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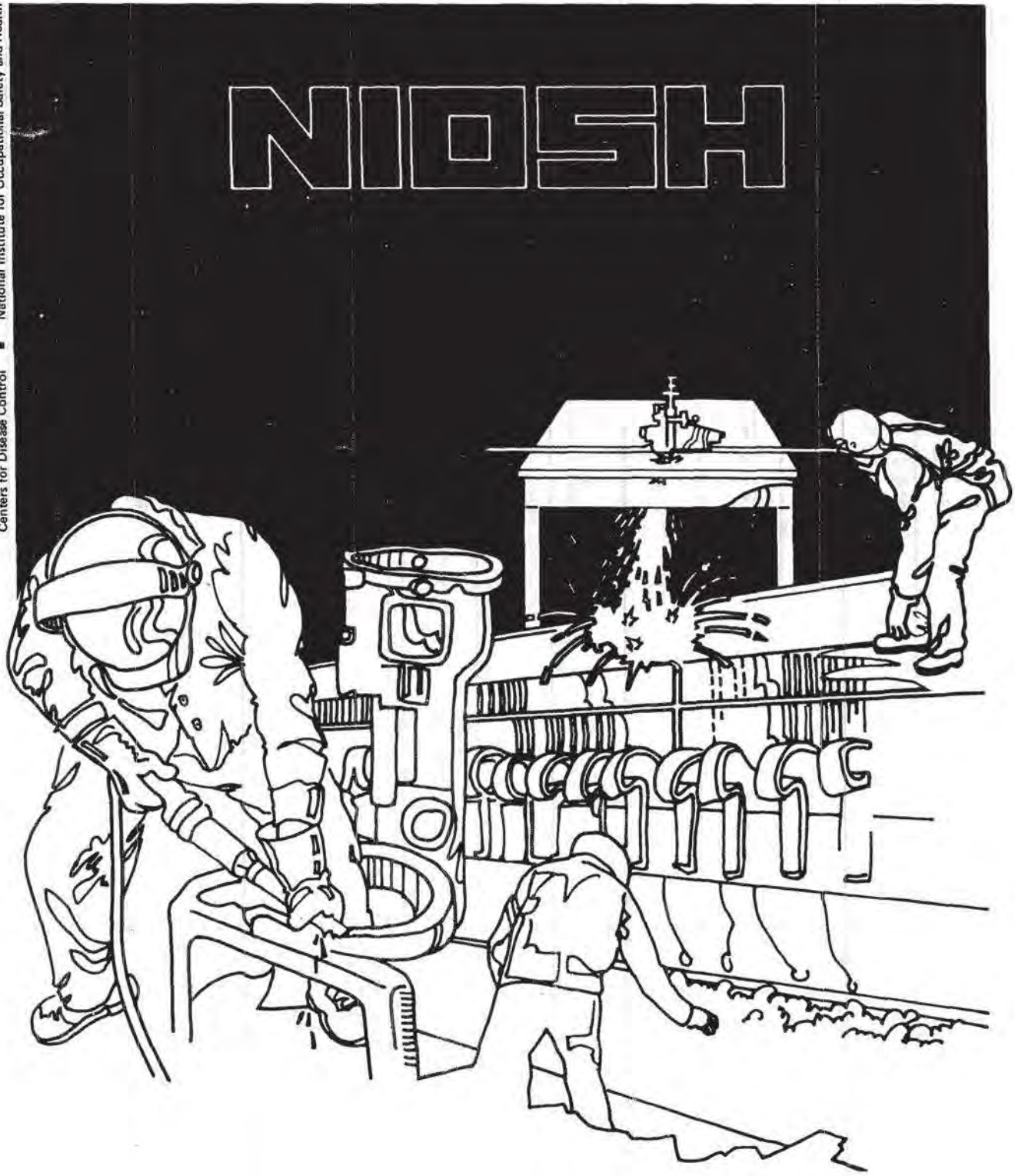

Health Hazard Evaluation Report

MHETA 85-226-1839
FRESHLABS, INC.
WARREN, MICHIGAN

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 nygiene 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.

MHETA 85-226-1839
FRESHLABS, INC.
AUGUST, 1987
WARREN, MICHIGAN

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I. SUMMARY:

Workers at the Freshlabs vitamin manufacturing facility in Warren, Michigan requested that representatives from NIOSH evaluate their work environment for exposure to irritating and asthma producing dusts, and asbestos. In general, dust measurements were found to be below the OSHA permissible exposure limits for "nuisance" dust. However, six cases of occupational asthma and seven cases of other hypersensitivity reactions such as severe nasal congestion, eye, throat, and bronchial irritation, were diagnosed by local physicians providing care to Freshlabs employees. Also, over half of the work force complained of acute eye, nose, and throat irritation due to past exposure. Much of the dust to which workers were exposed was acidic and probably caused the acute irritation and possibly the asthma and hypersensitivity reactions. Microbial growth and endotoxin levels were found to be low. Asbestos was found in ceiling insulation throughout the building and is occasionally contaminating the environment.

The "nuisance" dust standards may not be adequate to prevent workers from developing acute irritation. The local exhaust ventilation systems were found to be inadequate in controlling dust and should be redesigned to improve airflow distribution and capture of dust particles. Reduction of dust concentrations is recommended to decrease the frequency of acute irritation and may also decrease the occurrence of asthma and other hypersensitivity reactions. The asbestos-containing insulation should be removed.

Keywords: (SIC 2834 Acidic dusts, nuisance dusts, asbestos, ventilation, mucosal irritation, eye irritation, asthma).

II. INTRODUCTION:

Employees of Freshlabs, Inc., a vitamin manufacturing facility in Warren, Michigan, requested a health hazard evaluation because some workers had been diagnosed as having occupational asthma. Three cases were diagnosed by a local physician who claimed that rose hips, used in the manufacture of vitamin C tablets, was the cause of the asthma. Also, several workers were complaining of acute irritation of the eyes, skin, nose, throat, and upper airways, due to dust exposures in the plant and were concerned about the long-term effects of this exposure. In addition, the workers believed they were exposed to asbestos from flaking and falling ceiling insulation.

Representatives from the National Institute for Occupational Safety and Health (NIOSH) made an initial site visit in March, 1985 and a second visit in February, 1987 to investigate worker complaints and assess dust exposures.

The plant consists of a single large rectangular building located in a suburb of Detroit, Michigan. The company currently employs approximately 70 people in production, maintenance, housekeeping, and line supervision. There are approximately 40 workers on the first shift and 30 on the second shift. The general demographic characteristics are listed in Table I. The population is mostly young white males; women work primarily in inspection and clerk type positions. Almost 75% of the population has a history of smoking and half the population are current smokers.

A variety of vitamin supplement products are manufactured at the plant, including multiple vitamin and vitamin specific tablets. The center of the building where raw materials are placed serves as the warehouse. Raw materials are mixed to the proper consistency and then blended to the composition required for the production of particular products. Although both tablets and capsules are manufactured, capsules are a much smaller fraction of total production. The blended materials are compressed into tablets, which are subsequently film coated and inspected. Approved tablets are bulk packaged and sent to numerous marketing companies.

No reports of vitamin makers being irritated by dusts and developing occupational asthma were discovered in the literature. However, a report of herbal tea makers exposed to the Dog-rose (rose hips) indicated that rose hips at least may act as an eye and upper respiratory irritant.[1] The pulmonary function of those workers was not impaired, indicating that the exposure may not have caused chronic long-term lung changes.

State Inspections:

In addition to health hazard evaluations conducted by NIOSH, inspectors from the Michigan Department of Public Health - Bureau of Environmental and Occupational Health have investigated the Freshlabs plant. In January 1984, an inspector noted excessive dust levels in the compression department and potential hazards from exposure to asbestos. In a follow-up inspection conducted January 1986, the dust levels were reduced by two-thirds and the ventilation controls were considered to be adequate. It was recommended that those employees having respiratory problems with rose hips should wear approved disposable dust masks and that the asbestos insulation be encapsulated.

III. METHODS AND RESULTS:

First Survey - March 1985

A. Environmental:

Airborne Dust - Area respirable and total dust samples were collected near four tablet compression machines. The samplers were positioned near the breathing zones of the operators. Respirable dust samplers collect only smaller dust particles which are capable of depositing deep in the lung. Whereas, total dust samplers collect all airborne dust particles, even those too large to reach the lungs but might deposit in the nose, throat, and upper airways. The results of those measurements are presented in Table II.

