

X. APPENDIX III

MEMORANDUM

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

TO : Assistant Institute Director
for Research and Standards Development

DATE: April 27, 1973

FROM : Special Assistant for Medical Criteria

SUBJECT: NIOSH Ad Hoc Committee on Pulmonary Function Evaluation

The following members participated:

Harold Imbus, M.D., Medical Director, Burlington Industries,
Greensboro, N.C.

Arend Bouhuys, M.D., Professor of Medicine and Epidemiology Yale
University, School of Medicine, New Haven, Conn.

Roscoe C. Young, Jr., M.D., Assoc. Professor of Medicine, Howard
University Medical School, Washington, D.C.

K. Albert Harden, M.D., Emeritus Dean, Professor of Medicine Howard
University, Washington, D.C.

Thomas G. Shelton, M.D., Chief Pulmonary Disease Service, Veteran's
Hospital, Tuskegee, Ala.

Robert B. O'Connor, M.D., Consultant in Occupational Health to
NIOSH

William S. Lainhart, M.D., NIOSH, Cincinnati, Ohio

Keith C. Morgan, M.D., NIOSH, ALFORD, Morgantown, W.Va.

N. Leroy Lapp, M.D., NIOSH, ALFORD, Morgantown, W.Va.

The above committee was selected to advise NIOSH on how best to inform physicians practicing industrial medicine of the differences in lung volumes between black and white workers. Allowances should be made in pre-employment examinations for such ethnic differences.

Because of suspected ethnic differences in simple tests of lung function used in preplacement of employees entering the textile industry, the ad-hoc committee convened on March 14, 1973 to determine the significance of this difference, and to discuss methods of

eliminating it, so as to exercise proper precautions in prevention of byssinosis on one hand, and not be discriminating in hiring practices on the other.

The committee agreed that there is a difference in pulmonary vital capacity between various ethnic groups which in turn may be affected by other variables, e.g., geographical location, altitude, the underlying physiological cause for the difference is not known.

Several comparative studies on the vital capacity of black and white workers were discussed. The committee agreed that review of these studies showed the pulmonary vital capacity of black workers to be in general, about 15% less than that of white workers, for persons of equal height and age.

Dr. Imbus described his experience in pre-employment examinations of cotton workers. He found 20 workers in one group with a pulmonary vital capacity less than 75% of the predicted normal based on the accepted VA-U.S. Army Prediction Table Kory et al: American Journal Medicine 30: 243-58, 1961. Eighty percent of these 20 workers (18-30 years old) were black, whereas only 35% of the group examined were black.

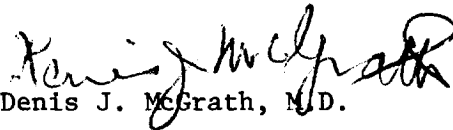
Dr. Imbus reviewed the medical records of the rejected blacks, found them to be young healthy males with negative medical histories and of whom on re-evaluation he found a large number fully qualified to work.

The committee agreed:

1. That criteria documents which recommend pulmonary function evaluations should point out that there is an ethnic difference in vital capacity, which persists if age, height, and sex are taken into account. (1) Smillie WG, Augustine DL: JAMA, 87, 2055, 1926
(2) Abramowitz et al: Amer. Review Respir Disease 92: 287-92 1965
(3) Damon Albert: Human Biology 38: 380-93 1966.
2. The committee agreed that the names and institutional affiliations of the committee members be listed in support of its recommendations (1).
3. That the following equations be recommended in the criteria documents as guidelines for use in pre-placement pulmonary function evaluations, using as a model the clinical experience of Dr. Imbus in pre-employment pulmonary function evaluations of cotton workers.
 - a. In white persons the FVC should not be less than 75% of the value predicted for age, sex and height, from the VA-U.S. Army study equations.

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- b. In black persons, the FVC as predicted according to a should first be multiplied by 0.85 to adjust for the 15% lower FVC in blacks, before applying the 75% rule described in a.
- c. Irrespective of ethnic origin, the ratio FEV 1.0/FVC should equal 70% or more.


Denis J. McGrath, M.D.

