

# **A Guide for Persons Employed in Cotton Dust Environments**



Division of Occupational Safety and Health  
N.C. Department of Labor  
1101 Mail Service Center  
Raleigh, NC 27699-1101

Cherie Berry  
Commissioner of Labor

**N.C. Department of Labor  
Occupational Safety and Health Program**

Cherie Berry  
Commissioner of Labor  
*OSHA State Plan Designee*

Allen McNeely  
Deputy Commissioner for Safety and Health

Kevin Beauregard  
Assistant Deputy Commissioner for Safety and Health

J. Edgar Geddie, Ph.D  
Reviewer

**Acknowledgments**

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**This guide is intended to be consistent with all existing OSHA standards; therefore, if an area is considered by the reader to be inconsistent with a standard, then the OSHA standard should be followed.**

**To obtain additional copies of this book, or if you have questions about North Carolina occupational safety and health standards or rules, please contact:**

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Bureau of Education, Training and Technical Assistance  
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Additional sources of information are listed on the inside back cover of this book.

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The projected cost of the NCDOL OSH program for federal fiscal year 2008–2009 is \$17,042,662. Federal funding provides approximately 30 percent (\$4,090,400) of this total.

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# Foreword

Many North Carolina employees work in the manufacture of cotton products. *A Guide for Persons Working in Cotton Dust Environments* details the hazards they face. Reading and understanding this guide can help protect these employees from the health and safety hazards commonly found in yarn plants; slashing, weaving, knitting and waste house operations; and cotton warehousing operations.

In North Carolina, DOL inspectors enforce the federal Occupational Safety and Health Act through a state plan approved by the U.S. Department of Labor. The Division of Occupational Safety and Health of the N.C. Department of Labor offers many educational programs to the public and produces publications, including this guide, to help inform people about their rights and responsibilities regarding occupational safety and health.

When looking through this guide, please remember the DOL mission is greater than just enforcement of regulations. An equally important goal is to help people find ways to create safe workplaces. This booklet, like the other educational materials produced by the N.C. Department of Labor, can help.

Cherie Berry  
Commissioner of Labor

## Cotton Dust—What Is It?

*Cotton dust* means dust present in the air during handling or processing of cotton. This dust is a complex mixture of components which may include ground-up plant matter, cotton fiber, bacterial, fungi soil, or pesticides. It may include other contaminants that have accumulated during the growing, harvesting, and subsequent processing or during storage periods. Any dust present during the handling and processing of cotton is considered cotton dust. Manufacturing processes using new or waste cotton fibers or cotton fiber by-products from textile mills also produce cotton dust.

*Cotton dust, not the cotton fiber, is considered to be the cause of a lung disease called “byssinosis.”*

### ***Occupational Safety and Health Cotton Dust Standard (29 CFR 1910.1043)***

The Occupational Safety and Health Administration has the responsibility for establishing and enforcing standards and regulations to protect the health of all workers. North Carolina has a state OSHA plan that meets or exceeds the requirements of the federal plan for occupational safety and health. Authority for all matters related to occupational safety and health rests with the N.C. Department of Labor, Division of Occupational Safety and Health.

In 1978, OSHA promulgated a mandatory standard regarding exposure to cotton dust in the workplace that was adopted by the N.C. Department of Labor, Division of Occupational Safety and Health. OSHA then amended the Cotton Dust standard in 1985 and again in 2001. The standard established *permissible exposure limits* (PEL) for cotton dust in all processes of the cotton industry. The permissible exposure limit is the amount of dust that someone can be exposed to for an eight-hour work shift over their working life without experiencing adverse health effects.

*The permissible exposure limit for cotton dust is established as follows:*

- 200 micrograms per cubic meter of lint-free respirable dust averaged over an eight-hour period in yarn manufacturing;
- 750 micrograms per cubic meter of lint-free respirable dust over an eight-hour period of slashing and weaving; and
- 500 micrograms per cubic meter of lint-free respirable dust over an eight-hour period in waste houses and yarn manufacturing areas where exposure to lower grade washed cotton occurs.