Airborne dusts such as those generated at Freshlabs are currently considered "nuisance" dusts. Nuisance dusts are supposedly dusts which have little adverse effect on the lungs and do not produce significant organic disease or toxic effect when exposures are kept under reasonable control.(2) For nuisance dusts the Occupational Safety and Health Administration (OSHA) requires that the 8-hour permissible exposure limit (PEL) not exceed 5 mg/m^3 respirable dust or 15 mg/m^3 total dust.(3) The American Conference of Governmental Industrial Hygienists (ACGIH) recommends that exposure to total nuisance particulate not exceed 10 mg/m^3.(4)

Dust concentrations at press #10 were clearly excessive, whereas concentrations at the other presses were under required limits.

Micro-organisms - Two bulk samples of rose hips were diluted in sterile water and plated on nutrient agar to observe growth of fungi and bacteria. Fungal and bacterial counts were less than 300 colony forming units per gram (cfu/gm) and less than 75 cfu/gm, respectively. These concentrations are not excessive and are unlikely to have caused the symptoms reported at Freshlabs.

Endotoxins are an integral part of the cell wall of gram-negative organisms. They are liberated in soluble form both during bacterial growth and presumably during death and disintegration of the organisms. Organisms that produce endotoxins are likely to produce disease since most endotoxins are toxic to cells and evoke inflammatory responses.[5] Two bulk samples of rose hips were suspended in sterile water and tested for levels of endotoxin using the limulus amebocyte lysate assay.[6] The levels of endotoxin detected per milligram of rose hips were 1.6 and 0.4 ng/mg. Exposure to materials containing endotoxins in these concentrations is not known to cause irritation or respiratory disease.[7]

Samples were collected in the compression rooms for airborne fungal spores using a Burkhard sampler. This sampler collects airborne particulate on glass slides for microscopic counts of fungal spores, but the samples were so severely overloaded with dust particles that quantitative estimates for spores were not possible.

Asbestos - Microscopic examination of the ceiling insulation revealed it to contain 25% chrysotile asbestos and 75% mineral wool/cellulose fiber.

B. Medical:

Questionnaire - During the first survey, March 1985, workers were given a self-administered questionnaire (see Appendix A). At the time of the first survey, there were 86 non-supervisory production workers, of which 71 (82.5%) responded to the questionnaire. The questionnaire was divided into a portion designed to determine the prevalence of acute conjunctival, upper respiratory, and skin irritation, and a portion based on the American Thoracic Society's questionnaire designed to determine the prevalence of chronic respiratory problems.

The results of the first questionnaire are presented in Table III. Over half the workers complained of eye/throat, nose, and chest irritation. Symptoms of irritation included the following: eyes - watery burning eyes; throat - scratchy raw throat; nose - stuffy runny nose, sneezing; chest - cough, chest tightness, and shortness of breath. About one third of the workers complained of frequent skin rashes.

The prevalence of chronic complaints are also tabulated in Table III, and compared to smokers in a blue-collar population not exposed to any toxic or irritating gases and vapors.[8] Since smokers typically exhibit more chronic respiratory symptoms than do non-smokers, and most of the employees at Freshlabs have a history of smoking, smokers are used as the referent group. The prevalence of all categories of chronic respiratory symptoms were greater among Freshlabs employees.

Pulmonary Function Testing (PFT) - An abnormally low ratio of forced expiratory volume in one second (FEV_1) to the total forced volume exhaled from the lungs (FEV_1/FVC) results from increased resistance of the airways and indicates an obstructive impairment of airflow out of the lungs. This is often accompanied by an abnormal FEV_1. Exposure to irritating dusts and vapors may result in increased airways resistance by causing constriction of muscles which narrow the bronchial tubes or by causing excess mucous secretion, which tends to obstruct the free movement of air in and out of the lungs. In order to determine whether workers, as a group, had abnormally low FEV_1 and/or FEV_1/FVC, their measurements were compared to those of blue-collar workers not exposed to any toxic or irritating gases and vapors.[9] Measurements from the blue-collar population were used to determine the predicted or expected FEV_1 and FEV_1/FVC for each individual, according to their age, race, sex, height, and smoking status. Measurements were taken on 69 employees, but both pre- and post-work-shift measurements were available on only 64 of these persons. Also, smoking status was missing on 11 other individuals so that predicted values could be calculated for only 53 individuals.

The mean differences from predicted values of FEV_1 and FEV_1/FVC for workers plantwide, and by exposure and tenure groups are presented in Table IV. The high exposure group is considered to be those workers who were working in the compression or blending departments, because airborne dust concentrations in those areas were considerably higher than concentrations in other areas (See Table IV). Since the median length of employment was five years, workers were divided into a high tenure group, or those who had worked greater than five years, and a low tenure group, or ones who had worked less than or equal to five years.

The FEV_1 for workers at Freshlabs was found on average to be 90 milliliters (ml) less than what was predicted from the comparison workers. The high exposure group had an average FEV_1 which was 230 ml below predicted, whereas the low exposure group on average were 20 ml above the predicted FEV_1. Unexpectedly, low tenure workers had a mean of 170 ml below predicted, but high tenure employees were on average similar to predicted.

Student's group comparison t-test was used to test comparisons statistically, with a significance level set at $p<0.05$. The p-value sets the probability that differences this great or greater would occur by chance alone less than 5% of the time. Although none of these comparisons achieved statistical significance, they do indicate that as a group workers at Freshlabs, particularly those exposed to higher dust levels, have a somewhat lower FEV_1 than predicted.

The mean FEV_1/FVC ratio was 4.5% less than the mean predicted ratio for Freshlabs employees. This difference was statistically significant ($p<0.0005$). Again, comparisons of mean differences by exposure and tenure groups indicates that higher dust exposed and lower tenured workers as a group had lower FEV_1/FVC ratios than predicted, but these values did not achieve statistical significance. The mean FEV_1/FVC ratio for all workers was 78.5%.

The mean differences between pre and post shift measurements of FEV_1 and FEV_1/FVC for workers plant wide, and by exposure and tenure groups are presented in Table V. In all categories the FEV_1 improved over the workshift. The improvement was somewhat greater for higher exposed and lower tenured workers.

The FEV_1/FVC ratio also improved for on average in all categories except the high tenured workers. This group had a mean decrease of 0.4% while the low tenured workers had a mean increase of 1%.

Second Survey - February 1987

A. Environmental:

Airborne Dust - Personal respirable and total dust samples were collected throughout all the production areas over two consecutive days. The second day samples were collected during both the first and second shifts (Table VI). Total dust sampling was emphasized because the symptoms experienced by the workers were mostly related to the eyes, skin, and upper respiratory system; respirable dust samples estimate concentrations of dust which tends to deposit in the lower airspaces of the lung.

The blending/milling and compression areas were clearly the dustiest, with the other areas all having lower and similar dust concentrations. Five (15.6%) total dust samples exceeded the ACGIH recommended exposure level for nuisance dusts.[4] None of the respirable dust samples, but two total dust samples from the compression area, exceeded the OSHA-PEL.[3]

Bulk material samples were placed in neutral water (pH = 7.0) to create a saturated solution, and pH was determined with a hydrogen ion specific electrode. On a pH scale from 1-14 (<7 being acidic and >7 being alkaline), the samples ranged from 3.0-7.1 (Table VII). Rose hips, vitamin C products, and stress tablets are clearly acidic. Also, several components used in the manufacture of vitamins at Freshlabs are acidic (Table VII). Acidic dusts can be very irritating to the mucosal membranes of the eyes, nose, and upper respiratory system.

Cascade impactor samples were collected in all production areas of the plant to determine the size distributions of airborne dust particles. The mass median diameter is an estimate of the particle size at which 50% of the airborne dust mass is less than this size and 50% is greater than this size. The geometric standard deviation indicates the variability about this median diameter (Table VIII). The median diameters from all dust samples are less than 22 um in diameter. This indicates that most of the airborne dust mass is in the inhalable size range and is likely to remain suspended in air for a number of seconds and upon inspiration impact on the mucosa of the nose, throat, and upper bronchi. Particles less than 10 um in diameter are often considered respirable, that is capable of depositing in the alveoli and small airways.

Asbestos - Six dust samples vacuumed onto a filter and one bulk sample of the ceiling insulation were collected to determine the percent, type, and distribution of asbestos within the facility. The bulk sample revealed that the ceiling insulation was between 25-40% chrysotile in combination with mineral wool and cellulose. This asbestos/mineral wool combination was found in vacuum dust collected at: 1) in-coming air duct in mixing room Sigma III; 2) ventilation duct in compression room #15; 3) on pipes outside the men's upstairs restroom; 4) over the doorway to the sugar coating compressor room; 5) a storage rack in the warehouse; and 6) a electrical box near storage rack #15. The presence of the asbestos/mineral wool composition in these samples suggests that the ceiling insulation is falling and represents a potential respiratory hazard.

