist in pulmonary medicine. The diagnosis requires a compatible history, with documentation of reversible airways obstruction temporally associated with workplace

exposure. During the period of medical evaluation, and subsequently if a diagnosis of occupational asthma is made, recommendation #3 would apply.

3. Every worker with asthma related to cyanoacrylate exposure should be offered a work assignment in an area of the plant where further exposure is most unlikely.

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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, Publications Dissemination Section, 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. Orbitron Products, Inc.
2. United Auto Workers, Region 2-B
3. NIOSH, Region V
4. 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.

TABLE I

Personal Breathing-Zone Air Concentrations  
of Methyl Ethyl KetoneOrbitron Products Corporation  
Delphos, Ohio  
HETA 84-371

July 31 - August 1, 1984

---

<u>Job</u>	<u>Sampling Period</u>	<u>Concentration (mg/m<sup>3</sup>)</u>
Clean Clock parts	7/31 - 705-819	430
Clean Katch-Alls	7/31 - 710-1450	170
Clean Parts 1924, 1980, and GM Ducts	8/1 - 715-1415	31
Clean Parts 1924, 1980, and GM Ducts	8/1 - 712-1415	41
Clean Katch-Alls	8/1 - 710-1110	17

---

Evaluation Criteria	590
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TABLE II  
Ethyl Cyanoacrylate Vapor Concentrations

Orbitron Products Corporation  
Delphos, Ohio  
HETA 84-371

July 31 - August 1, 1984

---

<u>Location</u>	<u>Sampling Period</u>	<u>Concentration(mg/m<sup>3</sup>)</u>
Table 1	7/31 - 735-1442	N.D.*
Table 1	8/1 - 725-1423	N.D.
Table 2	7/31 - 740-1445	N.D.
Table 2	8/1 - 727-1424	N.D.
Table 5	7/31 - 740-1440	N.D.
Table 5	8/1 - 720-1420	N.D.
Table 7	7/31 - 725-1438	1.6
Table 7	8/1 - 729-1425	0.1
Table 8	7/31 - 720-1435	N.D.
Table 8	8/1 - 730-1426	N.D.

---

\*N.D. = none detected (<0.1 mg/m<sup>3</sup>)

TABLE III

## Ethyl Cyanoacrylate Vapor Concentrations

Orbitron Products Corporation  
Delphos, Ohio  
HETA 84-371

May 14, 1985

---

<u>Location</u>	<u>Sampling Period</u>	<u>Concentration(mg/m<sup>3</sup>)</u>
Glueing station	720-1440	0.2
Glueing station	723-1420	0.1
End of conveyor	725-1422	0.1
Packing station	730-1425	0.3
Opening of exhaust duct	735-1430	0.5

---



TABLE IV  
Questionnaire Results  
Orbitron Products  
Delphos, Ohio  
HETA 84-371

July 31 - August 1, 1984

---

WHEEZING OR WHISTLING BREATH			
	WHEEZING OR WHISTLING BREATH	NO WHEEZING OR WHISTLING BREATH	TOTAL
CYANOACRYLATE WORKER	11 (52%)	10 (48%)	21
NON-CYANOACRYLATE WORKER	8 (15%)	44 (85%)	52
TOTAL	19	54	73

Those people who worked with ethyl cyanoacrylate at least once per week had a significantly higher prevalence of this symptom ( $\chi^2 = 8.80$ ,  $p < 0.01$ ).

---

TABLE V

Questionnaire Results  
Orbitron Products  
Delphos, Ohio  
HETA 84-371

July 31 - August 1, 1984

---

	SHORTNESS OF BREATH	NO SHORTNESS OF BREATH	TOTAL
CYANOACRYLATE WORKER	9 (43%)	12 (57%)	21
NON-CYANOACRYLATE WORKER	7 (13%)	45 (87%)	52
TOTAL	16	57	73

---

Those people who worked with ethyl cyanoacrylate at least once per week had a significantly higher prevalence of this symptom ( $X^2 = 5.93$ ,  $p < 0.01$ ).

---

TABLE VI  
Questionnaire Results  
Orbitron Products  
Delphos, Ohio  
HETA 84-371

July 31 - August 1, 1984

---

CHEST TIGHTNESS			
	CHEST TIGHTNESS	NO CHEST TIGHTNESS	TOTAL
CYANOACRYLATE WORKER	6 (30%)	14 (70%)	20
NON-CYANOACRYLATE WORKER	9 (17%)	43 (83%)	52
TOTAL	15	57	72

---

Those people who worked with ethyl cyanoacrylate at least once per week did not have a significantly higher prevalence of this symptom ( $\chi^2 = 0.75$ ,  $p < 0.05$ ).

---

TABLE VII

Questionnaire Results  
Orbitron Products  
Delphos, Ohio  
HETA 84-371

July 31 - August 1, 1984

---

SYMPTOM	CA WORKERS W/SYMPOM	NON-CA WORKERS W/SYMPOM	P VALUE
itchy, watering, or tearing eyes at work	15/21 (71%)	22/52 (42%)	0.02*
frequent sneezing at work	10/21 (48%)	11/52 (21%)	0.02*
stuffy nose at work	13/21 (62%)	16/52 (31%)	0.01*
itchy, runny nose at work	12/21 (57%)	14/52 (27%)	0.01*

\* People who, at the time of the survey, worked with ethyl cyanoacrylate (CA) at least one day per week were statistically significantly more likely to report this symptom, than those who had little or no exposure to CA.

---

TABLE VIII  
Questionnaire Results  
Orbitron Products  
Delphos, Ohio  
HETA 84-371

July 31 - August 1, 1984

---

	CA WORKERS	NON-CA WORKERS	P VALUE
GENDER	11/21 Female	11/52 Female	0.009*
AGE	31.1 $\pm$ 14.2 yrs.	36.6 $\pm$ 15.6 yrs.	> 0.05
TIME at Current Job	10.2 $\pm$ 10.4 mos.	32.7 $\pm$ 39.6 mos.	< 0.05*

\* These variables showed a statistically significant difference when people who worked at least one day per week with ethyl cyanoacrylate (CA) were compared with those who did not.

---



TABLE IX

Questionnaire Results  
ORBITRON PRODUCTS  
Delphos, Ohio  
HETA 84-371

July 31 - August 1, 1984

---

	CA WORKERS	NON-CA WORKERS	P VALUE
Ever smoked regularly	14/21 (67%)	36/52 (69%)	0.83
History of Asthma (Atopy)	1/21 (5%)	2/52 (4%)	0.86

There was no significant difference in either smoking history or atopy when those people who worked with ethyl cyanoacrylate (CA) at least one day per week were compared with those who did not.