APPENDIX IV RESPIRATORY QUESTIONNAIRE

A. IDENTIFICATION DATA

PLANT _____ SOCIAL SECURITY NO. _____
DAY MONTH YEAR
(figures) (last 2 digits)

NAME _____ DATE OF INTERVIEW _____
(Surname)

(First Names) M F

ADDRESS _____ AGE _____ (8,9) SEX _____ (10)
 _____ RACE W N IND. OTHER (11)

INTERVIEWER: 1 2 3 4 5 6 7 8 (12)

WORK SHIFT: 1st _____ 2nd _____ 3rd _____ (13) STANDING HEIGHT _____ (14,15)

PRESENT WORK AREA _____ WEIGHT _____ (16,18)

If working in more than one specified work area, X area where most of the work shift is spent. If "other," but spending 25% of the work shift in one of the specified work areas, classify in that work area. If carding department employee, check area within that department where most of the work shift is spent (if in doubt, check "throughout"). For work areas such as spinning and weaving where many work rooms may be involved, be sure to check the specific work room to which the employee is assigned — if he works in more than one work room within a department classify as 7 (all) for that department.

	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	
Workroom Number	Open	Pick	Area	Card #1	#2	Spin	Wind	Twist	Spool	Warp	Slash	Weave	Other
AT RISK (cotton & cotton blend)	1		Cards										
	2		Draw										
	3		Comb										
	4		Rove										
	5		Thru Out										
	6												
	7 (all)												
Control (synthetic & wool)	8												
Ex-Worker (cotton)	9												

Adapted from reference (158)

Use actual wording of each question. Put X in appropriate square after each question. When in doubt record 'No'.
When no square, circle appropriate answer.

B. COUGH

(on getting up)†
Do you usually cough first thing in the morning? _____ Yes ____ No ____ (31)
(Count a cough with first smoke or on "first going out of doors."
Exclude clearing throat or a single cough.)

Do you usually cough during the day or at night? _____ Yes ____ No ____ (32)
(Ignore an occasional cough.)

If 'Yes' to either question (31-32):

Do you cough like this on most days for as much as three months a year? _____ Yes ____ No ____ (33)

Do you cough on any particular day of the week? _____ Yes ____ No ____ (34)

(1) (2) (3) (4) (5) (6) (7)

If 'Yes': Which day? Mon. Tues. Wed. Thur. Fri. Sat Sun. _____ (35)

C. PHLEGM or alternative word to suit local custom.

(on getting up)†
Do you usually bring up any phlegm from your chest first thing in the morning? (Count phlegm with the first smoke or on "first going out of doors." Exclude phlegm from the nose. Count swallowed phlegm.) _____ Yes ____ No ____ (36)

Do you usually bring up any phlegm from your chest during the day or at night? (Accept twice or more.) _____ Yes ____ No ____ (37)

If 'Yes' to either question (36) or (37):

Do you bring up phlegm like this on most days for as much as three months each year? _____ Yes ____ No ____ (38)

If 'Yes' to question (33) or (38):

(cough)
How long have you had this phlegm? _____ (39)
(Write in number of years)
(1) 2 years or less
(2) More than 2 years-9 years
(3) 10-19 years
(4) 20+ years

†These words are for subjects who work at night

D. CHEST ILLNESSES

In the past three years, have you had a period of (increased) †cough and phlegm lasting for 3 weeks or more? _____ (40)
(1) No
(2) Yes, only one period
(3) Yes, two or more periods

†For subjects who usually have phlegm

During the past 3 years have you had any chest illness which has kept you off work, indoors at home or in bed? (For as long as one week, flu?) _____ Yes ____ No ____ (41)

If 'Yes' to (41): Did you bring up (more) phlegm than usual in any of these illnesses? _____ Yes ____ No ____ (42)

If 'Yes' to (42): During the past three years have you had: _____ (43)
Only one such illness with increased phlegm? (1)

More than one such illness: (2) _____ (44)

Br. Grade _____

E. TIGHTNESS

Does your chest ever feel tight or your breathing become difficult? _____ Yes _____ No _____ (45)

Is your chest tight or your breathing difficult on any particular day of the week? (after a week or 10 days away from the mill) _____ Yes _____ No _____ (46)

If 'Yes': Which day? Mon. (1) Sometimes (3) Tues. (2) Always (4) Wed. (5) Thur. (6) Fri. (7) Sat. (8) Sun. (47)

If 'Yes' Monday: At what time on Monday does your chest feel tight or your breathing difficult? 1 Before entering the mill (48)
2 After entering the mill

(Ask only if NO to Question (45))

In the past, has your chest ever been tight or your breathing difficult on any particular day of the week? _____ Yes _____ No _____ (49)

If 'Yes': Which day? Mon. (1) Sometimes (3) Tues. (2) Always (4) Wed. (5) Thur. (6) Fri. (7) Sat. (8) Sun. (50)

F. BREATHLESSNESS

If disabled from walking by any condition other than heart or lung disease put "X" here and leave questions (52-60) unasked. (51)

Are you ever troubled by shortness of breath, when hurrying on the level or walking up a slight hill? _____ Yes _____ No _____ (52)

If 'No', grade is 1. If 'Yes', proceed to next question

Do you get short of breath walking with other people at an ordinary pace on the level? _____ Yes _____ No _____ (53)

If 'No', grade is 2. If 'Yes', proceed to next question

Do you have to stop for breath when walking at your own pace on the level? _____ Yes _____ No _____ (54)

If 'No', grade is 3. If 'Yes', proceed to next question

Are you short of breath on washing or dressing? _____ Yes _____ No _____ (55)

If 'No', grade is 4. If 'Yes', grade is 5.