Ventilation - Face velocity measurements were made on the flexible hose openings and slot-hoods in milling, blending, and compression. While the face velocities ranged from 180-3400 feet per minute (fpm), the air volume was not adequate to provide capture of the dust being generated across the hoppers. Capture velocities were always less than 100 fpm just two to three inches from the hose or slot openings. A capture velocity of 100-200 fpm is recommended all across the zone of dust generation (i.e. the hoppers) for operations such as milling, blending, and compression.[11] Since the measured capture velocities were not effective beyond three inches, a large portion of the dust is being released into the environment. The measured face velocities and volumes for each hopper along with the required volumes to produce a capture velocity greater than 100 fpm across the zone of generation are presented in Table IX. Increasing the volume of air moving through some of the hoods may not be feasible; a more prudent approach would be to redesign the hoods to provide a better distribution of the air flow across the hoppers.

B. Medical:

Questionnaire - A second questionnaire to determine the prevalence of acute symptoms was interviewer-administered to 63 individuals in February 1987 (See Appendix B). Virtually all the production staff and approximately half of the maintenance, housekeeping, and supervisory staff were interviewed. The results of this questionnaire are presented in Table X. Workers were complaining of eye, nose, and throat symptoms with similar frequency as two years ago. The questionnaire indicates that there may have been a decrease in complaints of chest symptoms accompanied by and increase in skin rashes.

Tenure - The prevalence of symptoms was analyzed by length of employment (tenure) using the Mantel-Haenszel Chi square test (Table XI). Three tenure categories were constructed based on the upper and lower tenure quartiles, that is, since 25% of the workers had worked less than two years this became the low tenure category, and 25% had worked greater than nine years this became the high tenure category. Differences in frequency of symptoms by tenure category did not achieve statistical significance ($p<0.05$), however, workers with higher tenure tended to have a lower prevalence of nose, eye, and chest complaints. Analysis by tenure category may be confounded by the area of work, and personal characteristics such as age, race, and sex, but there are too few subjects in the study population to make adjustment for these confounders. The workers in blending and compression, which were areas of high dust concentrations, had lower mean tenure than other areas.

There were only five individuals in the plant who had worked less than 12 months, (actually none of the five had worked longer than three months) and none of these individuals complained of any symptoms. These five individuals represented four work areas (compression, film coating, shipping, and housekeeping).

The prevalence of symptoms was also studied by area of exposure. The number of workers in each work area is presented in Table XII. The prevalence of symptoms by production area are presented in Table XIII (maintenance, housekeeping, and supervisory workers are excluded). Because there are so few subjects in each area, statistical analysis is not useful, but symptoms of acute irritation of the nose, eyes, chest, and skin are likely to occur among individuals in any area of the plant.

Based on the dust concentrations as estimated by environmental sampling, workers were classified as exposed to "high" or "low" dust concentrations. Blending and compression workers were classified as being exposed to high dust concentrations (see Table VI). Chest and skin symptoms were roughly equally distributed between low and high dust categories (Table XIV). It was expected that skin symptoms not be correlated with airborne dust levels, however, we had expected more chest symptoms in the higher dust exposed group. Nose and eye symptoms did tend to be more prevalent among high dust exposed workers, although these differences in prevalence did not achieve statistical significance if a probability value (p-value) less than 0.05 is chosen to be the point of significance.

Medical Records - The medical records of two facilities providing contract-care for employees of Freshlabs were reviewed for the time period February 1979 to April 1985. Eighty different employees had visited the clinics one or more times during this time period. Employees most commonly sought treatment for dermatitis and conjunctivitis. Thirty of the eighty (37.5%) had complaints of dermatitis and 23 (28.8%) had complaints of conjunctivitis. Six individuals were diagnosed as having occupational asthma; three of these cases were presumed to have been caused by rose hips and one by dust from vitamin B-50 tablets. The specific cause of the other two remains unknown. Of the workers who developed occupational asthma, three worked in compression, one was a capsule operator, one an inspector, and one a packager. Seven other individuals developed hypersensitivity reactions resulting in severe nasal congestion, eye irritation, coughing episodes, or skin rashes. These hypersensitivity reactions were reported by four individuals to be caused by exposure to rose hips.

IV. DISCUSSION:

Airborne Dusts - Workers from all job categories at Freshlabs have occasionally experienced watery itchy eyes, sneezing, or runny stuffy noses during their tenure at the plant. Although skin rashes and symptoms of cough, chest tightness, and shortness of breath were less common, workers from all job categories still experienced these symptoms periodically. In the compression area of the plant where dust concentrations were the highest, almost all the workers experienced eye, nose, and throat irritation.

Apparently some workers have become sensitized to particular agents where in even low concentrations may cause severe irritation of the eyes, nose, sinuses, throat, and upper airways, and a few workers have developed occupational asthma. Occupational asthma is a narrowing of the airways

due to smooth muscle contraction which is initiated by exposure to some agent in the work environment. Asthma attacks result in wheezing and shortness of breath and can be life threatening.

As many as 200 agents have been documented to give rise to asthma.[12] Occupational asthma is a term used to describe a diverse group of lung diseases which all have the common feature of bronchoconstriction. Gandevia first introduced the classification of occupational asthma according to patho-physiologic mechanisms: broncho-constriction reflex; acute inflammatory; pharmocologic; and immunologic. However, often times the mechanism of broncho-constriction is unknown or more than one type of mechanism may be involved.[13,14] (See Appendix C).

Rose hips have been blamed for causing much of the irritation and asthma at Freshlabs. Rose hips are the fresh ripe fruits or ovaries of certain species of roses, such as the field, dog, and downy rose.[15] The pulp of the fruit is used in making vitamin C tablets and commonly contains 11 to 15% sugar, 3% citric and malic acids, and 1 to 2% ascorbic acid. Rose hips may be irritating due to their acidic nature (pH = 5.0), but they are also capable of illiciting immunologic reactions.

In addition to rose hips, workers at Freshlabs are exposed to numerous vitamin components with an acidic nature. Chief among these are: ascorbic acid (vitamin C); thiamine hydrochloride (vitamin B_1); riboflavin (vitamin B_2); niacin; pyridoxin hydrochloride (vitamin B_6); and folic acid (Table VII). Because of their acidic nature, aerosols of these materials are irritating to the eyes, and nasal/respiratory mucosa.

The nasal/respiratory mucosa and eyes maintain a moist, slightly alkaline surface (pH = 7.0-7.4) and have a buffering capacity to neutralize acidic materials which are collected on the surface. However, the surfaces have only a small volume of fluid and can be easily overwhelmed by high concentrations of acidic dust. If the fluid of the mucosal surfaces and eyes are made acidic the underlying tissue becomes irritated.

Since we found very little microbial growth and low endotoxin levels from bulk samples at Freshlabs, it is unlikely that workers' symptoms are caused by reaction to micro-organisms.

We conclude that most of the irritative symptoms experienced by workers at Freshlabs are caused by exposure to acidic dust and although acute irritation may occur in any area of the plant, it was more common in the areas where dust levels were highest. However, certain individuals have developed sensitivity to lower concentrations of dust. These hypersensitive individuals may be particularly susceptible to the irritative properties of the dust or because some of the dusts are proteins and polysaccharides, may have developed immunologic reactions.

It is very difficult to protect sensitized and asthmatic individuals. The best protection is to remove them from exposure to the particular agents to which they are sensitive by relocating them in areas of the plant where those agents are not used, or where airborne concentrations are very low. In some cases the company has already taken this approach. Of the six cases diagnosed as having occupational asthma, four were from the compression area, and of the seven cases of acute sensitization, four were from compression. Clearly, people with a history of asthma should be warned against working in the Freshlabs environment, especially in areas of relatively higher dust exposures.

It is difficult to assess the effect long-term exposure to these irritating dusts has had in this population. Some highly susceptible workers have developed asthma or become otherwise hypersensitive (e.g. stuffy runny nose, eye irritation, cough). Acute symptoms generally go away shortly after workers leave the environment and greatly resolve on weekends and vacations. Chronic symptoms, especially phlegm, were more prevalent among Freshlabs employees than among a non-exposed blue-collar population. In addition, FEV_1 and FEV_1/FVC, although generally not statistically significant, were decreased below the expected measurements from a non-exposed blue-collar population. These results indicate that there may be a slight increase in chronic bronchitis or obstructive pulmonary conditions. Decrements in FEV_1 and FEV_1/FVC were somewhat greater for those workers who were most heavily exposed. Decrements were less for high-tenured workers. This may be the result of a survivor population, that is, workers who have developed an obstructive condition have left Freshlabs, and those who are perhaps more resistant to developing airway changes have remained. This study, however, was not really designed to determine whether exposure to the dusts is causing chronic problems. A study design better suited to answer this question would be a follow-up of workers over a long period of time to determine changes in symptomology and lung function.

