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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45202

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 75-24-273

B. F. GOODRICH COMPANY, KOROSEAL DIVISION
MARIETTA, OHIO

APRIL 1976

I. TOXICITY DETERMINATION

A health hazard evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) on June 10 and 11, and on December 12, 1975, at the Koroseal Division of B. F. Goodrich Company in Marietta, Ohio. During this evaluation, environmental samples were taken for barium ferrite, lead and nuisance dust. Twenty-two employees were interviewed by the medical officer and medical records were also reviewed.

Based on the analysis of environmental samples and the results of the medical investigation, it was determined that the employees working in the area of this plant using barium ferrite are not exposed to toxic concentrations of barium compounds, lead or dust. Environmental sampling indicated concentrations of barium ferrite ranging from non-detectable to 2.2 mg/M³, lead concentrations up to 0.04 mg/M³, and nuisance dust concentrations up to 2.1 mg/M³. A medical investigation, including a review of available chest x-ray reports, medical records, and medical questionnaires, indicated no material impairment to health that can be attributed to exposure to barium ferrite powder.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are available upon request from NIOSH, 4676 Columbia Parkway, Cincinnati, Ohio 45226. Copies have been sent to:

- a) B. F. Goodrich Company
- b) International Chemical Workers, Local 343
- c) U. S. Department of Labor - Region V
- d) NIOSH - Region V

For the purpose of informing the approximately 20 affected employees, the employer shall promptly "post" for a period of 30 calendar days the Determination Report in a prominent place(s) near where exposed employees work.

III. INTRODUCTION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6), authorizes the Secretary of Health, Education, and Welfare, following a written request by an 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 National Institute for Occupational Safety and Health (NIOSH) received such a request from an authorized representative of The United Chemical Workers Union, Local 343, to evaluate the potential hazards associated with the use of barium ferrite.

IV. HEALTH HAZARD EVALUATION

A. Process Description

The process under study is involved in the production of an extrudable magnetic plastic manufactured in a batch process by physically combining small amounts of two synthetic rubber compounds with magnetizable barium ferrite. The barium ferrite powder is poured by hand onto the heated rollers of a canopy hooded mill to which small amounts of the rubber plasticizing agents have previously been added. The complete mixing of the components is normally effected in about fifteen minutes, during which time the mill operator returns to the top of the mill that powder which has fallen through the mill. This is accomplished by pulling the powder from under the rollers with a long handled, soft rubber scraper, then scooping it off the mill table which is slightly below waist level, with a wide, shallow scoop, back onto the mill rollers. The material comes off the mill at the end of the process in the form of plastic sheets approximately 1/2 inch thick. These sheets are then granulated into pellets about 1/4 inch cubed. The pellets are heat-extruded into an endless strip which is water cooled and wound into coils to be magnetized.

B. Evaluation Design

1. Environmental

Depending on the shift, there were either three or four mill operators and three extruder operators employed in this part of the plant. During the first visit to the plant in June of 1975, personal breathing zone samples were taken for both respirable and total dust on three mill operators, and for total dust on three extruder operators. One such set of samples was taken for an eight hour period during the day shift, and a second set was taken for a two hour period during the evening shift. These samples were subsequently analyzed for dust concentration, barium ferrite, and lead. In addition to these personal samples, short duration (one minute) samples were frequently taken using a dust monitor to check exposure during what appeared to be the most dusty segment of the operation. Measurements were also made of the ventilation system in the canopy hoods.

During the second visit to the plant, in December of 1975, personal breathing zone samples were taken for respirable dust on four mill operators. These samples were four hours in duration, taken during the day shift, and analyzed for dust, barium ferrite, and lead. Measurements were again made of the ventilation system in the hoods.

2. Medical

During the initial visit, a non-directed medical questionnaire including work history was administered to all employees working in the barium ferrite area on all shifts. From the results of this questionnaire, along with environmental data and other information gathered regarding exposure to this process, a decision was subsequently made to assign a medical officer to conduct an on-site evaluation to determine possible adverse health effects from exposure to barium ferrite upon the pulmonary systems of workers.

The medical evaluation consisted of three parts. One part involved a review of medical records and available chest x-rays of all employees working in the barium ferrite area. A second part consisted of a walk-through inspection of the area in which the barium ferrite powder is used, at a time when all processes were in full operation. The third part consisted of the administration of a medical questionnaire to all employees participating in this study. A copy of this questionnaire is enclosed in Appendix I of this report.