*Lint-free respirable dust* means particles of dust smaller than 15 microns. That is the size of a pinpoint. To get into the lungs (be respirable), particles must be 15 microns or smaller.

The following operations are exempt from the Cotton Dust standard: knitting, classing and warehousing, and handling woven or knitted material.

**Note:** This guide focuses on the requirements of 1910.1043, Cotton Dust. However, there is another reference to cotton dust that is contained in 1910.1000, Air Contaminants. Table Z-1 directs an 8-hour TWA of 1 mg/m<sup>3</sup> that applies to the cotton waste processing operations of waste recycling (sorting, blending, cleaning and willowing) and garnetting.

## Pulmonary Diseases

There is a group of lung diseases called *chronic obstructive pulmonary diseases*. The diseases in the group are major causes of illness and disability among workers. The most common types of chronic obstructive pulmonary disease are:

- Chronic bronchitis
- Asthma
- Emphysema

*Chronic bronchitis* is a disorder characterized by a cough and sputum lasting for three or more months of the year and recurring year after year.

*Asthma* is thought to be an allergic type of response that causes airways to swell and become narrow. There is increased mucous causing a wheezy, “whistly” sound to breathing. Usually both chronic bronchitis and asthma improve when the person is removed from the irritation causing this response.

*Emphysema* is destruction of the delicate walls between the tiny air sacs in the lungs. As the walls are destroyed, the air sacs enlarge and the lungs have less ability to supply oxygen to the bloodstream. In emphysema, there is no way to repair the destroyed air sacs.

### ***Other Factors Affecting Breathing***

As we get older we gradually lose some of our lung function. This loss of capacity of aging is expected, and prediction tables are adjusted for aging.

Infections such as chest colds, flu, pneumonia and even tuberculosis can affect lung function. While one often recovers full function after a cold or flu, frequent bouts of these infections can cause a loss of lung volume.

Cigarette smoking is known to be the leading cause of chronic obstructive pulmonary (lung) disease (COPD) and of lung cancer. Cigarette smokers also have increased risk of cough, colds and respiratory symptoms.\*

There is a relationship between chronic lung disease and other factors, such as air pollution, heredity and allergies. Those factors may contribute to chronic obstructive lung disease.

### ***Byssinosis***

Byssinosis is a term taken from a Greek word meaning white thread. It is a breathing disorder that occurs in some individuals with exposure to raw cotton dust. Symptoms of this breathing disorder are also recognized in people who work in flax or hemp dust. Characteristically, workers exhibit shortness of breath and/or the feeling of chest tightness when returning to work after being in the mill for a day or more. There may be increased cough and phlegm production. In the early stages of byssinosis, these symptoms subside by the end of the workday and reoccur Monday morning, after being away from the dust for a period of time.

The agent in the cotton dust that causes the symptoms of byssinosis is not known, but is believed to be a contaminant on the cotton. One currently held theory is that it is a bacterial product that is in the bract or leafy portion of the cotton boll. Extensive research continues to be done in an effort to identify and eliminate the problem.

As the length of exposure increases over the working years of the employee, symptoms of the chest tightness and shortness of breath occur more frequently and on workdays other than on the first day of the workweek. Medical monitoring, which includes a questionnaire and pulmonary function testing, is important for early identification of workers experiencing breathing problems that may be related to their workplace. Such monitoring is a requirement of the Occupational Safety and Health Division of the N.C. Department of Labor.

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\*U.S. Department of Health and Human Services, *Health Consequences of Smoking—Cancer and Chronic Lung Disease in the Workplace—A Report of the Surgeon General* (Rockville, Md.: U.S. Department of Health and Human Services, 1985), p. 7.

Dr. Richard Schilling, a physician studying the health of British textile workers, developed a system of grading workers based on their breathing complaints on the first workday of the week. Schilling's classification grades byssinosis according to how far it has progressed. Schilling's classifications are as follows.