Although most of the respirable and total dust measurements in the plant were well below the OSHA permissible exposure limits (PEL) for nuisance dusts, these acidic irritating dusts do not fit the nuisance dust definition and these limits perhaps do not provide adequate protection for the average worker. While much of the dust to which workers are exposed, such as sugars, starches, cellulose, and amorphous silicon dioxide, are inert nuisance dusts, the other acidic irritant dusts should be measured against different guidelines. Unfortunately, this report is not comprehensive enough to recommend what guidelines should apply or to what level acidic dusts should be reduced, but a general reduction in the airborne levels of acidic dusts would certainly reduce the prevalence of symptoms of irritation and probably reduce the prevalence of hypersensitization and asthma. Changes in ventilation and production design are the most effective means of reducing dust exposures.

Ventilation measurements that were taken in the milling, blending and compression departments all indicated the local exhaust ventilation was inadequate. The slot exhaust on some of the compression equipment is improperly positioned with respect to the hoppers being filled and the slot exhaust systems do not have adequate volume to provide a capture velocity sufficient to remove dust particles before they become suspended in room air. In other words, at a distance of more than three inches from the slot or hose openings, the capture of material is nil.

Because of the dusty conditions in the compression department, disposable dust masks were used, however, they are often worn improperly. Most wearers used only one strap of a two strap mask; the mask is approved for use with two straps. Also, when individuals with beards wear dust masks, even if worn properly, protection is compromised because they cannot get a proper face-to-mask seal. Control of dust exposure by respirators is not an acceptable alternative to well designed exhaust ventilation or engineering controls. It is even difficult to work in good, properly fitting respirators for long periods of time. Eventually the face-to-mask seal may be broken allowing the worker to be exposed. This may be a particularly troublesome problem with dusts that cause skin irritation. These dusts may deposit between the face and mask increasing the likelihood of irritation.

Asbestos - The presence of asbestos in a building does not mean that the health of building occupants is necessarily endangered. As long as asbestos-containing material remains in good condition and is not disturbed, exposure is unlikely. When building maintenance, repair, renovation or other activities disturb asbestos-containing material, or if it is damaged, asbestos fibers are released creating a potential hazard to building occupants.[16]

Damaged asbestos insulation is located on the ceiling throughout the Freshlabs facility. It has been clearly documented that because the insulation is falling and being deposited throughout the plant, workers are occasionally exposed to asbestos. Probably because of past water leaks on the roof and the age of the insulation, it has begun to deteriorate. Samples for airborne asbestos may confirm low exposure concentrations, but the condition of the material and its distribution pose a hazard for short exposures over a long period of time.

The relationship between exposure level and health risk is complex. The potential for disease appears to be related to the physical and chemical characteristics of asbestos fibers as well as the concentration of fibers in the air. Data on asbestos workers indicate that the risks of asbestosis, lung cancer, and cancer of the lining of the lungs and chest cavity (mesothelioma) decrease in direct proportion to a decrease in total asbestos dose. Because there is no direct information on health

risks from exposure to asbestos in buildings with asbestos-containing materials, the risks are estimated by extrapolation from studies of asbestos industry workers. Although estimates indicate that only a small proportion of people exposed to low levels of asbestos will develop asbestos-related disease, even low concentrations may present increased risk of developing lung cancer and mesothelioma.

V. RECOMMENDATIONS:

1. Local exhaust hoods should be designed to enclose the hoppers and mixing barrels in the compression, milling, and blending areas as much as possible. The more completely enclosed areas of material transfer are, the less air volume required to prevent escape of dust into the workroom air. The volume of air moving through these hoods should be great enough to provide a velocity capable of capturing dust all across the zone of generation. This velocity should be approximately 100-200fpm.

2. Workers in the compression rooms are most heavily exposed to dusts while scooping material from the supply barrels and placing it in the hoppers, particularly when they have to reach deep into the supply barrels. If this work practice could be eliminated it would greatly reduce dust exposures in this area. However, in lieu of some type of automatic hopper feeding device, the supply barrels should be placed close to the hoppers in order to reduce distance of material transfer. The barrels should be mechanically elevated closer to the hopper or provide a box step for the employees to fill hoppers.

3. Personal dust respirators should be worn properly with both straps placed around the head and the mask fitting snugly against the face. Respirators should be considered only as a secondary defense and not a dust control measure to be employed full-time.

4. Skin contact with materials in this environment is unavoidable. Gloves and tight fitting clothing may actually compound the problem by holding the materials close to the skin. To reduce skin rashes workers should remove dust from the skin with frequent washing and apply skin moisturizers and conditioners to prevent irritation due to frequent washing.

5. Encapsulation of the ceiling insulation or enclosing behind a drop-ceiling is not recommended. This will eventually lead to a continuation of the problem. While providing an aesthetically pleasing change for a while, the insulation will no doubt continue to fall because it has lost its adhesiveness and will collect above the drop-ceiling. In time the drop-ceiling itself may become damaged and certainly will have to be moved during maintenance operations. Thereby, exposures will continue to occur. Therefore, it is recommended that EPA guidelines be followed in removing the asbestos insulation from the building.

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VIII. DISTRIBUTION AND AVAILABILITY OF REPORT

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1. Teamsters, Local 614
2. Freshlabs, Inc.
3. OSHA, Detriot, MI
4. OSHA, Washington, DC
5. NIOSH Regional Office

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

TABLE I

Demographic Characteristics of Employees at
Freshlabs, Inc. - Warren, Michigan
February 1987

		n	%
Sex:			
	Male	42	66.7
	Female	21	33.3
Race:			
	White	59	93.7
	Black	4	6.3
Age:			
	≤ 29	27	42.9
	30-39	18	28.6
	40-49	10	15.9
	≥ 50	8	12.7

Mean age = 35 ± 12 years
Median = 30 years
Range = 19 - 77 years

Smoking:			
	Non Smokers	18	28.6
	Ex Smokers	13	20.6
	Smokers	32	50.8
Tenure:			
	≤ 1 year	5	7.9
	1-5 years	24	38.1
	> 5 years	34	54.0

Mean tenure = 6.6 ± 5 years
Median = 7 years
Range = < 1 year - 27 years

Table II

Area Respirable and Total Dust Measurements in
the Compression Department
Freshlabs, Inc. - Warren, Michigan
March 1985

Area	Resp (mg/m^3)	Total (mg/m^3)
Press 10	18.10	overloaded
Press 12	0.18	11.05
Press 15	0.52	2.86
Press 16	0.43	5.65

TABLE III

Symptoms: From Self-Administered Questionnaire
Freshlabs, Inc. - Warren, Michigan
March, 1985

Complaint	n	%	
Acute Irritation			
Eye/throat	43	60.6	
Nose	47	66.2	
Chest	36	50.7	
Skin	22	31.0	
Chronic Respiratory Problems			Smokers in Blue-Collar Non-Exposed Population(*)
Chronic Cough	21	29.6	18.1%
Chronic Phlegm	27	38.0	17.0%
Chronic Bronchitis with Exacerbations	31	43.6	7.9
Phlegm/Illness	36	50.7	3.9%
Wheeze/Shortness of Breath	19	26.7	10.6%

* = Petersen, M. and Castellan, R. "Prevalence of chest symptoms in Nonexposed Blue-Collar Workers" Jour. Occ. Med. 26:267-374(1984).

Table IV
Pulmonary Function Measurements (FEV_1/FVC) of Employees
Compared to a Nonexposed Blue-Collar Population (*)
Freshlabs, Inc. - Warren, Michigan
March 1985

Preshift FEV_1

		n	Mean ± Std (liters)	p
Plantwide mean Difference from Predicted		53	-0.09 ± 0.61	0.1<p<0.2
Comparison of mean difference from predicted between high and low exposure groups**	high	24	-.23 ± 0.59	0.05<p<0.1
	low	29	0.02 ± 0.61	
Comparison of mean difference from predicted between high and low tenure groups	>25 yr	30	0.00 ± 0.72	0.1<p<0.2
	≤ 5 yr	23	-.17 ± 0.50	

Preshift FEV_1/FVC

		n	Mean + Std (%)	p
Plantwide mean Difference from Predicted		53	-4.58 ± 9.06	p<0.0005
Comparison of mean difference from predicted between high and low exposure groups**	high	24	-5.18 ± 10.67	0.3<p<0.4
	low	29	-4.07 ± 7.64	
Comparison on mean difference from predicted between high and low tenure groups	> 5 yr	30	-3.96 ± 10.48	0.05<p<0.1
	≤ 5 yr	23	-5.05 ± 7.97	

* = Petersen, M. and Hankinson, J. "Spirometry Reference Values for Nonexposed Blue-Collar Workers" Jour. Occ. Med. 27:644-650(1985).