Dyspnea Grd. _____ (56)

ON MONDAYS:

Are you ever troubled by shortness of breath, when hurrying on the level or walking up a slight hill? _____ Yes _____ No _____ (57)

If 'No', grade is 1. If 'Yes', proceed to next question

Do you get short of breath walking with other people at an ordinary pace on the level? _____ Yes _____ No _____ (58)

If 'No', grade is 2. If 'Yes', proceed to next question

Do you have to stop for breath when walking at your own pace on the level? _____ Yes _____ No _____ (59)

If 'No', grade is 3. If 'Yes', proceed to next question

Are you short of breath on washing or dressing? _____ Yes _____ No _____ (60)

If 'No', grade is 4. If 'Yes', grade is 5

B. Grd. _____ (61)

G. OTHER ILLNESSES AND ALLERGY HISTORY

Do you have a heart condition for which you are under a doctor's care? _____ Yes _____ No _____ (62)
 Have you ever had asthma? _____ Yes _____ No _____ (63)
 If 'Yes', did it begin: (1) Before age 30
 (2) After age 30
 If 'Yes' before 30: did you have asthma before ever going to work in a textile mill? _____ Yes _____ No _____ (64)
 Have you ever had hay fever or other allergies (other than above)? _____ Yes _____ No _____ (65)

H. TOBACCO SMOKING*

Do you smoke?
 Record 'Yes' if regular smoker up to one month ago. (Cigarettes, cigar or pipe) _____ Yes _____ No _____ (66)
 If 'No' to (63).
 Have you ever smoked? (Cigarettes, cigars, pipe. Record 'No' if subject has never smoked as much as one cigarette a day, or 1 oz. of tobacco a month, for as long as one year.) _____ Yes _____ No _____ (67)
 If 'Yes' to (63) or (64); what have you smoked and for how many years? (Write in specific number of years in the appropriate square)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
Years	(<5)	(5-9)	(10-14)	(15-19)	(20-24)	(25-29)	(30-34)	(35-39)	(>40)	
Cigarettes										(68)
Pipe										(69)
Cigars										(70)

If cigarettes, how many packs per day? (Write in number of cigarettes) _____
 (1) less than 1/2 pack (71)
 (2) 1/2 pack, but less than 1 pack
 (3) 1 pack, but less than 1-1/2 packs
 (4) 1-1/2 packs or more

Number of pack years: _____ (72,73)

If an ex-smoker (cigarettes, cigar or pipe), how long since you stopped? _____ (74)
 (Write in number of years)
 (1) 0-1 year
 (2) 1-4 years
 (3) 5-9 years
 (4) 10+ years

*Have you changed your smoking habits since last interview? If yes, specify what changes.

I. OCCUPATIONAL HISTORY**

Have you ever worked in: A foundry? (As long as one year) _____ Yes _____ No _____ (75)
 Stone or mineral mining, quarrying or processing? (As long as one year) _____ Yes _____ No _____ (76)
 Asbestos milling or processing? (Ever) _____ Yes _____ No _____ (77)
 Cotton or cotton blend mill? (For controls only) _____ Yes _____ No _____ (78)
 Other dusts, fumes or smoke? If yes, specify: _____ Yes _____ No _____ (79)
 Type of exposure _____
 Length of exposure _____

** Ask only on first interview.

At what age did you first go to work in a textile mill? (Write in specific age in appropriate square).

(1)	(2)	(3)	(4)	(5)	(6)	
<20	20-24	25-29	30-34	35-39	40+	(80)

When you first worked in a textile mill, did you work with (1) Cotton or cotton blend (81)
 (2) Synthetic or wool

Within the first few days you first worked in a textile mill, do you remember becoming sick with fever, chills, cough or sickness of the stomach? (Accept any of the above signs or symptoms) _____ Yes _____ No _____ (82)

If "no" to (75): Have you ever had such an illness after returning to the mill after a few days away from the mill? _____ Yes _____ No _____ (83)

How many years have you worked in a textile mill? (Write in total number of years in appropriate square)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Processing:	<1	1-4	5-9	10-14	15-19	20-24	25-30	30+	(84)
Cotton or Cotton Blend									
All Synthetic or Wool									(85)