C. Evaluation Methods

All environmental samples were collected on pre-weighed filters, respirable samples being obtained using a 10 mm nylon cyclone. Dust concentration was determined by reweighing the filters, metal concentration was determined by atomic absorption spectrophotometry. Ventilation studies were accomplished with an Alnor "Senior" Velometer and smoke tubes. Short duration dust samples were obtained using a GCA Respirable Dust Monitor which operates on a beta absorption principle.

D. Evaluation Criteria

1. Environmental

The barium ferrite powder used by the B. F. Goodrich Company was determined to be an insoluble barium compound, and as such does not fall into the group of barium compounds to which the standards of the Occupational Safety and Health Administration (OSHA) or the threshold limit values (TLV) of the American Conference of Governmental Industrial Hygienists (ACGIH) apply. The ACGIH Documentation of Threshold Limit Values for Substances in Workroom Air¹ states, however, that the more soluble forms of barium tend to be the more injurious. It follows that if the insoluble ferrite was to be within the TLV for soluble compounds (0.5 mg/M³), it would not be expected to create a hazard.

Since there was reported to be some lead in the powder used in this plant, samples were also analyzed for this metal. These results were compared with the ACGIH TLV, (0.2 mg/M³), as were the results for gravimetric dust analysis (TLV's of 10 mg/M³ and 5 mg/M³ for total and respirable "nuisance" dust, respectively).

Ventilation measurements were compared with recommendations put forth in the ACGIH Manual of Industrial Ventilation.⁴

2. Medical

Barium ferrite powder is a mixture of barium oxide and iron oxide with iron oxide the usual major component. The exact proportion of barium oxide to iron oxide in the powder used at this plant is not known. The barium ferrite used at the plant studied in this evaluation was reported to have an acute oral LD₅₀ greater than 5 gm/kg and a one-hour LC₅₀ greater than 200 mg/l by inhalation in rats.⁸ This places the material in the slightly toxic range. No eye or skin irritation was reported in acute studies in rabbits.⁸ It has very limited solubility in water. The effects of intratracheal instillation and inhalation of barium ferrite powder (15% barium oxide, 85% iron oxide) in rats are reported in one Russian study.³ Accumulation of dust in the lungs with some fibrogenic changes were the only pathological changes noted in these animals. No human experience with barium ferrite powder has been reported.

Limited information is available concerning the health effects of barium oxide and iron oxide separately. Barium oxide is one of the intermediately soluble compounds of barium. Dermal and nasal irritation and the benign pneumoconiosis, baritosis, has been reported in exposed workers.¹ The accumulation of barium oxide in the lungs can be seen on the chest x-rays of exposed individuals, but no clinical pulmonary impairment can be demonstrated and there are no irreversible changes in lung structure. The lack of reports in the literature of systemic toxicity of the type seen with the more soluble barium compounds may be due to the limited solubility of barium oxide. Iron oxide dust may produce a similar benign pneumoconiosis known as siderosis.

Based on the limited information available barium ferrite powder may have potential for causing a pneumoconiosis. For each of its components the pneumoconiosis is benign. Two recent studies involving barium ferrite were also considered. One, by Zhislin et al², involved the exposure of rats to concentrations of from 20 to 200 mg/M³ for four hours daily for nine months. The second, by Kosova and Gershovich³, states that exposure to barium ferrite leads to fibrotic processes, the degree of which is dose dependent, but does not determine at what dose levels these processes occur. A Russian report in the literature of fibrotic changes due to inhalation exposure to this material by rats raises the possibility of similar effects in man.³ The medical survey was designed to investigate the possibility of these effects occurring in exposed workers.

E. Evaluation Results

1. Environmental

Results of environmental sampling indicate that the atmospheric concentrations of barium, lead and "nuisance" dust were approximately a tenth of the TLV's for those substances. Tables I and II give the results of the personal samples taken during the June and December surveys, respectively. Short duration (one minute) samples, taken with the GCA dust monitor, ranged from 0.05 to 0.3 mg/M³ and tend to confirm these results.