** = High Exposure Group = those subjects currently working in compression or blending.
Low Exposure Group = those subjects working in all other areas.

Table V
Difference Between Pre and Post Shift Pulmonary Function Measurements
of Employees
Freshlabs, Inc. - Warren, Michigan
March 1985

Shift Change in FEV_1

	n	Mean ± Std (liters)	p
Plantwide mean Difference	64	0.08 ± 0.22	-
Comparison of mean difference between high and low exposure groups*	high - 28 low - 36	0.10 ± 0.27 0.07 ± 0.18	0.2<p<0.3
Comparison of mean difference between high and low tenure groups	> 5 yr - 35 ≤ 5 yr - 29	0.04 ± 0.18 0.11 ± 0.24	0.05<p<0.1

Shift Change in FEV_1/FVC

	n	Mean ± Std (%)	p
Plantwide mean Difference	64	0.36 ± 3.81	-
Comparison of mean difference between high and low exposure groups*	high - 28 low - 36	0.17 ± 4.50 0.10 ± 3.21	0.2<p<0.3
Comparison of mean difference between high and low tenure groups	> 5 yr - 29 ≤ 5 yr - 35	-0.41 ± 2.37 1.00 ± 4.62	0.05<p<0.1

* High Exposure Group = those subjects currently working in compression or blending.
Low Exposure Group = those subjects working in all other areas.

TABLE VI

Personal Respirable and Total Dust Measurements
Freshlabs, Inc. - Warren, Michigan
February 1987

	Type	n	Mean ± Std (mg/m^3)	Range (mg/m^3)
Plantwide	Resp	23	0.28 ± 0.28	0.04 - 1.00
	Total	32	5.10 ± 10.42	0.08 - 53.0
Weigh-in	Resp	1	0.11	
	Total	1	0.41	
Milling/Blending	Resp	3	0.29 ± 0.23	0.13 - 0.55
	Total	6	3.20 ± 2.04	0.46 - 5.60
Compression	Resp	10	0.44 ± 0.34	0.08 - 1.00
	Total	10	13.52 ± 15.91	0.33 - 53.00
Coating	Resp	2	0.06 ± 0.03	0.04 - 0.08
	Total	5	0.51 ± 0.30	0.11 - 0.74
Inspection	Resp	4	0.15 ± 0.04	0.11 - 0.19
	Total	5	0.43 ± 0.19	0.12 - 0.63
Package/Shipping	Resp	2	0.11 ± 0.01	0.10 - 0.11
	Total	5	0.72 ± 0.70	0.08 - 1.80
Maintenance	Resp	1	0.04	
High dust (compression and milling/blending)	Resp	13	0.41 ± 0.31	0.08 - 1.00
	Total	16	9.65 ± 13.41	0.33 - 53.00
Low dust (all other areas)	Resp	10	0.11 ± 0.05	0.04 - 0.19
	Total	16	0.55 ± 0.42	0.08 - 1.80

Table VII

Hydrogen Ion Concentrations (pH) of Dusts
Freshlabs, Inc. - Warren, Michigan
February 1987

pH - determined with ion specific electrode

	pH
Rose hips	4.9-5.0
Rose hips/Vitamin C*	3.2
Vitamin C/Rose hips*	3.1-3.2
Vitamin C	3.0-3.2
Vita-min-plus	6.8-6.9
Stress formula/Zinc	4.0-4.1
Multivitamin (pink chewable)	6.7-7.1

Published pH values for vitamins (10)

Ascorbic acid = vitamin C	2-3
Thiamine hydrochloride (vitamin B_1)	3-4
Riboflavin = vitamin B_2	6
Niacin	3
Niacinamide	6
Pyridoxin hydrochloride	3
Folic Acid	4-4.8

* - the commodity named first is in the highest concentrations.

Table IX

Ventilation Systems Measurements
Freshlabs, Inc.
February 1987

Location	Measured Volume (CFM)(1)	Volume needed to provide Capture Velocity >100 fpm (CFM)(2)
Compression #1	53 first slot	199
	53 second slot	199
Compression #2	134 first slot	199
	134 barrel hose	1000
	196 machine hose	250
Compression #3	75 slot	336
	9 hose	1000
Compression #4	160 slot	336
	29 hose	1000
Compression #5	81 first slot	199
	54 second slot	199
	machine hose*	-
Compression #6	50 first slot	199
	153 second slot	199
	machine hose*	-
	33 barrel hose	1000
Compression #7	54 slot	199
	machine hose*	-
Compression #8	144 slot	199
	126 barrel hose	1000
	machine hose*	-
Compression #9	81 first slot	199
	81 second slot	199
	17 barrel slot	1000
	machine hose*	-
Compression #10	63 first slot	199
	99 second slot	199
	machine hose*	-
	machine hose*	-
Compression #11	117 slot	140
	machine hose*	-
	35 barrel hose	10000

Table VIII

Mass Median Aerodynamic Diameter, Standard Deviation, and Percent of Dust in Respirable Range (<10 um diameter) by Area
Freshlabs, Inc. - Warren, Michigan
February 1987

Area	MMD	GSD	%<10 um diameter
Blending	12	2.2	41%
Milling	12	1.8	38%
	16	2.2	25%
	9.6	2.1	48%
Compression	16	2.3	22%
	18	3.1	31%
	21	3.5	28%
	13	1.9	34%
	21.5	2.2	15%
	16	1.9	18%
Sugar Coating	6.2	13.8	62%
Inspection	9.4	2.7	51%
Bulk Package	18	2.2	20.%

MMD = mass median aerodynamic diameter
GSD = geometric standard deviation

Table IX (continued)

Ventilation Systems Measurements
Freshlabs, Inc.
February 1987

Location	Measured Volume (CFM)(1)	Volume needed to provide Capture Velocity >100 fpm (CFM)(2)
Compression #12	being cleaned	-
Compression #14	162 first slot	199
	144 second slot	199
	39 first barrel hose	1000
	44 second barrel hose	1000
Compression #15	45 slot	199
	18 barrel hose	1000
	machine hose*	-
Compression #17	See Note (3)	
Sigma I	580 at hood	879 at 13" capture
Sigma II	98 3" hose	250 at 6" capture
	29 2" hose	250 at 6" capture
Sigma III	265	750
Gemco I	52 first hose	250 at 6" capture
	175 second hose	250 at 6" capture
Gemco II	306 first hose	1000
	297 second hose	1000

Notes:

(1) Measured Volume - air velocity at the hose or hood opening. It's the face velocity measured in feet per minute (fpm) times the area of the hood in square feet.

(2) Capture Velocity - is the velocity at any point in front of the hood opening necessary to overcome air currents and capture the contaminant. Unless otherwise noted, calculations were based on a capture at one foot away and 100 fpm velocity since most of the hopper diameters were 10-12".

(3) Compression #17 - the design of this system is inadequate. The two pipe openings do not exhaust the entire surface area of the hopper.

*Machine Hose - air velocity was not checked.

TABLE X

Symptoms: From Interviewer - Administered Questionnaire
Freshlabs - Warren, Michigan
February, 1987

Complaint	n	%
Eye/throat	42	66.7
Nose	45	71.4
Chest	18	28.6
Skin	26	41.3

63 subjects responded to the questionnaire

Eye/Throat Symptoms included: watery, burning, red eyes, and dry, hoarse, or sore throat.

Nose Symptoms included: stuffy, runny nose and sneezing.

Chest Symptoms included: cough, chest tightness, and shortness of breath.