If cotton, how many years did you spend in each area? (Write in years in each area)

	(86)	(87)	(88)	(89)	(90)	(91)	(92)	(93)	(94)	(95)	(96)	
	Open	Pick	Card	Spin	Wind	Twist	Spool	Warp	Slash	Weave	Other	
<1												(1)
1-4												(2)
5-9												(3)
10-14												(4)
15-19												(5)
20-24												(6)
25-29												(7)
30+												(8)

For those working in more than one area:

Did you move from a dusty work area to one that was not as dusty? _____ Yes _____ No _____ (97)

If yes, did you move because the dust bothered your breathing? _____ Yes _____ No _____ (98)

XII. TABLES AND FIGURES
TABLE XII-1

WASTE ANALYSIS OF 950 BALES OF COTTON*

SHIRLEY ANALYZER WASTE**

Bales %	Total Range %	Visible (trash & fiber) Average %	Invisible (dust) Average %	Picker & Card Waste %
0.6	0.00-1.00	0.66	0.18	6.1
27.2	1.01-2.00	1.00	0.68	6.8
41.8	2.01-3.00	1.48	1.00	7.5
17.9	3.01-4.00	2.28	1.17	8.5
5.0	4.01-5.00	3.11	1.35	9.4
3.0	5.01-6.00	3.88	1.58	10.6
1.8	6.01-7.00	4.79	1.68	11.5
1.3	7.01-8.00	5.71	1.74	12.4
1.4	8.01- up	8.57	1.71	15.0

*From 1960, 1961 and 1962 crop years

**Determined by Shirley Analyzer Method, ASTM D 1451-67. [9]

From Graham [5]

TABLE XII-2

EFFECT OF COTTON GRADE ON TEXTILE PROCESSING WASTE

Process	Mix A %	Mix B %
Breaker and finisher picker	3.69	0.72
Card flat strips	5.90	3.35
Card cylinder and doffer strips	4.05	1.99
Motes and fly	5.80	1.67
Sweepings	0.44	0.21
Total Waste	19.88	7.94

From Graham [5]

TABLE XII-3

SIZE OF COTTON YARN PRODUCED AND EFFECT ON WORKERS

No. of mills visited	Average count* of cotton yarn	No. of Strippers & Grinders			Total examined	Total affected	
		Sound	Slightly affected	Markedly affected		No.	%
6	Below 30 (coarse)	2	8	13	23	21	91.3
17	Between 30 and 39 (medium)	23	27	32	82	59	71.95
8	40 and over (fine)	8	7	6	21	13	61.9
31	All counts	33	42	51	126	93	73.81

*The count of cotton yarn is the number of 840-yard hanks in one pound of yarn.

After Collis [38]

TABLE XII-4
 RELATIVE PREVALENCE OF BYSSINOSIS
 IN MALE COTTON MILL WORKERS AGED 40-50

Group	No. examined	Normal	No. with byssinosis		
			I	II	Total (%)
28 mills - Oldham	190	75	67	48	60
17 mills - Oldham	107	51	33	23	52
4 mills - Ashton under Lyne	44	10	17	17	54

From Schilling et al [55]

TABLE XII-5

PREVALENCE OF BYSSINOSIS IN CARDROOM WORKERS
AND SPINNERS AGED 40-59 IN SIX MILLS

Operation Group	Sex	No.	Age Mean	Exposure Mean Yrs.	Normal	Byssinosis		
						I	II	Total (%)
Card- and blowroom workers	M	56	48	25	21	22	13	62
Card, draw frame, slubber tenders	F	109	49	27	58	37	14	47
Intermediate and rover tenders	F	109	48	27	84	17	8	23
Mule spinners	M	62	50	29	55	5	2	11
Ring spinners	F	61	48	28	59	1	1	3

From Schilling et al [55]

TABLE XII-6

PREVALENCE OF BYSSINOSIS IN COTTON WORKERS

Country	Year Reported	Opening and Picking	Carding	Stripping and Grinding	Spinning	Other	Reference	Remarks	
		-----%-----							
England	1915			91			[38]	Coarse	
England	1915			72			[38]	Medium	
England	1915			62			[38]	Fine	
England	1950			43			[104]		
England	1955	66	43	65		42	[55]		
England	1956		39		7		[64]		
England	1960		51		2		[85]	Coarse	
England	1960		6				[85]	Fine	
Belgium	1961		8				[105]		
W. Germany	1963		62				[47]		
England	1964		14		2		[98]		
Netherlands	1964		18		2		[98]		
Sweden	1964		62			52	[50]	Other cardroom	

TABLE XII-6 (continued)