Mean air velocity measured at the face of the three sided canopy hood was 160 feet per minute, which slightly exceeds the recommended capture velocity of 150 FPM suggested for this type of operation⁴. However, the air flow is not uniform at all points, but tends to be higher near the top and drops off to around 100 FPM near the bottom of the opening.

2. Medical

On questioning, 9 of the 22 workers (40.8%) involved in the study had complaints compatible with chronic obstructive pulmonary disease. Of these, 8 were or still are heavy cigarette smokers ranging from 8-45 pack years with an average of 30.4 pack years smoking experience. Only two had x-ray changes consistent with chronic bronchitis. The only worker with no smoking history in the symptomatic group attributed his symptoms to a long history of hay fever and he noted that his symptoms of coughing and wheezing only occurred during the fall. This worker had no history of shortness of breath. Shortness of breath was reported by 7 of the 22 workers (31.7%). Five of these were in the smoking group noted above. Of the two remaining workers one gave a long history of hypertension and arteriosclerotic heart disease which could account for this complaint. The other worker gave a history of episodic bouts of hyperventilation with palpitations with which he associated his periods of shortness of breath. No active disease was reported in the chest x-rays of either of the workers with complaints of shortness of breath in the non-smoking group. No other findings compatible with respiratory disease were noted in reviewing the medical questionnaires.

No pattern of any respiratory disease was found in the review of the employee medical records.

Of the 22 workers evaluated 13 had a chest x-ray within the last 18 months. No pneumoconiosis or pulmonary fibrosis was noted. The only pulmonary abnormalities reported were increased markings in the bases consistent with chronic bronchitis in two workers with 33 and 36 cigarette pack year smoking histories. Old calcified hilar scars were reported in 10 of these 13 workers. In all cases the scars had been present since the first x-ray was taken, had not changed and in some cases these hilar scars were noted as long as thirteen years prior to the survey. In any event the hilar scarring was not consistent with pneumoconiosis or pulmonary fibrosis.

F. Conclusions

The only adverse effect reported for barium ferrite powder is the production of pulmonary fibrotic changes in rats in one study in the Russian literature. No data is available concerning the effects in humans of this substance but on examining the effects of the components one must suspect the possible development of benign pneumoconiosis from exposure to barium ferrite powder. Based on the review of available chest x-ray reports, employee medical records and a medical questionnaire administered to the 22 volunteers who comprise 88% of the exposed group at this plant no material impairment to health can be attributed to their exposure to barium ferrite powder. There was no x-ray evidence in the reports of 13 of these 22 workers of any condition resembling pneumoconiosis or pulmonary fibrosis. Although 9 workers had complaints compatible with respiratory disease (in this case chronic obstructive pulmonary disease), 8 of these workers had heavy cigarette smoking histories, and one had a history of hay fever and had symptoms only when the hay fever was active. Two additional workers had complaints of shortness of breath which could similarly be explained on other bases. Given these findings no hazard can be attributed to exposure to the barium ferrite powder under the conditions described above and observed at the B. F. Goodrich Company, Koroseal Division, Marietta, Ohio.

Results of environmental testing support the medical conclusions. Personal samples taken in the breathing zones of both mill and extruder operators are well below limits recommended as harmful to health, and in several cases were too low to be accurately measured. Concentrations of barium ferrite ranged from none detected (<0.08) to 2.2 milligrams per cubic meter.

V. RECOMMENDATIONS

1. Continue annual chest x-rays of all workers involved with barium ferrite powder including both mill operators and extruder operators.
2. Consider additional surveillance procedures including periodic histories, physical examinations and pulmonary function testing including as a minimum FVC and FEV₁, for early detection of the development of pulmonary disease, however remote the possibility.
3. Continue industrial hygiene monitoring of barium ferrite dust levels to insure that levels are maintained as low as possible below the recommended TLV for soluble barium compounds of 0.5 mg/M³.
4. Attempt to increase the face velocity at the bottom of the hood in the area where the dust is stirred up by the operator in his job of scooping it back onto the rollers. This might be done by the use of baffles, as was discussed with the corporate industrial hygienist, or by some other means. Care should be taken, however, not to make the ventilation inadequate in one part of the system while attempting to improve it in another part.
5. The possibility of providing make-up air by some means other than leaving a door open near the ferrite area should be considered.