---

TABLE X

Physicians' Diagnoses  
Orbitron Products  
Delphos, Ohio  
HETA 84-371

November 5-8, 1984

	<u>PHYSICIAN #1</u>						<u>Total</u>
	<u>Occ'l Asthma</u>	<u>Non-Occ'l Asthma</u>	<u>Chronic Bronchitis</u>	<u>Emphysema</u>	<u>Other Resp. Complaints</u>	<u>No Resp. Complaints</u>	
Occupational							
Asthma	5	0	1	0	3	0	9
Non-Occ'l							
Asthma	1	0	0	0	0	0	1
Chronic							
Bronchitis	0	0	5	0	1	1	7
Emphysema	0	0	0	0	0	0	0
Other Resp							
Complaints	3	1	1	1	13	1	20
No Resp.							
Complaints	0	0	0	0	2	4	6
Total	9	1	7	1	19	6	43

PHYSICIAN #2

TABLE XI

Pulmonary Function Test Results  
Orbitron Products  
Delphos, Ohio  
HETA 84-371

November 5 - 8, 1984

---

Status as Ethyl Cyanoacrylate Worker				
PFT RESULTS	CURRENT	FORMER	NEVER	TOTAL
Normal	7	7	16	30
Obstructive lung disease	2	0	0	2
Restrictive lung disease	2	2	4	8
Both Obstructive and Restrictive disease	0	2	1	3
Total	11	11	21	43

---

TABLE XII

Peak Expiratory Flow Results  
Variability of At Least 20%Orbitron Products  
Delphos, Ohio  
HETA 84-371

November 5 - 8, 1984

<u>I.D.</u>	<u>Day</u>	<u>Variability*</u>	<u>Status As Glue Operator</u>	<u>Exposed To Glue That Day</u>	<u>Short Of Breath</u>	<u>Wheeze</u>	<u>Chest Tightness</u>	<u>Cough</u>
1	1	20.8%	Never	No	Yes# <sup>0</sup>	No	Yes# <sup>0</sup>	Yes# <sup>0</sup>
2	4	22.2%	Former	No	No	No	No	No
3	1	35.2%	Never	No	No	No	No	No
"	2	28.0%	Never	No	No	No	No	No
"	3	26.0%	Never	No	No	No	No	No
4	1	30.0%	Former	No	Yes# <sup>0</sup>	Yes <sup>0</sup>	Yes# <sup>0</sup>	Yes# <sup>0</sup>
"	3	23.5%	Former	No	Yes# <sup>0</sup>	Yes# <sup>0</sup>	Yes# <sup>0</sup>	Yes# <sup>0</sup>
5	1	25.0%	Former	No	Yes# <sup>0</sup>	Yes# <sup>0</sup>	Yes# <sup>0</sup>	Yes# <sup>0</sup>
"	6	20.0%	Former	No	Yes# <sup>0</sup>	Yes# <sup>0</sup>	Yes# <sup>0</sup>	Yes# <sup>0</sup>
6	1	25.0%	Former	No	Yes# <sup>0</sup>	Yes	Yes <sup>0</sup>	Yes# <sup>0</sup>
7	4	22.4%	Never	No	Yes#	Yes#	Yes# <sup>0</sup>	Yes#
8	3	22.2%	Never	Yes	Yes# <sup>0</sup>	No	Yes#	No
"	4	36.3%	Never	Yes	Yes# <sup>0</sup>	No	Yes <sup>0</sup>	No
"	5	20.5%	Never	No	Yes# <sup>0</sup>	No	No	No
9	1	23.0%	Never	No	No	No	No	No
10	7	23.0%	Never	No	No	Yes#	Yes# <sup>0</sup>	Yes# <sup>0</sup>
11	6	20.0%	Current	No	No	No	No	No

\* Variability =  $\frac{\text{Best of Day} - \text{Worst of Day}}{\text{Best of Day}} \times 100$

#Symptom reported at the time of the day's lowest PEFR reading.  
#Symptom reported at the time of the day's highest PEFR reading.

TABLE XIII

Peak Expiratory Flow Results  
Daily Variation, By Status as An  
Ethyl Cyanoacrylate (CA) Worker

Orbitron Products  
Delphos, Ohio  
HETA 84-371

November 5 - 8, 1984

---

CA Status	PEF Mean Daily Variation (%) $\pm$ Standard Deviation
Never worked with CA	9.64 $\pm$ 7.17
Worked with CA at time of study	7.31 $\pm$ 4.91
Formerly worked with CA	11.89 $\pm$ 5.64

The mean daily PEF variation for each group (divided by CA status) was significantly different from the variation for each of the other two groups ( $p < 0.05$ , Duncan's Multiple Range Test).

---

TABLE XIV

Peak Expiratory Flow (PEF) Results  
Daily variation by same day exposure to ethyl cyanoacrylate (CA)

Orbitron Products  
Delphos, Ohio  
HETA 84-371

November 5 - 8, 1984

---

Exposure Status	PEF Mean Daily Variation (%) $\pm$ Standard Deviation
Exposed to CA that day	9.20 $\pm$ 6.59
Not exposed to CA	9.71 $\pm$ 6.31

Those people who reported being exposed to ethyl cyanoacrylate (CA) on a given day did not show a significantly greater variation in their PEF on that day, compared to those who were not exposed to CA ( $p = 0.61$ , Student's t-test).

---



TABLE XV

Peak Expiratory Flow Results  
by same day reporting of symptoms - shortness of breath

Orbitron Products  
Delphos, Ohio  
HETA 84-371

November 5 - 8, 1984

---

Shortness of Breath	PEF mean daily variation (%) $\pm$ standard deviation
Yes	14.48 $\pm$ 6.00
No	7.93 $\pm$ 5.59

Those people who reported shortness of breath on a given day showed a significantly greater variation in their PEF on that day compared to those who did not report being short of breath that day ( $p = 0.0001$ , Student's t-test).

---

TABLE XVI

Peak Expiratory Flow Results  
by same day reporting of symptoms - wheezing

Orbitron Products  
Delphos, Ohio  
HETA 84-371

November 5 - 8, 1984

---

Wheezing	PEF mean daily variation (%) $\pm$ standard deviation
Yes	13.52 $\pm$ 5.84
No	8.34 $\pm$ 6.01

Those people who reported wheezing on a given day showed a significantly greater variation in their PEF on that day compared to those who did not report wheezing that day ( $p = 0.0001$ , Student's t-test).