- Grade 0 = No complaints of breathing problems.
- Grade ½ = Chest tightness and/or shortness of breath sometimes on the first day of the workweek.
- Grade 1 = Chest tightness and/or shortness of breath always on the first day of the workweek.
- Grade 2 = Chest tightness and/or shortness of breath on the first workday and on other days of the workweek.
- Grade 3 = Chest tightness and/or shortness of breath on the first workday and other days as well as impairment of lung function.

It is believed that the degree or severity of response for individuals with symptoms of byssinosis is related to the dust level in the workplace. The beginning steps in yarn preparation generally produce more dust. Therefore, the closer to the beginning of the process, the higher will be the dust level and the more likely the pulmonary reaction or response for some workers.

Table 1 shows the permissible exposure limits for cotton dust for employees who work in different areas.

**Table 1**  
*Permissible Exposure Limits for Cotton Dust for Different Work Areas*

| Area       | PEL (Micrograms per cubic meter) |
|------------|----------------------------------|
| Opening    | 200                              |
| Picking    | 200                              |
| Carding    | 200                              |
| Combing    | 200                              |
| Roving     | 200                              |
| Spinning   | 200                              |
| Winding    | 200                              |
| Warping    | 200                              |
| Slashing   | 750                              |
| Weaving    | 750                              |
| Wastehouse | 500                              |

# 3

## Monitoring

Employees must be monitored if they are to work in an environment containing cotton dust. The environment containing the cotton dust must also be monitored.

### *Medical Monitoring*

In any workplace where cotton dust is present there must be a medical surveillance program for all employees exposed to cotton dust. Examinations must be done by or under the direction of a licensed physician. People administering the pulmonary function (breathing) tests must have attended a course approved by the National Institute for Occupational Safety and Health (NIOSH).

Medical examinations are to be provided to prospective employees *prior* to their initial assignment. As a minimum, the examinations should include:

- A medical history to identify any existing health problems or diseases that may affect breathing
- A standardized respiratory questionnaire inquiring about such concerns as cough, chest tightness and smoking history.
- A pulmonary function (breathing) test including the forced vital capacity (FVC), the amount of air one can force out after taking a deep breath, and forced expiratory volume in 1 second (FEV<sup>1</sup>), the amount of air forced out during the first second of expiration.

Test results are compared to a set of predicted tables based on a person's age, height, sex and race. Generally, tests are considered to be within the normal range if they are 80 percent or greater of the predicted value. The initial determinations should be made *prior to entering* the workplace on the first day worked and after having no cotton dust exposure for at least 35 hours. The pulmonary function tests will be repeated during the shift, at least four hours, but not longer than 10 hours after the first test. These tests are then compared for changes. If there is a decrease of 5 percent or greater on the second after-exposure test, it may indicate a reaction to cotton dust. Each employee will be assigned a byssinosis grade based on his or her response to the respiratory questionnaire.

Follow-up examinations are required annually for all employees exposed to cotton dust. The examinations include an update of the medical history and standardized questionnaire and a repeat of the pulmonary function test performed both before and after the exposure to cotton dust.

Examination is required every six months for employees who are below the expected normal value when compared to predicted values, or for employees who show a decrease in pulmonary function on the after-exposure test. If the physician feels significant changes have occurred from year to year, or if the worker has complaints about breathing, six-month testing will also be done.

Employees who are below 60 percent of the predicted value on their breathing test will be sent to a physician for an evaluation. Employees will be furnished written information on the results of their examination.

OSHA has not published specific criteria for hiring people to work in a cotton dust environment except to specify an initial examination be conducted. Experience has shown that people who have a history of asthma or other respiratory diseases do not fare well in a cotton dust environment. Many medical specialists recommend that individuals who have a breathing test result below 80 percent of the predicted normal value should not be hired to work in a cotton dust environment.

### *Exposure Monitoring*

Sampling of the workplace must be done at least every six months to determine the amount of cotton dust in the environment. Measurements must be representative of all employees in the workplace. Sampling will be done in all work areas and on each shift.