Skin Symptoms included: skin rashes

Table XI
Prevalence of Symptoms by Tenure
Freshlabs - Warren, Michigan
February 1987

		Tenure			
		≤2 yrs	3-8 yr	≥9 yrs	
Nose Symptoms	NO	5 (29.4)	6 (20.0)	7 (43.8)	X^2 =1.023 p = 0.31
	YES	12 (70.6)	24 (80.0)	9 (56.2)	
		<2 yrs	3-8 yr	>9 yrs	
Eye Symptoms	NO	6 (35.3)	6 (20.0)	9 (56.3)	X^2 =2.036 p = 0.15
	YES	11 (64.7)	24 (80.0)	7 (43.7)	
		<2 yrs	3-8 yr	>9 yrs	
Chest Symptoms	NO	13 (76.5)	19 (63.3)	13 (81.3)	X^2 =0.164 p = 0.68
	YES	4 (23.5)	11 (36.7)	3 (18.7)	
		<2 yrs	3-8 yr	>9 yrs	
Skin Symptoms	NO	13 (76.5)	15 (50.0)	9 (56.3)	X^2 =1.13 p = 0.29
	YES	4 (23.5)	15 (50.0)	7 (43.7)	

Table XII
Number of Workers Interviewed by Area
Freshlabs, Inc. - Warren, Michigan
February 1987

	n	percent (%)
Weigh-in	6	9.5
Blending/Milling	7	11.1
Compression	19	30.2
Coating	6	9.5
Inspection	10	15.9
Shipping/Packaging	7	11.1
Maintenance	6	9.5
Supervisors	2	3.2
Total	63	

Table XIII
Prevalence of Symptoms by Production Area
Freshlabs, Inc. - Warren, Michigan
February 1987

		Weigh	Blend	Compress	Coat	Inspect	Ship
Nose Symptoms	NO	1 (16.7)	3 (42.9)	2 (10.5)	3 (50.0)	2 (20.0)	2 (28.6)
	YES	5 (83.3)	4 (57.1)	17 (89.5)	3 (50.0)	8 (80.0)	5 (71.4)

		Weigh	Blend	Compress	Coat	Inspect	Ship
Eye Symptoms	NO	4 (66.7)	3 (42.9)	3 (15.8)	2 (33.3)	3 (30.0)	3 (42.9)
	YES	2 (33.3)	4 (57.1)	16 (84.2)	4 (66.7)	7 (70.0)	4 (57.1)

		Weigh	Blend	Compress	Coat	Inspect	Ship
Chest Symptoms	NO	4 (66.7)	6 (85.7)	13 (68.4)	5 (83.3)	7 (70.0)	4 (57.1)
	YES	2 (33.3)	1 (14.3)	6 (31.6)	1 (16.7)	3 (30.0)	3 (42.9)

		Weigh	Blend	Compress	Coat	Inspect	Ship
Skin Symptoms	NO	4 (66.7)	4 (57.1)	10 (52.6)	2 (33.3)	8 (80.0)	4 (57.1)
	YES	2 (33.3)	3 (42.9)	9 (47.4)	4 (66.7)	2 (20.0)	3 (42.9)

Table XIV
Prevalence of Symptoms by Dust Exposure
Freshlabs, Inc. - Warren, Michigan
February 1987

Exposure

		Low	High	
Nose Symptoms	NO	13 (35.1)	5 (19.2)	X^2 =1.86 p = 0.17
	YES	24 (64.9)	21 (80.8)	

		Low	High	
Eye Symptoms	NO	15 (40.5)	6 (23.08)	X^2 =2.06 p = 0.15
	YES	22 (59.5)	20 (76.92)	

		Low	High	
Chest Symptoms	NO	26 (70.3)	19 (73.1)	X^2 =0.06 p = 0.81
	YES	11 (29.7)	7 (26.9)	

		Low	High	
Skin Symptoms	NO	23 (62.2)	14 (53.9)	X^2 =0.43 p = 0.51
	YES	14 (37.8)	12 (46.1)	

APPENDIX A

00093

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

HEALTH HAZARD EVALUATION 85-226

FRESHLABS, INC.

I.

1. (OPTIONAL) Please tell us your name, address, and telephone number.

_____

_____

_____

Area Code _____ Telephone _____

2. What is your present job title at Freshlabs?

_____

3. In which department do you work?

_____

4. How long have you held this particular job title?

_____years _____months

5. Please list any other jobs you have held at Freshlabs, Inc. and how long you worked at them.

A. Latest Job: _____ Years or Months Worked: _____

B. Middle Job: _____ Years or Months Worked: _____

C. Earliest Job: _____ Years or Months Worked: _____

6. What are your working hours this week?

Start _____ Stop _____

7. Do you have any days off scheduled this week?

1. Yes ☐ 2. No ☐

7A. IF YES TO QUESTION 7, please indicate which days.

_____

_____

II. Allergy

8. Have you ever been told by a doctor that you have eczema?
   1. Yes ☐ 2. No ☐

8A. IF YES TO QUESTION 8, did you first develop eczema before the age of two years?
   1. Yes ☐ 2. No ☐ 7. Don't Know ☐

9. Have you ever been told by a doctor that you had an allergic reaction to a certain type of food or medicine?
   1. Yes, food only ☐
   2. Yes, medicine only ☐
   3. Yes, both food and medicine ☐
   4. No ☐

10. Have you ever been told by a doctor that you had an allergic reaction to pollen or dust?
   1. Yes ☐ 2. No ☐

11. Has a doctor ever told you that you had an allergic skin reaction to detergents or other chemicals? (Do not include poison oak or posion ivy.)
   1. Yes ☐ 2. No ☐

11A. IF YES TO QUESTION 11, please list these detergents or chemicals.

_____

_____

_____

12. Did you ever receive allergy shots?
   1. Yes ☐ 2. No ☐

13. How many of your immediate relations (i.e., mother, father, sister, brother, daughter, son) seem to have allergic reactions to <u>multiple substances</u>?
   _____ out of a total of _____family members.

III. Eye and Throat Symptoms

14. Have you regularly noticed eye and throat symptoms such as itching, burning or red eyes, or dry, irritated, scratchy or sore throat at any time during employment at Freshlabs?

1. Yes ☐ 2. No ☐

IF YES TO QUESTION 14

15A. Were these symptoms present before you started working at Freshlabs?

1. Yes ☐ 2. No ☐

15B. Do the symptoms disappear or get better on weekends off?

1. Yes ☐ 2. No ☐ 3. No Difference ☐

15C. Do the symptoms disappear or get better on vacations?

1. Yes ☐ 2. No ☐ 3. No Difference ☐

15D. Does this get worse when you come back to work?

1. Yes ☐ 2. No ☐

15E. If they get worse, how soon do they begin after you return to work?

(Circle your answer)
ONE ANSWER ONLY

1st day 1
2nd day 2
1st week 3
Longer 4

15F. Compared to when the symptoms first began, are they now better, worse or the same?

1. Better ☐ 2. Worse ☐ 3. Same ☐

Nose Symptoms

16. Have you regularly noticed nose symptoms such as running or stuffy nose or sneezing at any time during your employment at Freshlabs?

1. Yes ☐ 2. No ☐

IF YES TO QUESTION 16

17A. Were these symptoms present before you started working at Freshlabs?
1. Yes ☐ 2. No ☐

17B. Do the symptoms disappear or get better on weekends off?
1. Yes ☐ 2. No ☐ 3. No Difference ☐

17C. Do the symptoms disappear or get better on vacations?
1. Yes ☐ 2. No ☐ 3. No Difference ☐

17D. Does this get worse when you come back to work?
1. Yes ☐ 2. No ☐

17E. If they get worse, how soon do they begin after you return to work?

(Circle your answer)
ONE ANSWER ONLY

1st day 1
2nd day 2
1st week 3
Longer 4

17F. Compared to when the symptoms first began, are they now better, worse or the same?
1. Better ☐ 2. Worse ☐ 3. Same ☐

Chest Symptoms

18. Have you regularly noticed wheezing, cough, shortness of breath, or chest tightness?
1. Yes ☐ 2. No ☐

IF YES TO QUESTION 18

19A. Were these symptoms present before you started working at Freshlabs?
1. Yes ☐ 2. No ☐

19B. Do the symptoms disappear or get better on weekends off?
1. Yes ☐ 2. No ☐ 3. No Difference ☐

19C. Do the symptoms disappear or get better on vacations?
1. Yes ☐ 2. No ☐ 3. No Difference ☐

19D. Does this get worse when you come back to work?
1. Yes ☐ 2. No ☐

19E. If they get worse, how soon do they begin after you return to work?

(Circle your answer)
ONE ANSWER ONLY

1st day 1
2nd day 2
1st week 3
Longer 4

19F. Compared to when the symptoms first began, are they now better, worse or the same?
1. Better ☐ 2. Worse ☐ 3. Same ☐

19G. If you currently, or previously, experienced symptoms or wheezing, cough, shortness of breath or chest tightness, when in the day do these symptoms occur? (Times start with arrival at work.)
1. Immediately or within 30 minutes on coming to work ☐
2. 30 - 60 minutes after coming to work ☐
3. 1 - 4 hours after coming to work ☐
4. 4 - 8 hours after coming to work ☐
5. At home after work (8-12 hours) ☐
6. At home awakened from sleep (12-16 hours) ☐
7. At home, awakened shortly before arising (16-24 hours) ☐
8. Continuous ☐
9. Combination ☐

Skin Symptoms

20. Have you regularly noticed hives or skin rashes?
1. Yes ☐ 2. No ☐

IF YES TO QUESTION 20

21A. Were these symptoms present before you started working at Freshlabs?
1. Yes ☐ 2. No ☐

21B. Do these symptoms disappear or get better on weekends off?
1. Yes ☐ 2. No ☐

21C. Do these symptoms disappear of get better on vacations?
1. Yes ☐ 2. No ☐

21D. Do these symptoms get worse when you come back to work?
1. Yes ☐ 2. No ☐

21E. If they get worse, how soon do they begin after you return to work?