---

TABLE XVII

Peak Expiratory Flow Results  
by same day reporting of symptoms - chest tightness

Orbitron Products  
Delphos, Ohio  
HETA 84-371

November 5 - 8, 1984

---

Chest Tightness    PEF mean daily variation (%)  $\pm$  standard deviation

Yes	13.63 $\pm$ 6.34
No	7.80 $\pm$ 5.50

Those people who reported chest tightness on a given day showed a significantly greater variation in their PEF on that day compared to those who did not report chest tightness that day ( $p = 0.0001$ , Student's t-test).

---

TABLE XVIII

Peak Expiratory Flow Results  
by same day reporting of symptoms - cough

Orbitron Products  
Delphos, Ohio  
HETA 84-371

November 5 - 8, 1984

---

Cough	PEF mean daily variation (%) $\pm$ standard deviation
Yes	11.88 $\pm$ 6.39
No	8.28 $\pm$ 5.98

Those people who reported coughing on a given day showed a significantly greater variation in their PEF On that day compared to those who did not report coughing that day ( $p = 0.0001$ , Student's t-test).

---

TABLE XIX

## Immunologic Results

Orbitron Products  
Delphos, Ohio  
HETA 84-371

November 5-8, 1984

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<u>RAST (% Binding)</u>				
<u>ID#</u>	<u>PA*</u>	<u>PTI*</u>	<u>HDI*</u>	<u>MDI*</u>
1	0.6	0.3	0.7	0.7
2	0.6	0.8	0.5	0.6
3	0.6	0.7	0.7	0.8
4	0.5	0.6	0.4	0.6
5	0.5	0.5	0.6	0.7
6	0.5	0.8	0.5	0.6
7	0.6	0.6	0.5	0.8
8	0.5	0.6	0.6	0.6
9	0.7	0.5	0.7	0.7
10	0.6	0.9	0.5	0.6
11	0.8	0.5	0.6	0.8
12	0.6	0.4	0.5	0.7
13	0.9	0.6	0.5	0.6
+ Control	6.3	3.4	1.5	8.6
- Control	0.5	0.5	0.5	0.6
Normal	≤ 1.0	≤ 1.0	≤ 1.0	≤ 1.2

---

\*Human Serum Albumin Conjugates of Phthalates and Isocyanates

PA - phthalic anhydride

PTI - p-tolyl isocyanate

HDI - hexamethylene diisocyanate

MDI - methylene di-p-phenyldiisocyanate

APPENDIX

ATTACHMENT 2

PEAK FLOW RATES:

Instructions:

- 1) The use of the peak flow meter has been explained to you earlier.
- 2) Use the peak-flow meter at the times indicated from \_\_\_\_\_ (date & time) to \_\_\_\_\_ (date & time).
- 3) At the appropriate time, a. Fit a mouth-piece tightly to the peak-flow meter  
b. Adjust the indicator at the side of the meter to zero  
c. Hold the peak flow meter such that it is horizontal, and keep yours fingers clear of the indicator  
d. Take a maximum deep breath in, seal your lips tightly around the sides of the mouth-piece, and blow out as hard as you can into the meter with a short, sharp puff (as if blowing out a lighted match)  
e. Note the reading shown by the indicator, and record it on this form in the space provided.  
f. Gently move the indicator back to zero  
g. Repeat the procedure twice more and record the readings accordingly.
- 4) Also record on the form if you were working with or were exposed to Superglue, or other chemicals at this time (within the last hour).
- 5) Check the appropriate boxes if you are experiencing any symptoms of shortness of breath, wheezing, chest tightness, or cough at this time.
- 6) If you have just been awakened at night by shortness of breath, wheezing, chest tightness, or cough:
  - a. Record the time
  - b. Take three readings on the peak flow meter and record them, as explained in 3) above.
  - c. Check the appropriate boxes for the symptoms experienced.
- 7) If you have any further questions during 6th - 8th November, please contact Dr. Ching Aw at the Orbitron plant during the day, or at the Best Western Hotel ((419) 227-4114) at night. After 8th November, contact Matt London or Ching Aw at 513-6844393 (NIOSH, Cincinnati) for any queries.



# PEAK FLOW RESULTS

NAME \_\_\_\_\_

ID # \_\_\_\_\_

DATE \_\_\_\_\_

(1-5)

Be sure to also fill in the EXPOSURES AND SYMPTOMS page

## PEAK FLOW RATES (L/min)

TIME	1st attempt	2nd attempt	3rd attempt	
8 a.m.	_____	_____	_____	(6-14)
11 a.m.	_____	_____	_____	(15-23)
2 p.m.	_____	_____	_____	(24-32)
5 p.m.	_____	_____	_____	(33-41)
8 p.m.	_____	_____	_____	(42-50)
11 p.m.	_____	_____	_____	(51-59)
a.m. (during the night)	_____	_____	_____	(60-68)

If you took any breathing medicines 24 hours before or during the period of the peak-flow rate assessments, please record the name of the medicine, the time and the dose.

<u>Medicine</u>	<u>Date</u>	<u>Time</u>	<u>Dose</u>
_____	_____	_____ a.m./p.m.	_____
_____	_____	_____ a.m./p.m.	_____
_____	_____	_____ a.m./p.m.	_____
_____	_____	_____ a.m./p.m.	_____

card | 0 | 1 |

# EXPOSURES and SYMPTOMS

(PLEASE CIRCLE THE CORRECT ANSWERS)

	<u>EXPOSURES</u>				<u>SYMPTOMS</u>			
	<u>Working with Superglue</u>	<u>Exposed to Superglue</u>	<u>Exposed to other chemicals (if yes, specify)</u>	<u>Short of Breath</u>	<u>Wheeze</u>	<u>Chest Tightness</u>	<u>Cough</u>	Yes = 1 No = 2
8 a.m.	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	(6-12)
11 a.m.	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	(13-19)
2 p.m.	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	(20-26)
5 p.m.	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	(27-33)
8 p.m.	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	(34-40)
11 p.m.	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	(41-47)
a.m. (during the night)	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	(48-54)