VI. REFERENCES

1. Documentation of the Threshold Limit Values for Substances in Workroom Air, 3rd Ed., 1971, American Conference of Governmental Industrial Hygienists.
2. Zhislin, L.E., Gershovich, L.M., Kusova, L.V., Polishuk, L.I., "Effect of Barium Ferrite Dust on Organisms," Mater. Plenuma Respub. Kom. Bor'be Silikozom, Akad. Nauk Ukr. SSR, 23rd, 1972, p. 301-5.
3. Kosova, L.V., Gershovich, E.M., "Experimental Pneumoconiosis Due to Inspiration of Barium Ferrite Powders," Gig. Tr. Prof. Zabol., Vol. 16, Iss. 5, 1972, p. 41-4.
4. Industrial Ventilation: A Manual of Recommended Practice, 13th Ed., 1974, American Conference of Governmental Industrial Hygienists.
5. Parkes, W.R., Occupational Lung Disorders, Butterworth and Co., London, 1974.
6. Zenz, C.Z., Occupational Medicine, Principles and Practical Applications, Yearbook Medical Publishers, Chicago, 1975.
7. Hamilton, A. and Hardy, L., Industrial Toxicology, Third Edition, Publishing Sciences Group, Inc., Acton, Mass., 1974.
8. Rosner-Hixon Laboratories, Report on Stackpole Barium Ferrite, June 3, 1972.

VII. AUTHORSHIP AND ACKNOWLEDGMENT

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TABLE I
RESULTS OF PERSONAL BREATHING ZONE SAMPLES
June 10 and 11, 1975
D.F. GOODRICH COMPANY, KOROSEAL DIVISION
HARRIETTA, OHIO

Location	Type*	Dust**	Concentration, mg/M ³			Time Period of Samples	
			Ba	Ba Fe ₁₂ O ₁₉	P _b	Start	Stop
#2 Mill Operator	R	ND	<0.01	<0.00	<0.003	0804	1528
#2 Mill Operator	T	1.3	0.07	0.57	0.01	0804	1528
#3 Mill Operator	R	ND	----	----	----	----	----
#3 Mill Operator	T	0.6	0.02	0.16	0.006	0807	1525
#8 Mill Operator	R	ND	<0.01	<0.00	<0.003	0810	1523
#8 Mill Operator	T	0.1	<0.01	<0.00	0.003	0810	1523
#8 Extruder Operator	T	ND	<0.01	<0.00	0.003	0817	1529
#9 Extruder Operator	T	ND	<0.01	<0.00	0.01	0816	1519
#10 Extruder Operator	T	ND	<0.01	<0.00	<0.002	0814	1521
#2 Mill Operator	R	ND	<0.05	<0.4	<0.01	1632	1840
#2 Mill Operator	T	2.1	0.27	2.2	0.04	1632	1840
#3 Mill Operator	R	ND	<0.05	<0.4	<0.01	1624	1834
#3 Mill Operator	T	1.1	0.15	1.2	0.015	1624	1834
#8 Mill Operator	R	ND	<0.05	<0.4	<0.01	1620	1830
#8 Mill Operator	T	1.1	0.04	0.3	<0.000	1620	1830
#8 Extruder Operator	T	ND	<0.04	<0.3	<0.000	1632	1836
#9 Extruder Operator	T	ND	<0.04	<0.3	<0.000	1635	1834
#10 Extruder Operator	T	ND	<0.04	<0.3	<0.000	1630	1831

* R - Respirable, T - Total

** "ND" indicates weight increase of filter was less than average weight increase of blanks.

TABLE II
 RESULTS OF PERSONAL BREATHING ZONE SAMPLES
 December 12, 1975
 B.F. GOODRICH COMPANY, KOROSEAL DIVISION
 MARIETTA, OHIO

Description	Mass					Concentration			Time Period of Samples	
	Mg Dust	Mg Ba	Mg Fe	Mg Pb	Mg* BaFe ₁₂ O ₁₉	Mg/M ³ Dust	Mg/M ³ Pb	Mg/M ³ BaFe ₁₂ O ₁₉	Start	Stop
Personal sample on operator of #8 mill	0.18	<0.004	0.037	0.003	0.06	0.45	0.008	0.15	0843	1236
Personal sample on operator of #3 mill	0.15	<0.004	0.010	0.001	0.02	0.38	0.003	0.05	0845	1235
Personal sample on operator of calendar mill	0.06	<0.004	0.012	0.001	0.02	0.15	0.003	0.05	0852	1221
Personal sample on operator of #2 mill	0.08	<0.004	0.010	0.001	0.02	0.20	0.003	0.05	0902	1239

*Calculated from iron analysis.