PREVALENCE OF BYSSINOSIS IN COTTON WORKERS

Country	Year Reported	Opening and Picking	Stripping and Grinding			Other	Reference	Remarks
			Carding	Spinning				
		-----%						
England	1966		30				[106]	
England	1966		62				[106]	
England	1967					18	[49]	Winding
U.S.	1969		26		29		[48]	
U.S.	1969		25		12		[14]	
England	1970	24	24	49	25*	4	[13]	Medium (10-50)
England	1970	14	32	48	29*	9	[13]	Coarse (1-24)
U.S.	1970	15	29		10	7	[15]	
U.S.	1972		20			2	[62]	Modern Mill
U.S.	1973		23		4	13	[17]	Winding
England	1973		26		4	2	[16]	Slashing, Weaving

*Includes drawframe tenter, speedframe tenter, and comber tenter.

TABLE XII-7
COTTON DUST: SIZE AND DEPOSITION SITE

Constituent	Aerodynamic diameter (μm)	Remarks
Lint and fuzz fibers	>20	Essentially no deposition in respiratory tract
Vegetable trash	>15	Do
Vegetable trash	8-15	Mainly oronasal and tracheal deposition
Vegetable trash	<8	Some deposition in pulmonary spaces, proportion increasing as size decreases
Mineral matter	<8	Do
Air pollution	<8	Do

From Ayer [128]

TABLE XII-8
CLASSIFICATION OF WORK AREA
BY TOTAL DUST CONCENTRATION

Grade of Dustiness	Concentration Total Dust
A. Safe, with medical supervision of workers	<1 mg/cu m
B. Dust control desirable and medical control essential	1 - 2.5 mg/cu m
C. Dust control and medical supervision essential	>2.5 mg/cu m

From Roach and Schilling [85]

TABLE XII-9
 CATEGORIZATION OF WORK AREAS BY 8-HOUR,
 FLY-FREE COTTON DUST CONCENTRATION

Dust Category	Concentration, Less Fly Averaged over 8 hours (mg/cu m)
Low	0.5 or less
Moderate	more than 0.5 and less than 1.0
High	1.0 or more

From British Occupational Hygiene Society Committee
 on Hygiene Standards [126]

Note: The concentration, less fly, is the weight of dust in milligrams per cubic meter of air excluding particles which would be caught by a 2-mm wire mesh gauze, or which would not pass through a vertical elutriator designed to accept 50% of unit density spheres 30 microns in diameter. The recommended maximum average concentrations is therefore 0.5 mg/cu m, less fly.

TABLE XII-10
 PREVALENCE OF BYSSINOSIS
 COMPARED TO KNOWN DUST EXPOSURES

Total Dust Exposure mg/cu m	Prevalence*	No. of People Examined
0 - 0.5	1.5%	212
0.5 - 1.0	2.8%	108
1.0 - 2.0	9.9%	1,259
2.0 - 3.0	8.5%	1,226
3.0 - 4.0	34.0%	465
4.0 - 5.0	55.0%	245
5.0 - (34.0)	27.5%	92
	Total	<u>3,607</u>

*Byssinosis all grades.

From British Occupational Hygiene Society Committee
 on Hygiene Standards [126]

TABLE XII-11

NUMBER OF BYSSINOTIC WORKERS WITH GRADE II SYMPTOMS
AT VARIOUS LEVELS OF DUST CONCENTRATION

Total Dust mg/cu m	No. of Workers with Byssinosis		Reference
	All Grades	Grade II	
1.5	9	0	[85]
1.6	8	1	[49]
1.7	13	3	[85]
1.7	27	7	[14]
2.8	23	2	[49]
2.8	6	0	[49]
3.5	22	5	[49]
4.0	142	29	[85]
6.0	5	0	[49]
Total	255	47 (18.5%)	

From British Occupational Hygiene Society Committee
on Hygiene Standards [126]

TABLE XII-12

RECOMMENDATIONS FOR CLASSIFICATION AND MANAGEMENT
OF WORKERS EXPOSED TO COTTON DUST

Functional severity	FEV 1* (% of predicted)	FEV 1** (%)	Interpretation of FEV 1	Recommendations for Employment
F0	>80 (No evidence of chronic ventilatory impairment)	(a) -4 to 0; or more	(a) Minimal or no acute effect of dust on ventilatory capacity	No change; annual FEV 1, and questionnaire
		(b) -9 to -5 or more	(b) Moderate acute effect of dust on ventilatory capacity	No change; 6 mo. FEV 1, and questionnaire
		(c) -10 or more	(c) Definite and marked acute effect of dust on ventilatory capacity	Move to lower risk area; 6 mo. FEV 1, and questionnaire
F1	60-79 (Evidence of slight to moderate irreversible impairment of ventilatory capacity)	(a) -4 to 0; or more	As (a) above	No change; 6 mo. FEV 1, and questionnaire
		b) -5 or more	As (b) above	Move to lower risk area; 6 mo. FEV 1, and questionnaire
F2	<60 (Evidence of moderate to severe irreversible impairment of ventilatory capacity)	---	---	Work requiring no cotton dust exposure, detailed pulmonary examination, and questionnaire

*FEV 1 in absence of dust exposure (2 days or longer).