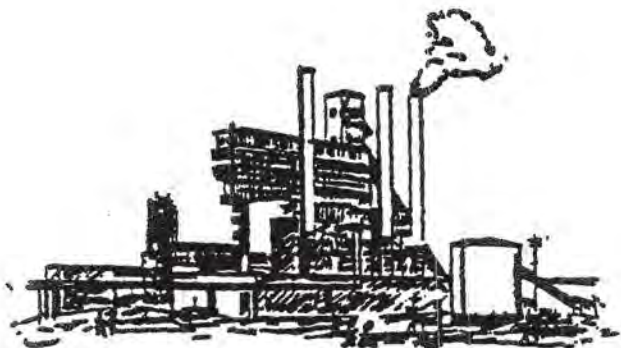
# NIOSH

ORBITRON  
DELPHOS, OHIO

HETA 84-371

QUESTIONNAIRE

JULY 1984



U. S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
Public Health Service/Centers for Disease Control  
National Institute for Occupational Safety and Health

ORBITRON  
DELPHOS, OHIO  
HETA 84-371

QUESTIONNAIRE

IDENTIFICATION #: \_\_\_\_\_ (1-4)

INTERVIEWER: \_\_\_\_\_

TIME INTERVIEW BEGAN: \_\_\_\_\_ (5-8)

DATE OF INTERVIEW (Month-Day-Year): \_\_\_\_\_ (9-14)

I. PERSONAL DATA

(Please Print)

1. NAME (Last-First-Middle Initial): \_\_\_\_\_

2. STREET ADDRESS: \_\_\_\_\_

3. CITY: \_\_\_\_\_ 4. ZIP CODE: \_\_\_\_\_

5. TELEPHONE: (Area Code) \_\_\_\_\_ - \_\_\_\_\_

6. RACE: 1 ☐ White, not of Hispanic origin 4 ☐ American Indian/Alaskan Native  
2 ☐ Black, not of Hispanic origin 5 ☐ Asian or Pacific Islander (15)  
3 ☐ Hispanic

7. SEX: 1 ☐ Male 2 ☐ Female (16)

8. DATE OF BIRTH (Month-Day-Year): \_\_\_\_\_ (17-22)

9. HIGHEST YEAR THAT YOU REACHED IN SCHOOL:

Grade School:	01	02	03	04	05	06	07	08	09	10	11	12	
College:		13		14		15		16		17		18	(23-24)
		Freshman		Sophomore		Junior		Senior		Masters		Doctorate	

10. CURRENT HEIGHT (Inches): \_\_\_\_\_ (25-26)

11. CURRENT WEIGHT (Pounds): \_\_\_\_\_ (27-29)

## II. OCCUPATIONAL HISTORY

1. WHAT IS YOUR PRESENT JOB TITLE: \_\_\_\_\_ (30-31)
2. WHAT IS YOUR CURRENT WORK SHIFT? 1    Days 2    Evenings 3    Nights (32)
3. WHAT IS YOUR REGULAR WORK SHIFT?  
1    Days 2    Evenings 3    Nights 4    Rotating (33)
4. PLEASE GIVE A DESCRIPTION OF YOUR CURRENT JOB & LIST ANY CHEMICALS THAT YOU ARE EXPOSED TO WHILE WORKING.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
5. ON AN AVERAGE, HOW OFTEN DO YOU WORK WITH CYANOACRYLATE (SUPERGLUE)?  
1    Not at all (Go to Q. #6) 3    Once a week or more, but not every day  
2    Less than once a week 4    Every working day (34)
- a. IF YOU WORK WITH SUPERGLUE, APPROXIMATELY HOW MANY HOURS A WEEK DO YOU USE IT? \_\_\_\_\_ (35-36)
6. HOW MANY MONTHS HAVE YOU WORKED AT YOUR PRESENT JOB? \_\_\_\_\_ (37-39)
7. DO YOU USE A MASK OR RESPIRATOR IN YOUR WORK? 1    Yes 2    No (40)
8. PLEASE LIST OTHER JOBS YOU HAVE HAD AT THIS PLANT AND THE DATES YOU BEGAN AND ENDED EACH JOB. ALSO, PLEASE INDICATE IF YOU WORKED WITH CYANOACRYLATE IN ANY OF THESE PREVIOUS JOBS (CHECK BOX ON RIGHT IF "YES").

	<u>JOB</u>	<u>DATES</u>	<u>WORKED WITH CYANOACRYLATE</u>	
a.	_____	_____	1 <u>  </u>	(41)
b.	_____	_____	1 <u>  </u>	(42)
c.	_____	_____	1 <u>  </u>	(43)

9. HAVE YOU WORKED AT OTHER COMPANIES MAKING OR USING  
CYANOACRYLATE (SUPERGLUE)?

1 ☐ Yes 2 ☐ No (44)

a. IF YES, PLEASE LIST THE COMPANY NAME, A DESCRIPTION OF YOUR JOB THERE THE  
BEGINNING AND ENDING DATES OF YOUR EMPLOYMENT, AND THE AVERAGE NUMBER OF  
HOURS A DAY YOU WORKED WITH SUPERGLUE.

	<u>COMPANY</u>	<u>JOB DESCRIPTION</u>	<u>DATES</u>	<u># HOURS</u>	
(1)	_____	_____	_____		(45-46)
(2)	_____	_____	_____		(47-48)

10. HAVE YOU WORKED AT OTHER COMPANIES PRODUCING OR PACKAGING  
EGG PRODUCTS?

1 ☐ Yes 2 ☐ No (49)

a. IF YES, PLEASE LIST THE COMPANY NAME, A DESCRIPTION OF YOUR JOB THERE THE  
BEGINNING AND ENDING DATES OF YOUR EMPLOYMENT, AND THE AVERAGE NUMBER OF  
HOURS YOU WORKED WITH EGGS.

	<u>COMPANY</u>	<u>JOB DESCRIPTION</u>	<u>DATES</u>	<u># HOURS</u>	
(1)	_____	_____	_____		(50-51)
(2)	_____	_____	_____		(52-53)