(Circle your answer)
ONE ANSWER ONLY

1st day 1
2nd day 2
1st week 3
Longer 4

21F. Compared to when the symptoms first began, are they now better, worse, or the same?
1. Better ☐ 2. Worse ☐ 3. Same ☐

Cough

22A. Do you usually have a cough? (Count a cough with first smoke or on first going out-of-doors. Exclude clearing throat.) (IF NO, SKIP TO QUESTION 22C.) 1. Yes ☐ 2. No ☐

22B. Do you usually cough as much as 4 to 6 times a day, four or more days of the week? 1. Yes ☐ 2. No ☐

22C. Do you usually cough at all on getting up, or first thing in the morning?
1. Yes ☐ 2. No ☐

22D. Do you usually cough at all during the rest of the day or night?
1. Yes ☐ 2. No ☐

IF YES TO ANY OF THE ABOVE (22A, B, C, D) ANSWER THE FOLLOWING: IF NO TO ALL, CHECK "DOES NOT APPLY" AND SKIP TO THE NEXT QUESTION.

23A. Do you usually cough like this on most days for three consecutive months or more during the year?
1. Yes ☐ 2. No ☐ 8. Does not apply ☐

23B. For how many years have you had this cough?
____ years 88. Does not apply ☐

23C. When does your cough give you most trouble?
(Circle your answer) ONE ANSWER ONLY

1	2	3	4	5	6
Spring	Summer	Fall	Winter	No relation to time of year	Does not apply

Phlegm

24A. Do you usually bring up phlegm from your chest? (Count phlegm with the first smoke or on first going out-of-doors. Exclude phlegm from the nose. Count swallowed phlegm.) (IF NO, SKIP TO 24C.)
1. Yes ☐ 2. No ☐

24B. Do you usually bring up phlegm like this as much as twice a day, four or more days out of the week? 1. Yes ☐ 2. No ☐

24C. Do you usually bring up phlegm at all on getting up, or first thing in the morning? 1. Yes ☐ 2. No ☐

24D. Do you usually bring up phlegm at all during the rest of the day or at night? 1. Yes ☐ 2. No ☐

IF YES TO ANY OF THE ABOVE (24A, B, C, D) ANSWER THE FOLLOWING. IF NO TO ALL CHECK "DOES NOT APPLY" AND SKIP TO NEXT QUESTION.

24E. Do you bring up phlegm like this for three consecutive months or more during the year? 1. Yes ☐ 2. No ☐ 8. Does not apply ☐

24F. For how many years have you had trouble with phlegm?
_____years 88. Does not apply ☐

24G. When does phlegm give you most trouble?
(Circle your answer) ONE ANSWER ONLY

1	2	3	4	5	6
Spring	Summer	Fall	Winter	No relation to time of year	Does not apply

Episodes of Phlegm

25A. Have you had periods of cough and/or phlegm for three weeks or more each year?, or increased cough and/or phlegm for persons who usually have cough or phlegm? 1. Yes ☐ 2. No ☐

IF YES TO QUESTION 25A

25B. For how long have you had at least one such episode per year?
_____years 88. Does not apply ☐

Wheezing

26. Does your chest ever sound wheezy or whistling:

26A. When you have a cold? 1. Yes ☐ 2. No ☐

26B. Occasionally apart from colds? 1. Yes ☐ 2. No ☐

26C. Most days or night? 1. Yes ☐ 2. No ☐

IF YES TO QUESTION 26A, B, OR C:

26D. For how many years has this been present?

_____years 88. Does not apply ☐

27A. Have you ever had an attack of wheezing that has made you feel short of breath? 1. Yes ☐ 2. No ☐

IF YES TO QUESTION 27A:

27B. How old were you when you had your first such attack?

_____Age in years 88. Does not apply ☐

27C. Have you had two or more such episodes? 1. Yes ☐ 2. No ☐

27D. Have you ever required medicine or treatment for the(se) attack(s)?
1. Yes ☐ 2. No ☐ 88. Does not apply ☐

27E. When does wheezing give you most trouble?
(Circle your answer) one answer only

1	2	3	4	5	6
Spring	Summer	Fall	Winter	No relation to time of year	Does not apply

Breathlessness

28. Are you disabled from walking by any condition other than heart or lung disease? 1. Yes ☐ 2. No ☐

29A. Are you troubled by shortness of breath when hurrying on the level or walking up a slight hill? 1. Yes ☐ 2. No ☐

IF YES TO QUESTION 29A:

29B. Do you have to walk slower than people of your age on the level because of breathlessness? 1. Yes ☐ 2. No ☐ 8. Does not apply ☐

29C. Do you ever have to stop for breath when walking at your own pace on the level? 1. Yes ☐ 2. No ☐ 8. Does not apply ☐

29D. Do you have to stop for breath after walking about 100 yards (or after a few minutes on the level)? 1. Yes ☐ 2. No ☐ 8. Does not apply ☐

29E. Are you too breathless to leave the house or breathless when dressing or undressing? 1. Yes ☐ 2. No ☐ 8. Does not apply ☐

29F. For how long have you been short of breath?
_____years 88. Does not apply ☐

29G. When does phlegm give you most trouble?
(Circle your answer) ONE ANSWER ONLY

1	2	3	4	5	6
Spring	Summer	Fall	Winter	No relation to time of year	Does not apply

Chest Colds and Chest Illnesses

30. If you get a cold, does it usually go to your chest? (Usually means more the 1/2 the time.) 1. Yes ☐ 2. No ☐ 8. Does not apply ☐

31A. During the past three years, have you had any chest illnesses, or flu-like illnesses, that have kept you off work, indoors at home or in bed?
1. Yes ☐ 2. No ☐

IF YES TO QUESTION 31A:

31B. Did you produce phlegm with any of these chest illnesses?
1. Yes ☐ 2. No ☐ 8. Does not apply ☐

31C. In the last three years how many such illnesses with (increased) phlegm, did you have which lasted a week or more?
_____ Number of illnesses

IV. Past Illnesses

32A. Did you have lung trouble before the age of 16? (Excluding head colds and sinus infections.) 1. Yes ☐ 2. No ☐

32B. Attacks of bronchitis? 1. Yes ☐ 2. No ☐

IF YES TO QUESTION 32B:

32C. Was it confirmed by a doctor? 1. Yes ☐ 2. No ☐
8. Does not apply ☐

32D. At what age was your first attack? _____Age in years
88. Does not apply ☐

33A. Pneumonia (include broncho-pneumonia)? 1. Yes ☐ 2. No ☐

IF YES TO QUESTION 33A:

33B. Was it confirmed by a doctor?
1. Yes ☐ 2. No ☐ 8. Does not apply ☐

33C. At what age did you first have it? _____Age in years
88. Does not apply ☐

34A. Hay fever? 1. Yes ☐ 2. No ☐

IF YES TO QUESTION 34A:

34B. Was it confirmed by a doctor?
1. Yes ☐ 2. No ☐ 8. Does not apply ☐

34C. At what age did it start? _____Age in years
88. Does not apply ☐

35A. Have you ever had chronic bronchitis? 1. Yes ☐ 2. No ☐

IF YES TO QUESTION 35A:

35B. Do you still have it? 1. Yes ☐ 2. No ☐ 8. Does not apply ☐

35C. Was it confirmed by a doctor?
1. Yes ☐ 2. No ☐ 8. Does not apply ☐

35D. At what age did it start? _____Age in years
88. Does not apply ☐

36A. Have you ever had emphysema? 1. Yes ☐ 2. No ☐

IF YES TO QUESTION 36A:

36B. Do you still have it? 1. Yes ☐ 2. No ☐ 8. Does not apply ☐

36C. Was it confirmed by a doctor?
1. Yes ☐ 2. No ☐ 8. Does not apply ☐

36D. At what age did it start? _____Age in years
88. Does not apply ☐

37A. Have you ever had asthma? 1. Yes ☐ 2. No ☐

IF YES TO QUESTION 37A:

37B. Do you still have it? 1. Yes ☐ 2. No ☐ 8. Does not apply ☐

37C. Was it confirmed by a doctor?
1. Yes ☐ 2. No ☐ 8. Does not apply ☐

37D. At what age did it start? _____Age in years
88. Does not apply ☐

37E. If you no longer have it, at what age did it stop?
_____Age stopped 88. Does not apply ☐

37F. Do you currently require medicine or treatment for asthma?
1. Yes ☐ 2. No ☐ 8. Does not apply ☐

37G. If you require medicines, please list their names.