**Difference between FEV 1 before and after 6+ hours of cotton dust exposure on a first working day.

Derived from Organizing Committee of National Conference on Cotton Dust and Health, [162] Bouhuys et al, [152] and reference 158

TABLE XII-13

PREDICTED DUST LEVELS TO PRODUCE
VARIOUS PREVALENCES OF BYSSINOSIS

Byssinosis Prevalence (Per Cent)	Milligrams per Cubic Meter of <15 (u)m Dust					
	All Grades		Grades 1 + 2		Grade 2	
	Level	95% Limits	Level	95% Limits	Level	95% Limits
1	0.021	0.012	.060	0.034	0.082	0.042
		0.033		0.086		0.12
2	0.036	0.021	.097	0.063	0.14	0.086
		0.051		0.130		0.19
3	0.050	0.032	0.13	0.091	0.20	0.13
		0.068		0.17		0.26
4	0.063	0.043	0.16	0.12	0.25	0.18
		0.084		0.21		0.33
5	0.07	0.054	0.20	0.15	0.31	0.24
		0.10		0.25		0.41
10	0.15	0.12	0.38	0.31	0.64	0.49
		0.18		0.46		0.93
25	0.48	0.40	1.10	0.84	2.1	1.4
		0.59		1.6		4.6
50	1.70	1.2	3.63	2.3	8.0	3.9
		2.7		7.4		28.5

From data of Merchant et al, [18]

TABLE XII-14

PREDICTED PREVALENCE OF BYSSINOSIS
by <math><15\ \mu\text{m}</math> Dust Level

Cotton Preparation and Yarn Area Workers North Carolina 1970-1971						
<math><15\ \mu\text{m}</math> Dust Level mg/cu m	Percent Byssinosis					
	All Grades		Grades I + II		Grade II	
	Percent	95% Limits	Percent	95% Limits	Percent	95% Limits
0.1	6.5	5.0	2.1	1.3	1.3	0.7
		8.5		3.3		2.3
0.2	12.7	10.8	5.0	3.8	3.0	2.1
		14.9		6.6		4.3
0.5	25.8	22.5	13.1	10.7	8.0	6.1
		29.3		15.8		10.2

From Merchant et al [18]

TABLE XII-15

PREVALENCE OF BYSSINOSIS IN TIME-WEIGHTED
DUST EXPOSURE GROUPS

Time-weighted dust group (mg years/cu m)	No. of subjects examined	Mean time- weighted dust measurements (mg years/cu m)	%Prevalence of byssinosis (Grade 1/2 and over)
0.0-10.0 ..	330	5.75	3.63
10.1-20.0 ..	257	15.34	9.73
20.1-30.0 ..	206	24.06	12.31
30.0 ..	347	48.50	22.19

After Fox et al [123]

TABLE XII-16

BYSSINOSIS CASES AND DUST CONCENTRATIONS

A. Exposed to over 0.25 mg/cu m fly-free dust

<u>Investigator</u>	<u>Ref.</u>	<u>Year</u>	<u>Number of Cases</u>	<u>Dust Concentration- mg/cu m</u>	
				<u>Total(t) or respirable(r)</u>	<u>Fly-free or <15 μm</u>
Roach	[85]	1960	155	1.5-5+ (t)	(0.3-1.5+)
Wood	[11]	1964	52		0.7-1.2
Lammers	[98]	1964	106	0.2 (r)	0.4
Belin	[50]	1965	67		1.65-4.54
Mekky	[49]	1967	63		0.35-1.92
Molyneux	[125]	1968	365	0.9-5.4 (t)	(0.28-1.65)
Zuskin	[14]	1969	27		0.43-1.07
El Samra	[119]	1972	1	1.0 (t)	(0.3)
Valic	[120]	1972	6	1.07 (r)	(2.1)
Valic	[122]	1972	29	0.55 (r)	(1.1)
Merchant	[18]	1973	197		0.35-1.7
Tuma	[93]	1973	211		0.25+
Fox	[123]	1973	157		0.55-3.74
Berry	[65]	1974	289		0.25-2.38
Imbus	*	1974	158		0.2-2.0
Total			1883		