*Sampling* involves measuring with a standard cotton dust monitor called a *vertical elutriator* (VE) or by an approved similar device. Air is drawn into the vertical elutriator at a specified speed, and particles of 15 microns or smaller are collected on a filter. The particles collected are measured to determine the amount of respirable dust (dust that can get into

the lungs) there is in the work area. It is important to realize that other “dusts,” such as starch or oil mist are also collected on the filter and may contribute to the cotton dust levels.

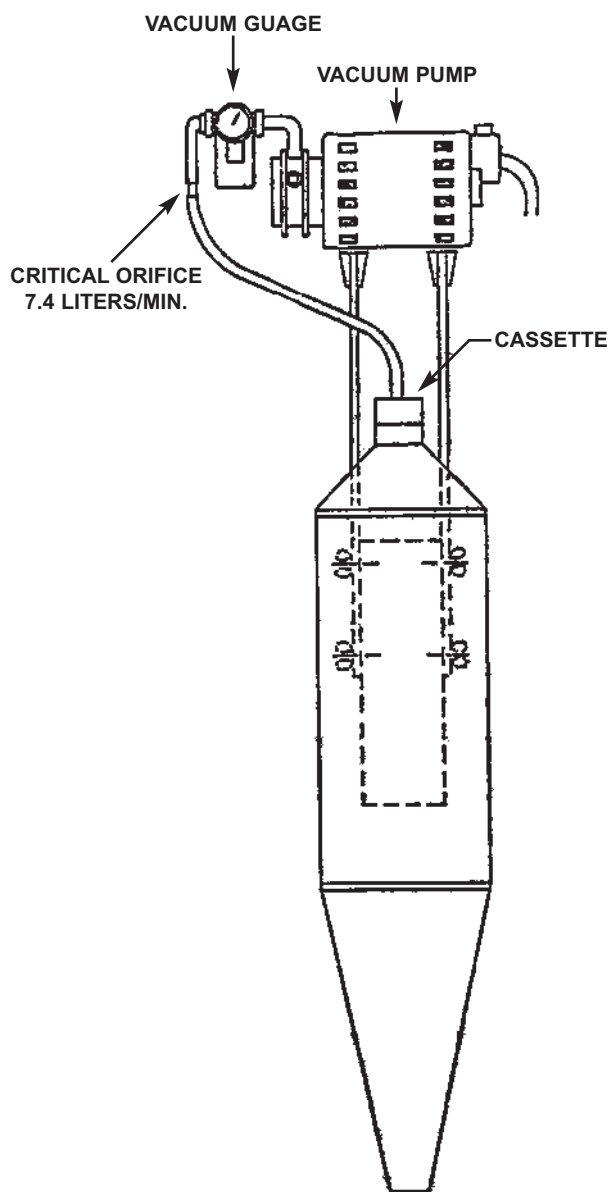
Sampling is done for a period equal to at least three-quarters of the shift (for example, six hours of an eight-hour shift). While sampling is being done, other information is collected that may pertain to the generation of cotton dust. The percent of cotton fiber in the mix; the grade of the cotton and where it was grown; types of yarn being run; and the number and types of machines operating in each area may all affect the amount of cotton dust in the workplace.

Employees will be notified of the findings of cotton dust air sampling once the results have been received. When the results show that an employee is exposed to dust greater than the permissible exposure limit, control measures must be taken to reduce exposure to an acceptable level. Detailed exposure measurement records must be made, and they must be retained for 20 years.

Figure 1 depicts a vertical elutriator, used to monitor employee exposure to cotton dust in the workplace.

**Figure 1**

*Vertical Elutriator*



## Dust Control, Employee Work Practices and Respirators

### *Dust Control*

When sampling indicates that cotton dust exposure exceeds the permissible exposure limits (PEL), engineering solutions are needed. Dust control equipment can be installed or built into machinery to capture dust before it can be distributed into any work area.

Another engineering solution is to clean and filter air that is circulating in the work area. When mechanical ventilation is used to control exposure, fans and filters must be checked periodically to ensure that they are working correctly.