_____

_____

_____

38. Have you ever had:

38A. Any other chest illness? 1. Yes ☐ 2. No ☐

38B. Any chest operations? 1. Yes ☐ 2. No ☐

38C. Any chest injuries? 1. Yes ☐ 2. No ☐

V. Tobacco Smoking

39A. Have you ever smoked cigarettes? (No means less than 20 packs of cigarettes or 12 oz. of tobacco in a lifetime or less than one cigarette a day for one year.) 1. Yes ☐ 2. No ☐

IF YES TO QUESTION 39A:

39B. Do you now smoke (as of one month ago)? 1. Yes ☐ 2. No ☐

39C. How old were you when you first started regular cigarette smoking?
_____Age in years

39D. If you have stopped smoking cigarettes completely, how old were you when you stopped? _____Age in years
88. ☐ If you have not stopped smoking

39E. How many cigarettes do you smoke per day now?
_____Cigarettes per day

39F. On the average of the entire time you smoked, how many cigarettes did you smoke per day? _____Cigarettes per day

39G. Do or did you inhale the cigarette smoke?
1. Not at all
2. Slightly
3. Moderately
4. Deeply
8. Does not apply

40. Have you ever smoked a pipe regularly? (Yes means more the 12 oz. of tobacco in the lifetime.) 1. Yes ☐ 2. No ☐

41. Have you ever smoked cigars regularly? (Yes means more than one cigar a week for a year.) 1. Yes ☐ 2. No ☐

42. Did you develop frequent wheezing or chest tightness within the past year?
1. Yes ☐ 2. No ☐

IF YES TO QUESTION 42:

43. Please indicate which month you think this problem started.
(Check one answer only)

01. ☐ March 1985
02. ☐ February 1985
03. ☐ January 1985
04. ☐ December 1984
05. ☐ November 1984
06. ☐ October 1984
07. ☐ September 1984
08. ☐ August 1984
09. ☐ July 1984
10. ☐ June 1984
11. ☐ May 1984
12. ☐ April 1984
98. ☐ Don't Remember
99. ☐ Not Applicable

APPENDIX B

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
HEALTH HAZARD EVALUATION 85-226

FRESHLABS, INC. - WARREN, MICHIGAN

2ND QUESTIONNAIRE

I. PERSONAL HISTORY

SUBJECT IDENTIFICATION NO.: ____ ____ ____ (1 2 3)

DATE: _____

NAME (LAST-FIRST-MIDDLE INT.): _____

ADDRESS: _____

_____

TELEPHONE: ( ) - _____ - _____

BIRTH MONTH: (Month - Year) ____ ____ - ____ ____ (4 5 8 9)

1 = WHITE 4 = HISPANIC
2 = BLACK 5 = ASIAN
3 = AMERICAN NATIVE

RACE: _____ (8)

1 = MALE
2 = FEMALE

SEX: _____ (9)

WHEN DID YOU BEGIN WORK AT FRESHLABS? ____ ____ - ____ ____ (10 11 - 12 13)

WHAT IS YOUR CURRENT JOB? _____ _____ (14 15)

WHEN DID YOU START THIS JOB? ____ ____ - ____ ____ (16 17 18 19)

OTHER JOBS:

A. _____ ____ ____ (20 21)

FROM ____ ____ - ____ ____ (22 23 24 25) TO ____ ____ - ____ ____ (26 27 28 29)

B. _____ ____ ____ (30 31)

FROM ____ ____ - ____ ____ (32 33 34 35) TO ____ ____ - ____ ____ (36 37 38 39)

A. SMOKING

HAVE YOU EVER SMOKED CIGARETTES? _____ 40

IF YES, a) DO YOU SMOKE CIGARETTES NOW? _____ 41

b) WHAT IS THE TOTAL NUMBER OF YEARS YOU SMOKED? _____ 42 _____ 43

c) WHAT IS THE AVERAGE NUMBER OF CIGARETTES YOU SMOKED PER DAY? _____ 44 _____ 45

DO YOU HAVE ANY ALLERGIES? _____ 46
TO WHAT?

HAVE YOU HAD TO CHANGE JOBS WHILE AT FRESHLABS DUE TO HEALTH? _____ 47

<u>EYE AND THROAT SYMPTOMS</u>

HAVE YOU NOTICED EYE AND THROAT SYMPTOMS SUCH AS ITCHING, BURNING OR RED EYES, OR DRY IRRITATED, SCRATCHY OR SORE THROAT AT ANY TIME DURING EMPLOYMENT AT FRESHLABS?

_____ 48

WERE THESE SYMPTOMS PRESENT BEFORE YOU BEGAN WORKING AT FRESHLABS?

_____ 49

DO THESE SYMPTOMS GET BETTER WHILE AWAY FROM WORK, SUCH AS ON WEEKENDS OR VACATION?

_____ 50

WHAT DO YOU THINK CAUSES THESE SYMPTOMS?

_____ 51 _____ 52

NOSE SYMPTOMS

HAVE YOU REGULARLY NOTICED NOSE SYMPTOMS SUCH AS RUNNING OR STUFFY NOSE OR SNEEZING AT ANY TIME DURING YOUR EMPLOYMENT AT FRESHLABS?

_____
53

WERE THESE SYMPTOMS PRESENT BEFORE YOU BEGAN WORKING AT FRESHLABS?

_____
54

DO THESE SYMPTOMS GET BETTER WHILE AWAY FROM WORK, SUCH AS ON WEEKENDS OR VACATION?

_____
55

WHAT DO YOU THINK CAUSES THESE SYMPTOMS?

___ ___
56 57

CHEST SYMPTOMS

HAVE YOU REGULARLY NOTICED WHEEZING, COUGH, SHORTNESS OF BREATH, OR CHEST TIGHTNESS?

_____
58

WERE THESE SYMPTOMS PRESENT BEFORE YOU BEGAN WORKING AT FRESHLABS?

_____
59

DO THESE SYMPTOMS GET BETTER WHILE AWAY FROM WORK, SUCH AS ON WEEKENDS OR VACATION?

_____
60

IF YOU CURRENTLY, OR PREVIOUSLY, EXPERIENCED SYMPTOMS OF WHEEZING, COUGH, SHORTNESS OF BREATH, OR CHEST TIGHTNESS, WHEN IN THE DAY DO THESE SYMPTOMS OCCUR?

1 = WITHIN 1 HOUR OF STARTING WORK
2 = WITHIN 4-8 HOURS OF STARTING WORK
3 = AT HOME >8 HOUR AFTER WORK

_____
61

WHAT DO YOU THINK CAUSES THESE SYMPTOMS?

___ ___
62 63

SKIN SYMPTOMS

HAVE YOU REGULARLY NOTICED HIVES, SKIN IRRITATION, OR RASHES?

_____
64

WERE THESE SYMPTOMS PRESENT BEFORE YOU BEGAN WORKING AT FRESHLABS?

_____
65

DO THESE SYMPTOMS GET BETTER WHILE AWAY FROM WORK, SUCH AS ON WEEKENDS OR VACATION?

_____
66

WHAT DO YOU THINK CAUSES THESE SYMPTOMS?

___ ___
67 68

HAVE YOU SEEN A PHYSICIAN FOR MEDICAL PROBLEMS THAT YOU OR YOUR PHYSICIAN FELT WERE RELATED TO WORK AT FRESHLABS?

_____
69

WHAT WAS THE PROBLEM? _____

AT WHAT PHYSICIAN, CLINIC, HOSPITAL WERE YOU SEEN? (RELEASE)

_____ _____

END OF QUESTIONNAIRE
THANK YOU FOR YOUR TIME!

APPENDIX C

Reflex Bronchoconstriction: cold air, inhalation of inert particles, or noxious gases or fumes may cause bronchoconstriction by direct effect on the irritant receptors in the bronchial walls. This type of asthma usually occurs in subjects with preexisting bronchial asthma rather than in normal healthy subjects.

Inflammatory Bronchoconstriction: exposures to very high doses of irritant gases, vapors, and dusts may result in acute inflammation of the airways and bronchoconstriction. Workers typically develop cough, wheeze, shortness of breath shortly after exposure which usually results from accidental exposure to levels much above what is normally encountered in the work place.

Pharmocologic Bronchoconstriction: some agents in the environment may induce asthma in a typical dose-response fashion. That is, if the exposure concentrations were high enough, eventually all exposed subjects would develop bronchoconstriction. The highest prevalence tends to occur among those workers with the highest exposure.

Allergic Bronchoconstriction: by far the greatest number of occupational agents causing asthma have known or suspected allergic properties. Organic compounds such as proteins and polysaccharides can induce allergic response by producing specific antibodies. Atopic (individuals having a history of allergies) are much more frequently affected than non atopic subjects.

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