B. Exposed to less than 0.25 mg/cu m fly-free dust

<u>Investigator</u>	<u>Ref.</u>	<u>Year</u>	<u>Number of Cases</u>	<u>Dust Concentration- mg/cu m</u>	
				<u>Total(t) or respirable(r)</u>	<u>Fly-free or <15 μm</u>
Roach	[85]	1960	6	1.0- (t)	(0.3-)
Lammers	[98]	1964	11	0.03-0.1 (r)	(0.06-0.2)
Merchant	[18]	1973	58		0.05-0.23
Imbus	*	1974	23		0.2-
Total			98		

*Written communication from HR Imbus, 1974

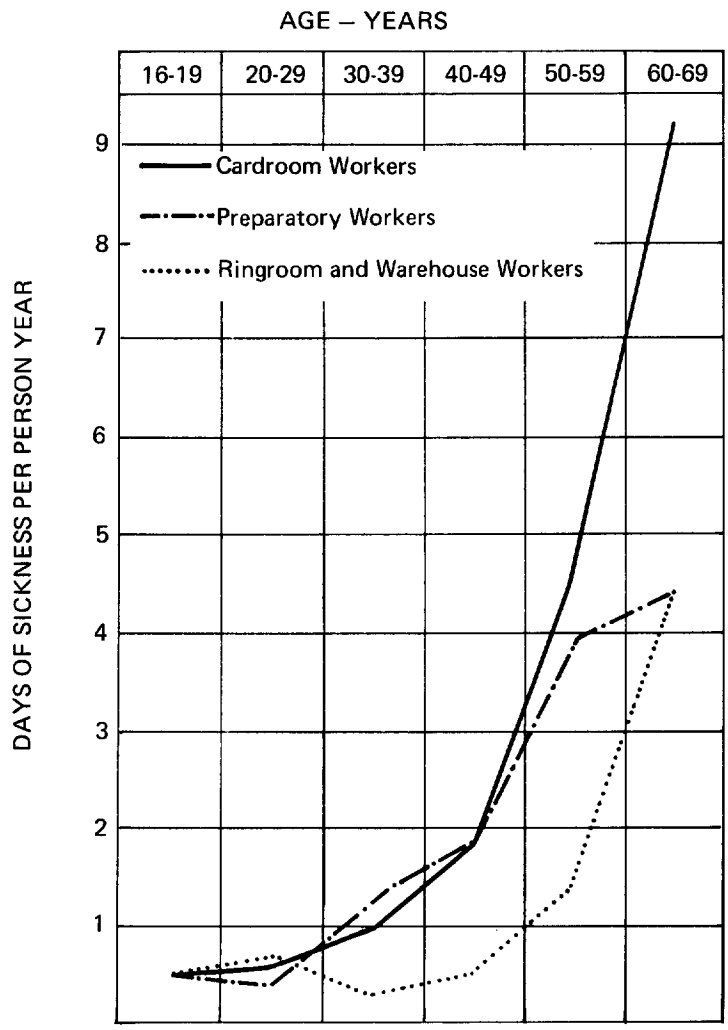


FIGURE XII-1
 DAYS OF SICKNESS VS AGE
 MALE COTTON OPERATIVES
 LANCASHIRE, ENGLAND, 1923-1927

From Hill (40) and Prausnitz (41)

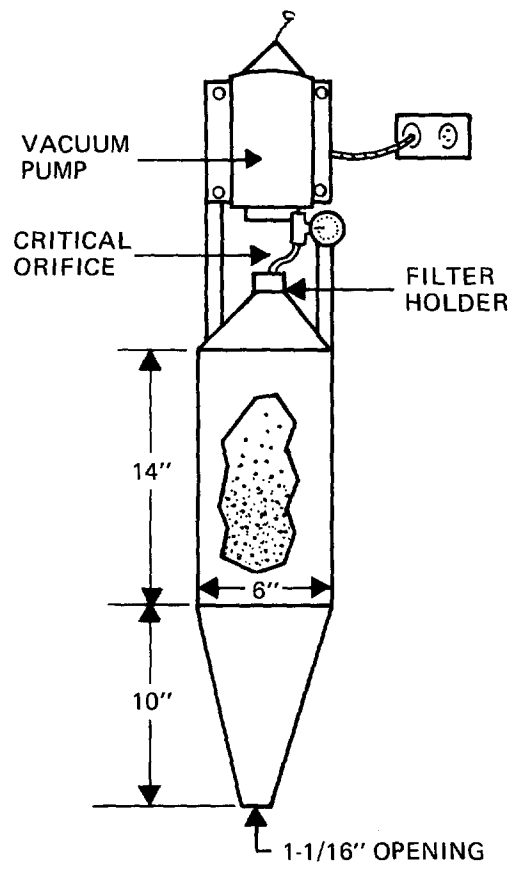


FIGURE XII-2
 VERTICAL ELUTRIATOR COTTON DUST SAMPLER

From Lynch (124)