11. HAVE YOU WORKED IN PREVIOUS JOBS INVOLVING EXPOSURE TO OR CONTACT WITH:

- |  |                                |                               |      |
|--|--------------------------------|-------------------------------|------|
| a. ISOCYANATES                           | 1 <input type="checkbox"/> Yes | 2 <input type="checkbox"/> No | (54) |
| b. COTTON DUST                           | 1 <input type="checkbox"/> Yes | 2 <input type="checkbox"/> No | (55) |
| c. PLATINUM SALTS                        | 1 <input type="checkbox"/> Yes | 2 <input type="checkbox"/> No | (56) |
| d. ALUMINUM SOLDERING FLUX               | 1 <input type="checkbox"/> Yes | 2 <input type="checkbox"/> No | (57) |
| e. PIPERAZINE                            | 1 <input type="checkbox"/> Yes | 2 <input type="checkbox"/> No | (58) |
| f. WOOD DUST                             | 1 <input type="checkbox"/> Yes | 2 <input type="checkbox"/> No | (59) |
| g. WOOL, FUR OR FEATHERS                 | 1 <input type="checkbox"/> Yes | 2 <input type="checkbox"/> No | (60) |
| h. WHEAT GRAIN OR FLOUR                  | 1 <input type="checkbox"/> Yes | 2 <input type="checkbox"/> No | (61) |
| i. ENZYMES FOR DETERGENTS/WASHING POWDER | 1 <input type="checkbox"/> Yes | 2 <input type="checkbox"/> No | (62) |
| j. GLUES, GUMS EPOXY-RESINS OR PAINTS    | 1 <input type="checkbox"/> Yes | 2 <input type="checkbox"/> No | (63) |
| k. BIRDS, POULTRY OR LABORATORY ANIMALS  | 1 <input type="checkbox"/> Yes | 2 <input type="checkbox"/> No | (64) |
| l. SOLVENTS OR OTHER CHEMICALS           | 1 <input type="checkbox"/> Yes | 2 <input type="checkbox"/> No | (65) |

12. DO YOU HAVE ANY HOBBIES INVOLVING USE OF PAINTS, GLUES OR SOLVENTS? 1 ☐ Yes 2 ☐ No (66)

a. IF YES, PLEASE SPECIFY TYPE AND FREQUENCY USED: \_\_\_\_\_

CARD | 0 | 1 | (79-80)

### III. HABITS

#### CIGARETTES

1. HAVE YOU EVER SMOKED CIGARETTES? 1 ☐ Yes 2 ☐ No (5)
- a. IF YES, DO YOU SMOKE CIGARETTES NOW? 1 ☐ Yes 2 ☐ No (6)
- b. WHAT IS THE TOTAL NUMBER OF YEARS YOU HAVE SMOKED?    (7-8)
- c. WHAT IS THE AVERAGE NUMBER OF CIGARETTES YOU SMOKE(D) PER DAY?    (9-10)

#### PETS

2. DO YOU KEEP ANY PETS AT HOME? 1 ☐ Yes 2 ☐ No (11)
- a. IF YES, PLEASE SPECIFY THE TYPE OF PETS YOU HAVE NOW: \_\_\_\_\_
- b. HOW MANY YEARS HAVE YOU HAD THEM?    (12-13)

#### EGGS

3. DO YOU EAT EGGS AT LEAST ONCE A WEEK? 1 ☐ Yes 2 ☐ No (14)
- a. IF NO, WHEN WAS THE LAST TIME YOU ATE ANY EGGS? 19    (15-16)
- b. WHY DID YOU STOP EATING EGGS? \_\_\_\_\_

4. PLEASE TELL ME IF YOU EVER EXPERIENCED ANY OF THE FOLLOWING CONDITIONS AFTER YOU HAVE EATEN EGGS AND THE YEAR THIS CONDITION LAST OCCURRED.

	<u>CONDITION</u>		<u>YEAR</u>	
a.	COUGH	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No (17)	19 <input type="text"/> <input type="text"/> <input type="text"/>	(18-19)
b.	CHEST TIGHTNESS	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No (20)	19 <input type="text"/> <input type="text"/> <input type="text"/>	(21-22)
c.	WHEEZING	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No (23)	19 <input type="text"/> <input type="text"/> <input type="text"/>	(24-25)
d.	SHORTNESS OF BREATH	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No (26)	19 <input type="text"/> <input type="text"/> <input type="text"/>	(27-28)
e.	RUNNY OR STUFFY NOSE	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No (29)	19 <input type="text"/> <input type="text"/> <input type="text"/>	(30-31)
f.	DIARRHEA	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No (32)	19 <input type="text"/> <input type="text"/> <input type="text"/>	(33-34)
g.	ABDOMINAL CRAMPS	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No (35)	19 <input type="text"/> <input type="text"/> <input type="text"/>	(36-37)
h.	VOMITING	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No (38)	19 <input type="text"/> <input type="text"/> <input type="text"/>	(39-40)

#### IV. SYMPTOMS

##### WHEEZING

1. WITHIN THE PAST MONTH, HAS YOUR BREATHING SOUNDED WHEEZY OR WHISTLING?

1 ☐ Yes 2 ☐ No (41)

IF NO, GO TO QUESTION 2.

a. IF YES, IN WHAT YEAR DID YOU FIRST NOTICE THIS WHEEZY OR WHISTLING BREATHING?

19    (42-43)

b. WAS IT ESPECIALLY BAD DURING ANY PARTICULAR YEAR(S)?

1 ☐ Yes 2 ☐ No (44)

(1) IF YES, PLEASE SPECIFY WHEN: \_\_\_\_\_

c. WERE THESE EPISODES OF WHEEZY OR WHISTLING BREATHING USUALLY ACCOMPANIED BY:

(1) SHORTNESS OF BREATH

1 ☐ Yes 2 ☐ No (45)

(2) CHEST TIGHTNESS

1 ☐ Yes 2 ☐ No (46)

(3) COUGH

1 ☐ Yes 2 ☐ No (47)

d. DURING WHAT TIME OF THE YEAR DOES YOUR WHEEZY OR WHISTLING BREATHING GIVE YOU THE MOST TROUBLE?

1 ☐ Spring

3 ☐ Fall

5 ☐ Unrelated to time of year

2 ☐ Summer

4 ☐ Winter

(48)

e. WHAT TIME OF DAY DOES IT USUALLY OCCUR?

1 ☐ Morning

3 ☐ Evening

5 ☐ Unrelated to time of day

2 ☐ Afternoon

4 ☐ Night

(49)

f. HOW LONG DOES IT USUALLY LAST? 1 ☐ Less than 1 hour 2 ☐ 1 hour or more (50)

(1) IF IT CONTINUES FOR 1 HOUR OR MORE, HOW MANY HOURS DOES IT LAST? \_\_\_\_\_

(51-52)

g. DOES IT OCCUR FOLLOWING CERTAIN ACTIVITIES OR AFTER EXPOSURE TO SPECIFIC MATERIALS AT HOME?

1 ☐ Yes, most times

2 ☐ Yes, sometimes

3 ☐ Yes, seldom

4 ☐ Never

(53)

(1) IF YES, PLEASE DESCRIBE THESE ACTIVITIES OR MATERIALS: \_\_\_\_\_

(2) WHEN DID YOU FIRST NOTICE THIS ASSOCIATION  
(Month-Year)? \_\_\_\_\_ (54-57)

(3) HOW SOON AFTER BEGINNING THESE ACTIVITIES OR USING THESE MATERIALS DO  
YOUR SYMPTOMS APPEAR?