APPENDIX I
MEDICAL QUESTIONNAIRE

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
518 POST OFFICE BUILDING
CINCINNATI, OHIO 45202

CONSENT

I voluntarily agree to participate in a study at the B. F. Goodrich Company, Koroseal Division, Marietta, Ohio, conducted by the Public Health Service, to evaluate possible-effects on the lungs from Barium Ferrite powder. I understand that the medical evaluation will consist of answering questions about my health.

I understand that my participation in this study is voluntary and that all information obtained will be considered confidential in accordance with U.S. Public Health Service Regulation (42 CFR Part 1). The information will be utilized statistically, but I will not be identified as an individual without my express consent. I am free to withdraw from the study at any time.

DATE _____

Name _____
(printed or typed)

Signature _____

Witness _____

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

MEDICAL QUESTIONNAIRE

DATE _____

IDENTIFICATION SECTION

1. Name _____
2. Address _____
3. Phone Number _____
4. Social Security Number _____
5. Birthdate _____
6. Age _____
7. Sex _____ 8. Race _____ W _____ B _____ Other _____
9. Standing Height _____ in. 10. Weight _____ lbs.

OCCUPATIONAL HISTORY SECTION

11. In what year did you start working here? _____
12. What exactly is your main job? (Describe it) _____

13. On the average how many days per week do you work? _____
14. On the average how many hours per day do you work? _____
15. How many years have you worked at this particular job? _____
16. Do you have any health problems you feel are related to your job? _____
17. If yes to above describe them _____

Historical Information Section

In filling in this section of the questionnaire in all cases unless otherwise specified enter 1 for yes, 2 for no, leave blank if patient does not know or refuses to answer.

You may be asked to skip certain questions depending on the answers to other questions. Follow these instructions carefully. When questions are skipped as directed leave them blank. At the end of this section there are a number of questions which appear to be blank lines, i.e. 156. _____.

These are spaces which are used for optional questions not used in this survey. Ignore these 'blank' questions unless they are actually filled in on your copies of the questionnaire, i.e. 156. Ever exposed to tritium? _____.

Try to use the actual wording of each question. Begin these questions with this preamble: "I am going to ask you some questions mainly about your chest. I would like you to answer yes or no whenever possible unless other information is asked for."

20. Do you usually cough first thing in the morning?

10
□

21. Do you usually cough at other times of the day or night?

11
□

(IF YES TO 20 OR 21 ASK 22 AND 23, IF NO GO TO 25)

22. Do you cough on most days for as much as three months of the year?

12
□

23. For how many years have you had this cough?

13
□

(1-less than 2 years, 2- 2-5 years, 3-more than 5 years)

25. Do you usually bring up phlegm, sputum or mucus from your chest first thing in the morning?

14

26. Do you usually bring up phlegm, sputum or mucus from your chest at other times of the day or night?

15

(IF YES TO 25 or 26 ASK 27-30, IF NO GO TO 31)

27. Do you bring up phlegm, sputum or mucus from your chest on most days for as much as three months of the year?

16

28. For how many years have you raised phlegm, sputum or mucus from your chest?

17

(1-less than 2 yrs, 2-2-5 yrs, 3-more than 5 yrs)

29. What is the usual color of the phlegm, sputum or mucus you bring up from your chest?
 (1-don't know, 2-clear, 3-white, 4-other, 5-yellow, 6-green)

18

(IF 1,2,3 or 4 ASK 30, otherwise GO TO 31)

30. Have you ever had episodes of yellow or green phlegm, sputum or mucus?

19

31. Have you ever coughed up blood?

20

(IF YES ASK 32-34, IF NO GO TO 40)

32. How many times have you coughed blood?
 (insert # times, i.e. 4 is 04)

21 22

--	--

33. How many months ago was the last episode?

23 24

--	--

34. How much blood was the most ever coughed up?
 (1-less than 1 tsp, 2-1 tsp-1tbs, 3-1tbs-1cup, 4-more than a cup)

25

40. Have you ever noticed any whistling, wheezing or tightness in your chest?

26

(IF YES ASK 41-63, IF NO GO TO 70)