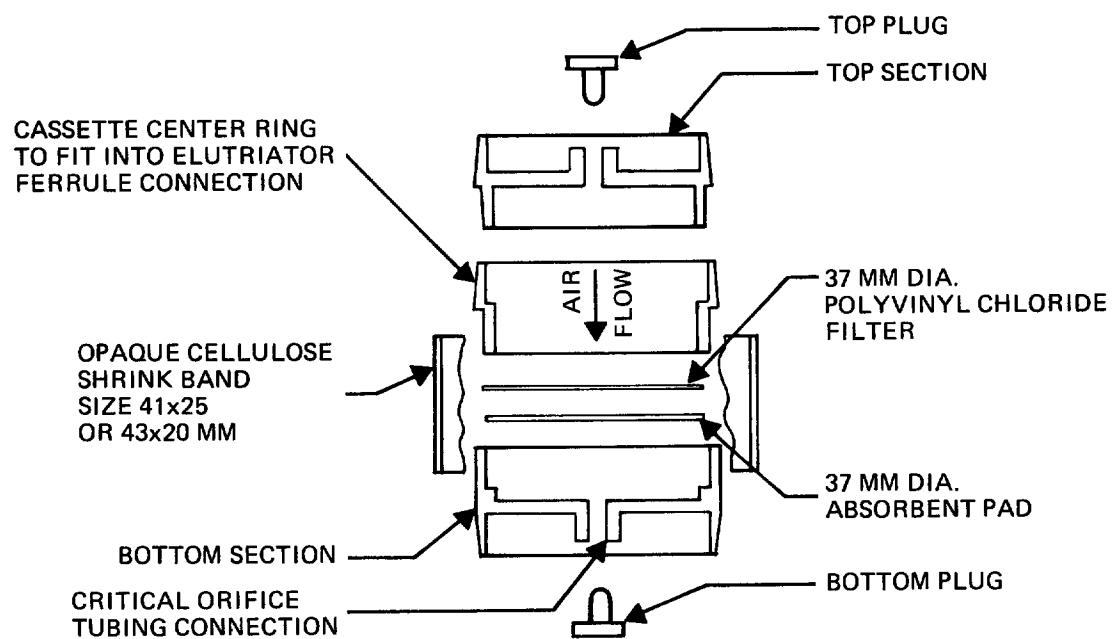


FIGURE XII-3
 FILTER CASSETTE ASSEMBLY

From Barr et al (127)

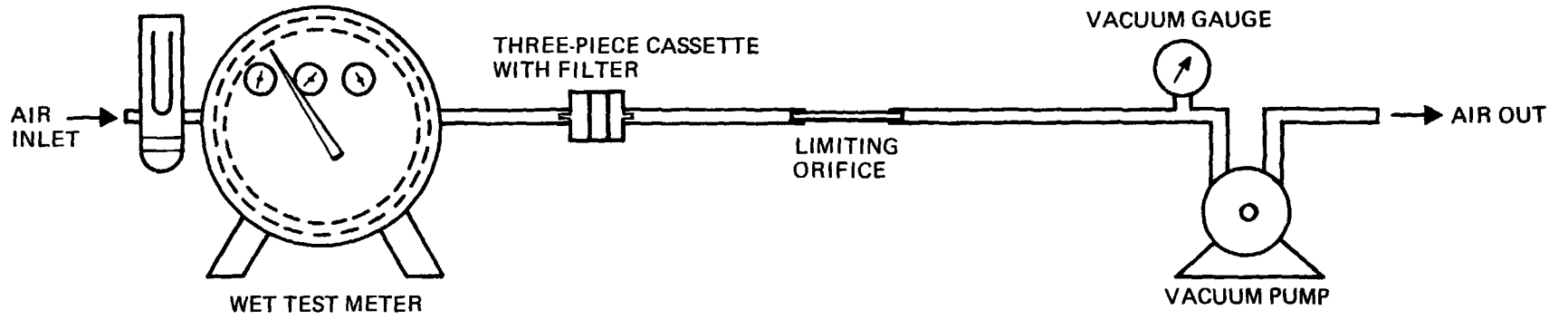


FIGURE XII-4
CALIBRATION SAMPLING TRAIN FOR CASSETTE
WITH FILTER AND LIMITING ORIFICE

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