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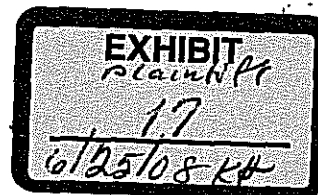
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INTERNAL MEDICINE

MOHAMMAD T. HOSSAIN, M. D.
CHARLES M. SUTTLES, M. D.

December 13, 1973



Robert W. Pringle, M. D.
Pittsburgh Diagnostic Clinic
Mellon Pavilion
4815 Liberty Avenue
Pittsburgh, Pennsylvania 15224

Dear Doctor Pringle:

Enclosed is a summary of the sixty employees of the North American Rockwell Brake Division, Ashtabula, Ohio, who underwent pulmonary function evaluation at the Ashtabula Clinic during the year of 1973. The rationale for the study is presented, the methods of investigation are discussed and limited conclusions are made.

We feel very strongly that a cursory evaluation would serve no preventative purpose in the early detection of such a protean and insidious disease as asbestos pneumoconiosis. For this reason we have recommended a more complete evaluation.

A limiting factor in this initial study pertains to the comparison of observed data with that of predicted normal values. Although worldwide recognized predicted values were utilized, the information obtained cannot be compared with that of serial individual determinations. The importance of comparing an individual with his own established values is paramount. During the ensuing year this will be accomplished and the investigation will be of far greater value to North American Rockwell Brake Division in that changes, not expected by age increase, will be detected. This we hope will result in early detection of a possibly correctable disease.

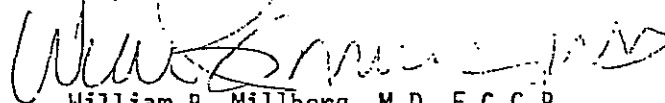
Since asbestosis is primarily an interstitial disease, we would highly recommend the addition of diffusion studies to the present program. This parameter appears to be the earliest effected in asbestos exposure and would enhance the early detection of abnormality. With the addition of

Robert W. Pringle, M. D.
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diffusion studies (single breath and if necessary, steady state carbon monoxide diffusion test) we feel that your surveillance program would be most complete and satisfy any critical investigation.

If you so agree, we would be most happy to discuss this with you at any time.

Respectfully submitted,


William B. Millberg, M.D., F.C.C.P.

WBM:bw

Enclosures

cc: Mr. Edward Gierok

REPORT TO NORTH AMERICAN ROCKWELL BRAKE DIVISION, ASHTABULA, OHIO
CONCERNING THE PULMONARY FUNCTION EVALUATION
OF THOSE EMPLOYEES EXPOSED TO ASBESTOS

The purpose of this study was to detect any clinical, radiological, or physiological effects of asbestos exposure upon the work force of North American Rockwell Brake Division, Ashtabula, Ohio. The basic parameters of this study comply with the recommendations of the National Institute for Occupational Safety and Health of the United States Department of Health, Education and Welfare for the occupational exposure to asbestos. Although the basic recommended criteria were followed, the present evaluation was expanded and investigated in far greater detail.

Each individual was evaluated from three diagnostic approaches which consisted of clinical evaluation, radiological examination and physiological pulmonary function testing. To maintain consistency throughout the study and eliminate individual variations, only one technician was involved in the actual performance of the pulmonary function testing and interpretation of the physiological data was accomplished by one physician. All radiological examinations were taken by two technicians. To eliminate problems of radiological film processing, films were automatically processed by a Kodak RP X-omat Processor. All films were interpreted by one physician. The qualifications of the physician interpreting the radiological, physiological, and clinical data include Diplomate of the Board of Thoracic Surgery, Fellowship in the American College of Chest Physicians and membership in the American Thoracic Society.

CLINICAL EVALUATION

Clinical evaluation consisted of a review of the individuals past medical history, a systemic review, a review of industrial exposures, and an appraisal of smoking habits. Emphasis was placed on cardiopulmonary problems in the past or present respiratory symptoms. "The Questionnaire on Respiratory Symptoms", approved by the British Medical Research Councils Committee on research into chronic bronchitis and considered the world wide standard was basically followed.