41. Which of these symptoms have you experienced, wheezing or tightness or both?
 (1-only wheezing or whistling, 2-only chest tightness, 3-mainly wheezing and whistling, 4-mainly chest tightness, 5-both wheezing and whistling and chest tightness)

27

42. At what age did your wheezing, whistling or chest tightness begin?

28 29

--	--

- 43. When did this wheezing, whistling or chest tightness last occur?
(1-within last 4 wks, 2-within last 12 mos, 3-more than 1 yr but less than 5 yrs ago, 4-more than 5 yrs ago) 30
- 44. How frequently have you experienced this wheezing, whistling or chest tightness?
(1-usually at least once a day or night, 2-only a few times a week, 3-only a few times a mo., 4-only a few times a year, 5-only a few times ever, 6-only once)

(IF 5 or 6 GO TO 70) 31
- 45. Does or did your wheezing, whistling or chest tightness occur with colds or sore throats? 32
- 46. Does or did your wheezing, whistling or chest tightness occur with episodes of increased phlegm in your chest? 33
- 47. Is or was your wheezing, whistling or chest tightness associated with attacks of shortness of breath? 34
- Is or was your wheezing, whistling or chest tightness brought on by or made worse by exposure to:
- 48. House dust? 35
- 49. Other dust or fumes in the house? 36
- 50. Contact with animals? 37
- 51. Plants or pollens? 38
- 52. Dusts, gases or fumes at work? 39
- 53. Tobacco Smoke? 40
- 54. Other factors? 41
- 54a. If yes to above specify _____ 42
- 55. Is or was your wheezing, whistling or chest tightness worse on any particular day or days of the week? In other words is there any difference between Friday, Monday, Sunday or Thursday?

(IF YES ASK 56 and 57, IF NO GO TO 58) 43
- 56. On which day or days is it worse?
(1-1st day back at work, 2-other days at work, 3-weekends or days off) 44
- 57. Did this worsening occur sometimes or always?
(1-sometimes, 2-always)

58. Is or was your wheezing, whistling or chest tightness better on any particular day or days of the week or weekend?

45

59. When is it better?
(1-weekday or workday, 2-weekend or day off)

46

60. Is or was your wheezing, whistling or chest tightness better, the same or worse on vacation?
(1-better, 2-same, 3-worse)

47

61. Is or was your wheezing, whistling or chest tightness worse during a particular season?

48

(IF YES ASK 62 and 63, IF NO GO TO 70)

62. Which is or was the worst season?
(1-winter, 2-spring, 3-summer, 4-fall)

49

63. Do or did these symptoms occur only during this season?

50

70. Are you disabled by any condition other than lung disease which would interfere with your walking?

51

70a. (IF YES TO ABOVE SPECIFY AND GO TO 80)

71. Are you troubled by shortness of breath when hurrying on level ground or walking up a slight hill?

52

(IF NO GO TO 80, IF YES ASK 72)

72. Do you get short of breath when walking with people of your own age on level ground?

53

(IF NO GO TO 80, IF YES ASK 73)

73. Do you get short of breath on walking $\frac{1}{4}$ mile on level ground in about 15 minutes?

54

80. During the past three years how much trouble have you had with such illnesses as chest colds, bronchitis or pneumonia?
(1-none, 2-slight, 3-some, 4-considerable, 5-great deal)

55

HAVE YOU EVER HAD:

81. Bronchial Asthma?

56

82. Bronchitis?

57

83. Pneumonia?

58

84. Pleurisy?

59

85. Pulmonary tuberculosis? 60
[]
86. A chest injury such as a fractured rib or spine? 61
[]
- 86a. (IF YES TO ABOVE SPECIFY) _____ 62
[]
87. A chest operation? []
- 87a. (IF YES TO ABOVE SPECIFY) _____ 63
[]
88. Do you now smoke cigarettes? []
- (IF NO GO TO 95)
89. Do you smoke cigarettes with or without filters?
(1-filters, 2- without filters, 3-both) 64
[]
90. Do you inhale? 65
[]
91. How old were you when you began to smoke cigarettes? 66 67
[] []
92. How many cigarettes do you usually smoke each day at the present time? 68 69
[] []
93. At what age did you start smoking this many? 70 71
[] []
94. Prior to this age how many did you smoke each day? 72 73
[] []
- (GO TO 104)
95. Did you ever smoke cigarettes? 74
[]
- (IF NO GO TO 104)
96. Did you smoke cigarettes with or without filters?
(1-with, 2-without, 3-both) 75
[]
97. Did you inhale? 76
[]
98. How old were you when you began to smoke cigarettes? 77 78
[] []
99. How old were you when you stopped smoking cigarettes regularly? 79 80
[] []