- 1 ☐ During activity or use of material  
2 ☐ Within 1 hour of completion of activity or use of material  
3 ☐ 1-6 hours after activity or use of material  
4 ☐ More than 6 hours after activity or use of material (58)

i. DOES IT OCCUR FOLLOWING CERTAIN ACTIVITIES OR AFTER EXPOSURE TO SPECIFIC  
MATERIALS AT WORK?

1 ☐ Yes, most times 2 ☐ Yes, sometimes 3 ☐ Yes, seldom 4 ☐ Never (59)

(1) IF YES, PLEASE DESCRIBE THESE ACTIVITIES OR MATERIALS: \_\_\_\_\_

(2) WHEN DID YOU FIRST NOTICE THIS ASSOCIATION  
(Month-Year)? \_\_\_\_\_ (60-63)

(3) HOW SOON AFTER BEGINNING THESE ACTIVITIES OR USING THESE MATERIALS DO  
YOUR SYMPTOMS APPEAR?

- 1 ☐ During activity or use of material  
2 ☐ Within 1 hour of completion of activity or use of material  
3 ☐ 1-6 hours after activity or use of material  
4 ☐ More than 6 hours after activity or use of material (64)

j. DO THE SYMPTOMS CONTINUE AFTER COMING HOME FROM WORK? 1 ☐ Yes 2 ☐ No (65)

(1) IF YES, HOW MANY HOURS DOES IT CONTINUE BEFORE IT STOPS? \_\_\_\_\_ (66-67)

k. ON DAYS AWAY FROM WORK, DOES THE WHEEZY OR WHISTLING BREATHING OCCUR:

- 1 ☐ Not at all  
2 ☐ Less frequently than on workdays  
3 ☐ Same as workdays  
4 ☐ More frequently than on workdays (68)

l. ON VACATION, DOES THE WHEEZY OR WHISTLING BREATHING OCCUR:

- 1 ☐ Not at all  
2 ☐ Less frequently than on workdays  
3 ☐ Same as workdays  
4 ☐ More frequently than on workdays (69)

CARD | 0 | 2 | (79-80)

SHORTNESS OF BREATH

2. WITHIN THE PAST MONTH, HAVE YOU HAD EPISODES OF SHORTNESS OF BREATH?

1 ☐ Yes 2 ☐ No (5)

IF NO, GO TO QUESTION 3.

a. IF YES, IN WHAT YEAR DID YOU FIRST NOTICE THIS SHORTNESS OF BREATH?

19    (6-7)

b. WAS IT ESPECIALLY BAD DURING ANY PARTICULAR YEAR(S)? 1 ☐ Yes 2 ☐ No (8)

(1) IF YES, PLEASE SPECIFY WHEN: \_\_\_\_\_

c. WERE THESE EPISODES OF SHORTNESS OF BREATH USUALLY ACCOMPANIED BY:

(1) WHEEZING OR WHISTLING BREATHING 1 ☐ Yes 2 ☐ No (9)

(2) CHEST TIGHTNESS 1 ☐ Yes 2 ☐ No (10)

(3) COUGH 1 ☐ Yes 2 ☐ No (11)

d. DURING WHAT TIME OF THE YEAR DOES YOUR SHORTNESS OF BREATH GIVE YOU THE MOST TROUBLE?

1 ☐ Spring 3 ☐ Fall 5 ☐ Unrelated to time of year  
2 ☐ Summer 4 ☐ Winter (12)

e. WHAT TIME OF DAY DOES IT USUALLY OCCUR?

1 ☐ Morning 3 ☐ Evening 5 ☐ Unrelated to time of day  
2 ☐ Afternoon 4 ☐ Night (13)

f. HOW LONG DOES IT USUALLY LAST? 1 ☐ Less than 1 hour 2 ☐ 1 hour or more (14)

(1) IF IT CONTINUES FOR 1 HOUR OR MORE, HOW MANY HOURS DOES IT LAST?

(15-16)

g. DOES IT OCCUR FOLLOWING CERTAIN ACTIVITIES OR AFTER EXPOSURE TO SPECIFIC MATERIALS AT HOME?

1 ☐ Yes, most times 2 ☐ Yes, sometimes 3 ☐ Yes, seldom 4 ☐ Never (17)

(1) IF YES, PLEASE DESCRIBE THESE ACTIVITIES OR MATERIALS: \_\_\_\_\_

(2) WHEN DID YOU FIRST NOTICE THIS ASSOCIATION  
(Month-Year)?

\_\_\_\_ - \_\_\_\_ (18-21)

(3) HOW SOON AFTER BEGINNING THESE ACTIVITIES OR USING THESE MATERIALS DO  
YOUR SYMPTOMS APPEAR?

- 1 ☐ During activity or use of material  
2 ☐ Within 1 hour of completion of activity or use of material  
3 ☐ 1-6 hours after activity or use of material  
4 ☐ More than 6 hours after activity or use of material (22)

i. DOES IT OCCUR FOLLOWING CERTAIN ACTIVITIES OR AFTER EXPOSURE TO SPECIFIC  
MATERIALS AT WORK?

1 ☐ Yes, most times 2 ☐ Yes, sometimes 3 ☐ Yes, seldom 4 ☐ Never (23)

(1) IF YES, PLEASE DESCRIBE THESE ACTIVITIES OR MATERIALS: \_\_\_\_\_

(2) WHEN DID YOU FIRST NOTICE THIS ASSOCIATION  
(Month-Year)?

\_\_\_\_ - \_\_\_\_ (24-27)

(3) HOW SOON AFTER BEGINNING THESE ACTIVITIES OR USING THESE MATERIALS DO  
YOUR SYMPTOMS APPEAR?

- 1 ☐ During activity or use of material  
2 ☐ Within 1 hour of completion of activity or use of material  
3 ☐ 1-6 hours after activity or use of material  
4 ☐ More than 6 hours after activity or use of material (28)

j. DO THE SYMPTOMS CONTINUE AFTER COMING HOME FROM WORK? 1 ☐ Yes 2 ☐ No (29)

(1) IF YES, HOW MANY HOURS DOES IT CONTINUE BEFORE IT STOPS? \_\_\_\_ (30-31)

k. ON DAYS AWAY FROM WORK, DOES THE SHORTNESS OF BREATH OCCUR:

- 1 ☐ Not at all  
2 ☐ Less frequently than on workdays  
3 ☐ Same as workdays  
4 ☐ More frequently than on workdays (32)

l. ON VACATION, DOES THE SHORTNESS OF BREATH OCCUR:

- 1 ☐ Not at all  
2 ☐ Less frequently than on workdays  
3 ☐ Same as workdays  
4 ☐ More frequently than on workdays (33)

CHEST TIGHTNESS

3. WITHIN THE PAST MONTH, HAS YOUR CHEST EVER FELT "TIGHT"  
(UNCOMFORTABLE)? 1 ☐ Yes 2 ☐ No (34)

IF NO, GO TO QUESTION 4.