When engineering controls and work practices are not sufficient to reduce employee exposure to acceptable limits, the employer is required to provide additional controls. A written compliance program will detail the steps undertaken to reduce worker exposure to permissible limits.

As a last resort, employees may be required to wear respirators to protect their health until engineering controls can effectively reduce the cotton dust levels. A minimum acceptable respirator program must include:

1. Written standard operating procedures covering the selection and use of respirators;
2. Appropriate respirator selection based on worker exposure;
3. Instruction and training of employees in uses and limitations of respirators;
4. Proper cleaning, storage and inspection of respirators;
5. Proper fit testing for each employee using a respirator; respirators must be tested and certified for dust protection by the National Institute for Occupational Safety and Health;
6. Evaluation of the effectiveness of the program;
7. Medical qualification of workers to wear respirators.

### *Employee Work Practices*

Employees must be informed of specific operations that result in cotton dust exposure as well as the work practices concerned with the operations. The OSHA cotton dust standard must be posted in the workplace and must be available to employees. Warning signs must be posted in all areas where the PEL is exceeded. Figure 2 illustrates an acceptable warning sign.

Figure 2

*Warning Sign*



Work practices for each job in an area should be developed in a written program and used in the orientation and training of all employees. A work practice program should include the considerations listed below:

1. Blow-down, or blow-off, is the cleaning of equipment and surfaces with compressed air. Such usage of compressed air for cleaning purposes should be prohibited when other means of cleaning are possible. Where blow-down cleaning is done (meaning general cleaning of the entire room, including the walls and ceilings ventilation ducts), employees performing the cleaning must wear respirators. Safety goggles are also recommended. All other employees not involved with the blow-down cleaning must leave the area.
2. Cleaning of clothing or floors with compressed air is prohibited.
3. Floor sweeping will be done by vacuum or other methods designed to minimize the breathing of dust.
4. Waste will be handled by mechanical means. If this is not feasible, manual handling should be limited as much as possible.
5. Engineering control equipment and ventilation systems should be inspected on a scheduled basis and, if necessary, cleaned and repaired.

### **Work Practices for Materials Handling and Cleaning**

The following work practices apply to materials handling and cleaning:

1. Cotton, cotton waste and materials containing cotton dust should be stacked, sorted, baled, dumped, removed or otherwise handled by methods that will reduce dust exposure to the lowest feasible level.
2. Where brooms are used to clean floors, the brooms should be pushed carefully to keep the dust from becoming airborne.
3. Care must be taken to keep airborne dust as low as possible when picking up waste collected with pushbrooms. Where possible, opposing brooms, long handled rakes or dustpans should be used to pick up waste.
4. When cleaning machines with brushes or cloths, the individual doing the cleaning should stroke the waste from top to bottom as far from the face as possible. Surfaces should not be beaten or fanned during cleaning.
5. Waste should not be allowed to accumulate on the floor and should be placed as soon as practical into a waste storage container.
6. Foreign objects collected during sweeping should be removed immediately by the sweeper and placed in trash containers rather than left in the containers with the textile waste so that sorting in the wastehouse is not required to remove the foreign objects.
7. Waste receptacles or waste transport containers should not be placed or transported under overhead blowers unless covered.
8. Waste receptacles should not be overfilled such that material spills to the floor during storage or transport to the wastehouse.
9. Spring-loaded cans and carts should not be used as waste receptacles in order to avoid dust dispersion during compression of the spring-loaded bottoms.
10. When materials such as laps, sliver cans and roving bobbins are delayed in process or stored for an extended period in an area where there is a likelihood of significant dust or lint accumulation, the materials should be covered. The storage area and the covers should be periodically cleaned to prevent lint and dust accumulation. Covering may not be required for materials in normal process flow stored for short periods or for materials stored in enclosed areas separated from cotton processing equipment where there is not extensive lint or dust accumulation.