100. What was the usual number of cigarettes you smoked per day just before you stopped?

10	11

101. At what age did you start smoking this many?

12	13

102. Prior to this how many did you smoke per day?

14	15

103. Where you influenced to stop because you had a cough, wheezing or shortness of breath?

16

104. Do you now smoke pipes or cigars?

17

(IF NO GO TO 108)

105. How many pipefuls or cigars do you usually smoke each day?

18 19

106. Do you usually inhale when you smoke either pipes or cigars?

20

107. How old were you when first smoked pipes or cigars?

21 22

(GO TO 114)

108. Did you ever smoke pipes or cigars?

23

(IF NO GO TO 114)

109. How many pipefuls or cigars did you usually smoke each day?

24 25

110. Did you usually inhale when you smoked either pipes or cigars?

26

111. How old were you when you first smoked pipes or cigars?

27 28

112. How old were you when you stopped smoking pipes or cigars?

29 30

113. Were you influenced to stop because you had a cough, wheezing or shortness of breath?

31

Use the following code in answering questions 114-132: 1-No, 2-for less than three months, 3-for 4 months to 1 yr, 4-for more than 1 to 5 yrs, 5-for more than 5-10 yrs, 6-for more than 10-20 years, 7-for more than 20 years)

Have you ever worked:

114. At a coal mine?

32

115. In any other mine?

33

116. In a quarry?

34

117. In a foundry?

35

118. In a pottery?

36

119. In a cotton, flax or hemp mill?

37

120. With asbestos?

38

121. On a farm?

39

122. In any other dusty job?

40

122a. (IF YES TO 122 SPECIFY) _____

Have you had prolonged or repeated exposure to:

123. Asbestos (insulation, car undercoating, brake linings, fireproofing buildings)?

41

124. Radioactive materials (uranium, radon gas, ore)?

42

125. Arsenic (powder, insecticide, sheep dip, spray ores)?

43

126. Nickel or chromium (manufacture or refining)?

44

127. Iron and silica (hematite mine, foundry, sand blast, metal grinding)?

45

128. Petroleum products (gas retorts, distillation)?

46

129. Carbon monoxide (garage work)?

47

130. Very dusty environment?

48

131. Lead (storage battery plant, dyes rubber, paint factory, mercury industry)?

49

132. Other significant exposure?

50

132a. (IF YES TO 132 SPECIFY) _____

Have you ever had:

133. Eczema?

51

134. Dermatitis?

52

135. Pneumoconiosis?

53

136. Byssinosis?

54

137. Heart trouble?

55

140. Do you or does any member of your household keep animals or pets?

56

141. Have you any hobby that exposes you to dusts, gases or fumes, such as from paints, glues or wood dust?

57

142. Have you ever lived in a town or area other than here?

58

(IF YES ASK 143 and 144, IF NO GO TO 145)

143. At what age did you move into this town or area?

59 60

144. Where did you live previously?
(1-mainly country,2-mainly city,3-both)
145. What type of heating system is used in your home?
(1-none,2-forced air heating,3-circulating hot water or steam,4-electric radiant heating,5-other)
- 145a. (IF 5 TO ABOVE, SPECIFY) _____
146. In addition to the above do you use a fireplace in your home?
147. What fuel is used for cooking?
(1-electricity,2-gas,3-wood,4-coal)
148. Do you have a humidifier?
149. Do you have air conditioning?
150. Do you have an air cleaning device in your home?
151. What is the number of people in your household?
152. How many are smokers?
153. Has anyone in your family had:
- a. Asthma?
- b. Hayfever?
- c. Hives?
- d. Eczema?
154. Do you have any allergies?
- 154a. (IF YES TO ABOVE, SPECIFY) _____
155. Do you take any medications?
- 155a. (IF YES TO ABOVE, SPECIFY) _____
156. _____
- _____
157. _____
- _____
158. _____
- _____

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End of Historical Section