- a. IF YES, IN WHAT YEAR DID YOU FIRST NOTICE THIS CHEST  
TIGHTNESS? 19 ☐ ☐ ☐ (35-36)
- b. WAS IT ESPECIALLY BAD DURING ANY PARTICULAR YEAR(S)? 1 ☐ Yes 2 ☐ No (37)
- (1) IF YES, PLEASE SPECIFY WHEN: \_\_\_\_\_
- c. WERE THESE EPISODES OF CHEST TIGHTNESS USUALLY ACCOMPANIED BY:
- (1) WHEEZING OR WHISTLING BREATHING 1 ☐ Yes 2 ☐ No (38)
- (2) SHORTNESS OF BREATH 1 ☐ Yes 2 ☐ No (39)
- (3) COUGH 1 ☐ Yes 2 ☐ No (40)
- d. DURING WHAT TIME OF THE YEAR DOES YOUR CHEST TIGHTNESS GIVE YOU THE  
MOST TROUBLE?
- 1 ☐ Spring 3 ☐ Fall 5 ☐ Unrelated to time of year  
2 ☐ Summer 4 ☐ Winter (41)
- e. WHAT TIME OF DAY DOES IT USUALLY OCCUR?
- 1 ☐ Morning 3 ☐ Evening 5 ☐ Unrelated to time of day  
2 ☐ Afternoon 4 ☐ Night (42)
- f. HOW LONG DOES IT USUALLY LAST? 1 ☐ Less than 1 hour 2 ☐ 1 hour or more (43)
- (1) IF IT CONTINUES FOR 1 HOUR OR MORE, HOW MANY HOURS DOES IT  
LAST? ☐ ☐ ☐ (44-45)
- g. DOES IT OCCUR FOLLOWING CERTAIN ACTIVITIES OR AFTER EXPOSURE TO SPECIFIC  
MATERIALS AT HOME?
- 1 ☐ Yes, most times 2 ☐ Yes, sometimes 3 ☐ Yes, seldom 4 ☐ Never (46)
- (1) IF YES, PLEASE DESCRIBE THESE ACTIVITIES OR MATERIALS: \_\_\_\_\_
- (2) WHEN DID YOU FIRST NOTICE THIS ASSOCIATION  
(Month-Year)? ☐ ☐ - ☐ ☐ (47-50)
- (3) HOW SOON AFTER BEGINNING THESE ACTIVITIES OR USING THESE MATERIALS DO  
YOUR SYMPTOMS APPEAR?
- 1 ☐ During activity or use of material  
2 ☐ Within 1 hour of completion of activity or use of material  
3 ☐ 1-6 hours after activity or use of material (51)  
4 ☐ More than 6 hours after activity or use of material



i. DOES IT OCCUR FOLLOWING CERTAIN ACTIVITIES OR AFTER EXPOSURE TO SPECIFIC MATERIALS AT WORK?

1    Yes, most times    2    Yes, sometimes    3    Yes, seldom    4    Never    (52)

(1) IF YES, PLEASE DESCRIBE THESE ACTIVITIES OR MATERIALS: \_\_\_\_\_

(2) WHEN DID YOU FIRST NOTICE THIS ASSOCIATION  
(Month-Year)?                               -          (53-56)

(3) HOW SOON AFTER BEGINNING THESE ACTIVITIES OR USING THESE MATERIALS DO YOUR SYMPTOMS APPEAR?

- 1    During activity or use of material  
2    Within 1 hour of completion of activity or use of material  
3    1-6 hours after activity or use of material  
4    More than 6 hours after activity or use of material    (57)

j. DO THE SYMPTOMS CONTINUE AFTER COMING HOME FROM WORK? 1    Yes    2    No    (58)

(1) IF YES, HOW MANY HOURS DOES IT CONTINUE BEFORE IT STOPS?             (59-60)

k. ON DAYS AWAY FROM WORK, DOES THE CHEST TIGHTNESS OCCUR:

- 1    Not at all  
2    Less frequently than on workdays  
3    Same as workdays  
4    More frequently than on workdays    (61)

l. ON VACATION, DOES THE CHEST TIGHTNESS OCCUR:

- 1    Not at all  
2    Less frequently than on workdays  
3    Same as workdays  
4    More frequently than on workdays    (62)

CARD             (79-80)

## COUGH

4. HAVE YOU EVER EXPERIENCED A COUGH FOR AS MUCH AS 3 MONTHS IN A YEAR? 1 ☐ Yes 2 ☐ No (5)
- a. IF YES, WHICH YEARS? \_\_\_\_\_
- b. IS THE COUGH USUALLY PRODUCTIVE OF MUCUS? 1 ☐ Yes 2 ☐ No (6)
- c. WHAT TIME OF DAY DOES IT USUALLY OCCUR?
- 1 ☐ Morning 3 ☐ Evening 5 ☐ Unrelated to time of day  
2 ☐ Afternoon 4 ☐ Night (7)
5. HAVE YOU EVER BEEN AWAKENED FROM SLEEP BY A BOUT OF COUGHING? 1 ☐ Yes 2 ☐ No (8)