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## Glossary

*Byssinosis.* A specific respiratory disease attributed to the effect of cotton dust on breathing and characterized by chest tightness and/or shortness of breath on the first workday of the week.

*Cotton dust.* Any dust present in the air during the handling or processing of cotton—may include other contaminants accumulated during growing, harvesting processing and storage of cotton.

*Engineering controls.* Ventilation, change in machinery, improvements in handling cotton and similar means used to reduce the amount of dust to which workers are exposed.

*FEV<sup>1</sup>.* Forced expiratory volume in 1 Second is the amount of air one can forcefully exhale in the first second of the expiration. The normal range is 80 percent of predicted value or greater.

*FVC.* Forced vital capacity is the amount of air one can forcefully exhale after maximum inspiration. The normal range is 80 percent of predicted value or greater.

*NIOSH.* National Institute for Occupational Safety and Health, under the U.S. Department of Health and Human Services—responsible for investigation, research and teaching.

*OSHA.* Occupational Safety and Health Act, administered through the U.S. Department of Labor. In North Carolina, OSHA is also known as OSHANC (Occupational Safety and Health Act of North Carolina) and is administered through the N.C. Department of Labor, Division of Occupational Safety and Health. (See the address and telephone number on the inside back cover of this publication.)

*PEL.* The permissible exposure limit is the amount of a substance one can be exposed to over their working life without experiencing adverse health effects. The PEL is usually based on an eight-hour day for a five-day workweek.

*Predicted value.* The amount of air one is predicted to be able to forcefully exhale based on what other people of the same height, sex, race and age are able to do.

*Pulmonary function test (PFT).* Breathing test to measure how much air one can take into the lungs and how much can be blown out of the lungs.

*Respirable.* Able to be inhaled into the lungs.

*Respiratory.* Having to do with breathing or the act of breathing.

*Vertical elutriator.* A device used to measure the amount of respirable dust in the air.

*Work practices.* A set of procedures for doing a specific job and cleanup of a specific area to reduce or eliminate worker exposure to hazards.

# 6

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**The following industry guides are available from the N.C. Department of Labor's Division of Occupational Safety and Health:**

- #1. *A Guide to Safety in Confined Spaces*
- #2. *A Guide to Procedures of the Safety and Health Review Board of North Carolina* (downloadable PDF **ONLY**)
- #3. *A Guide to Machine Safeguarding*
- #4. *A Guide to OSHA in North Carolina*
- #5. *A Guide for Persons Employed in Cotton Dust Environments* (downloadable PDF **ONLY**)
- #6. *A Guide to Lead Exposure in the Construction Industry* (downloadable PDF **ONLY**)
- #7. *A Guide to Bloodborne Pathogens in the Workplace*
- #8. *A Guide to Voluntary Training and Training Requirements in OSHA Standards*
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- #31. *A Guide to Formaldehyde* (downloadable PDF **ONLY**)
- #32. *A Guide to Fall Prevention in Industry*
- #32s. *Guía de Protección Contra Caídas en la Industria (Spanish version of #32)*
- #33. *A Guide to Office Safety and Health* (downloadable PDF **ONLY**)
- #34. *A Guide to Safety and Health in the Poultry Industry* (downloadable PDF **ONLY**)
- #35. *A Guide to Preventing Heat Stress*
- #38. *A Guide to Safe Scaffolding*
- #40. *A Guide to Emergency Action Planning*
- #41. *A Guide to OSHA for Small Businesses in North Carolina*
- #41s. *Guía OSHA para Pequeños Negocios en Carolina del Norte (Spanish version of #41)*

## **Occupational Safety and Health (OSH) Sources of Information**

**You may call 1-800-NC-LABOR (1-800-625-2267) to reach any division of the N.C. Department of Labor; or visit the NCDOL home page on the World Wide Web: <http://www.nclabor.com>.**

### **N.C. Division of Occupational Safety and Health**

Mailing Address:  
1101 Mail Service Center  
Raleigh, NC 27699-1101  
Local Telephone: (919) 807-2900 Fax: (919) 807-2856

Physical Location:  
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