## MUCOSAL IRRITATION

6. DO YOU OFTEN HAVE AN ITCHY, RUNNY NOSE WHILE AT WORK? 1 ☐ Yes 2 ☐ No (9)
- a. IF YES, WHEN DID YOU FIRST NOTICE THIS (Month-Year)?  -  (10-13)
- b. HOW OFTEN HAVE YOU EXPERIENCED IT SINCE THEN?
- 1 ☐ Daily 2 ☐ Several times/week 3 ☐ Once/week 4 ☐ Less than 1/week (14)
7. DO YOU OFTEN HAVE A STUFFY NOSE WHILE AT WORK? 1 ☐ Yes 2 ☐ No (15)
- a. IF YES, WHEN DID YOU FIRST NOTICE THIS (Month-Year)?  -  (16-19)
- b. HOW OFTEN HAVE YOU EXPERIENCED IT SINCE THEN?
- 1 ☐ Daily 2 ☐ Several times/week 3 ☐ Once/week 4 ☐ Less than 1/week (20)
8. DO YOU OFTEN HAVE FREQUENT SNEEZING AT WORK? 1 ☐ Yes 2 ☐ No (21)
- a. IF YES, WHEN DID YOU FIRST NOTICE THIS (Month-Year)?  -  (22-25)
- b. HOW OFTEN HAVE YOU EXPERIENCED IT SINCE THEN?
- 1 ☐ Daily 3 ☐ Once/week 5 ☐ Less than 1/year  
2 ☐ Several times/week 4 ☐ Less than 1/week (26)
9. DO YOU HAVE ITCHY, WATERING OR TEARING EYES WHILE AT WORK? 1 ☐ Yes 2 ☐ No (27)
- a. IF YES, WHEN DID YOU FIRST NOTICE THIS (Month-Year)?  -  (28-31)
- b. HOW OFTEN HAVE YOU EXPERIENCED IT SINCE THEN?
- 1 ☐ Daily 3 ☐ Once/week 5 ☐ Less than 1/year  
2 ☐ Several times/week 4 ☐ Less than 1/week (32)
- CARD  0  4  (79-80)

V. MEDICAL HISTORY

1. OTHER THAN WHAT YOU HAVE MENTIONED EARLIER, HAVE YOU EVER BEEN HOSPITALIZED FOR ANY CHEST ILLNESS, CHEST INJURY OR CHEST SURGERY?

1 ☐ Yes 2 ☐ No (5)

- a. IF YES, FOR EACH HOSPITALIZATION, GIVE THE REASON AND THE DATE:

REASON

DATE

- (1) \_\_\_\_\_  
(2) \_\_\_\_\_  
(3) \_\_\_\_\_  
(4) \_\_\_\_\_

2. HAVE YOU EVER HAD ASTHMA?

1 ☐ Yes 2 ☐ No (6)

- a. IF YES, WAS THE ASTHMA DIAGNOSED BY A PHYSICIAN?

1 ☐ Yes 2 ☐ No (7)

- b. DID YOU HAVE ASTHMA AS A CHILD (18 YEARS OR YOUNGER)?

1 ☐ Yes 2 ☐ No (8)

- c. DID YOU HAVE ASTHMA AS AN ADULT (OVER 18 YEARS)?

1 ☐ Yes 2 ☐ No (9)

- (1) IF YES, WHAT YEAR DID THE ASTHMA BEGIN (AS AN ADULT)?

19          (10-11)

- d. WERE YOU EVER PRESCRIBED SPECIFIC MEDICINES FOR ASTHMA?

1 ☐ Yes 2 ☐ No (12)

- (1) IF YES, PLEASE SPECIFY THESE MEDICINES AND THE DATES YOU TOOK THEM:

MEDICINE

DATES

- (a) \_\_\_\_\_  
(b) \_\_\_\_\_  
(c) \_\_\_\_\_

3. WERE YOU EVER TOLD BY A PHYSICIAN THAT YOU HAVE ANY OF THE FOLLOWING CONDITIONS?  
IF YOU HAVE HAD ANY OF THESE, PLEASE GIVE THE YEAR IN WHICH IT WAS FIRST DIAGNOSED.

	<u>CONDITIONS</u>	<u>YEAR</u>
a. TUBERCULOSIS	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No (13)	19 <input type="text"/> <input type="text"/> <input type="text"/> (14-15)
b. PNEUMONIA	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No (16)	19 <input type="text"/> <input type="text"/> <input type="text"/> (17-18)
c. PLEURISY	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No (19)	19 <input type="text"/> <input type="text"/> <input type="text"/> (20-21)
d. BRONCHITIS	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No (22)	19 <input type="text"/> <input type="text"/> <input type="text"/> (23-24)
e. EMPHYSEMA	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No (25)	19 <input type="text"/> <input type="text"/> <input type="text"/> (26-27)
f. OTHER CHEST OR LUNG DISEASE	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No (28)	19 <input type="text"/> <input type="text"/> <input type="text"/> (29-30)
(1) <u>IF YES</u> , PLEASE SPECIFY: _____		
g. ECZEMA	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No (31)	19 <input type="text"/> <input type="text"/> <input type="text"/> (32-33)
h. SINUSITIS	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No (34)	19 <input type="text"/> <input type="text"/> <input type="text"/> (35-36)
i. HAY FEVER	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No (37)	19 <input type="text"/> <input type="text"/> <input type="text"/> (38-39)
j. OTHER ALLERGIES	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No (40)	19 <input type="text"/> <input type="text"/> <input type="text"/> (41-42)
(1) <u>IF YES</u> , PLEASE SPECIFY: _____		
k. CANCER	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No (43)	19 <input type="text"/> <input type="text"/> <input type="text"/> (44-45)
(1) <u>IF YES</u> , PLEASE SPECIFY SITE: _____		
l. HEART DISEASE	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No (46)	19 <input type="text"/> <input type="text"/> <input type="text"/> (47-48)
(1) <u>IF YES</u> , PLEASE SPECIFY: _____		

4. OTHER THAN THE MEDICINES MENTIONED EARLIER, HAVE YOU EVER TAKEN ANY OTHER PRESCRIPTION MEDICATIONS? (EXCLUDE ASPIRIN, TYLENOL AND OVER-THE-COUNTER COUGH AND COLD MEDICINES.) ALSO, PLEASE INCLUDE THE LENGTH OF TIME YOU TOOK THE MEDICINE AND THE REASON FOR IT.

	<u>MEDICATION</u>	<u>LENGTH OF TIME</u>	<u>REASON</u>
a.	_____	_____	_____
b.	_____	_____	_____
c.	_____	_____	_____

5. HAS ANYONE IN YOUR FAMILY (PARENTS, BROTHERS OR SISTERS) HAD ANY OF THE FOLLOWING:

a. ASTHMA	1 <input type="checkbox"/> Yes	2 <input type="checkbox"/> No	8 <input type="checkbox"/> Unknown	(49)
b. HAY FEVER	1 <input type="checkbox"/> Yes	2 <input type="checkbox"/> No	8 <input type="checkbox"/> Unknown	(50)
c. ECZEMA	1 <input type="checkbox"/> Yes	2 <input type="checkbox"/> No	8 <input type="checkbox"/> Unknown	(51)

TIME INTERVIEW ENDED:

\_\_\_\_\_|\_\_\_\_\_|\_\_\_\_\_|\_\_\_\_\_|\_\_\_\_\_| (52-55)

CARD | 0 | 5 | (79-80)

DEPARTMENT OF HEALTH AND HUMAN SERVICES  
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