A physical examination was then conducted with special emphasis placed on the cardio-respiratory symptoms. Two specific parameters were thoroughly evaluated and consisted of evaluation of pulmonary basilar rales and digital clubbing.

RADIOLOGICAL EVALUATION

Radiological evaluation consisted of three separate 14 x 17 teleoroentgenograms. A PA teleoroentgenogram taken in maximal inspiration, a PA teleoroentgenogram taken in maximal expiration and a left lateral teleoroentgenogram taken in maximal inspiration were performed on each individual. High quality DuPont Cronex 4 film was used throughout and films were automatically processed utilizing the Kodak RP X-omat Processor. The three views were selected since an early manifestation of asbestosis is limitation of costal and diaphragmatic excursion. The three views also manifest far better correlation with pulmonary function testing.

PHYSIOLOGICAL PULMONARY FUNCTION EVALUATION

Physiological pulmonary function evaluation consisted of determination of total lung capacity and the subdivisions. Forced, timed, inspiratory and expiratory volumes were performed. Maximal voluntary ventilation and oxygen consumption were evaluated.

All studies were performed on a Godart Pulmonet, type 59004, to which was attached a Cardiopulmonary Instruments Corporation Flow-volume digitizer, Model 541 and a C.P.I. Norm Calculator, Model 550.

Total lung capacity was determined by the Godart spirometer gas analyzer. The spirometer is a water sealed spirometer with a capacity of nine liters. The brass spirometer bell is lightweight (0.1 mm. thickness) and balanced so that the subject breathes at an absolute zero pressure point. A constant flow of homogeneous gas mixture is provided within the circuit. A two speed recording Kymograph, operating at 60 and 1200 mm. per minute, provides a permanent record. Digital display of volume and flow is provided by the flow volume digitizer.

The functional residual capacity was determined by the closed system helium determination technique utilizing a thermo conductivity gas analyzer for helium.

Forced inspiration and expiration volumes were determined both graphically and by digital display on the flow volume digitizer.

Maximal voluntary ventilation was determined both graphically and by digital display, using the flow volume flow volume digitizer and the spirometer.

All parameters of the physiological evaluation were repeated at least three times and the best observed value was recorded. Each individual was assumed free of recent upper respiratory tract infection and if such existed, the test was postponed. The timed spirographic tracing was evaluated and all observed data was compared with predicted values. The predicted values used were those of the V. A. Cooperative study, the Oregon Thoracic study, DuBois Body Surface chart and the normal values for pulmonary function testing of Bates and Christie and the predicted maximal breathing capacity of Baldwin et al.

Guidelines for the interpretation of the physiological data were fundamentally expressed as follows:

Vital capacity

80 - 90%	Slight reduction
60 - 80%	Moderate reduction
40 - 60%	Marked reduction
Less than 40%	Very marked reduction

Increase In Residual Volume

125 - 175%	Moderate increase
175 - 250%	Marked increase
Above 250%	Very marked increase

Decrease In Residual Volume

60 - 80% of predicted	Moderate decrease
40 - 60% of predicted	Marked decrease
Below 40% of predicted	Very marked decrease

Ratio of Residual Air To Total Lung Capacity

35 - 50	Moderate degree of emphysema
Above 50	Severe degree of emphysema
Above 65	Very severe degree of emphysema

Maximal Voluntary Ventilation

80 - 95%	Slight decrease
60 - 80%	Moderate decrease
40 - 60%	Marked decrease
Less than 40%	Very marked decrease

Impairment Of Pulmonary Mixing

2 - 2 1/2 minutes	Slight decrease
2 1/2 - 3 minutes	Moderate decrease
3 - 4 1/2 minutes	Severe decrease
4 1/2 minutes or more	Very severe decrease

		<u>NORMAL</u>
FEV/FEV	0.5 sec.	50 - 55%
FEV/FEV	1 sec.	80 - 85%
FEV/FEV	3 sec.	97 - 100%

DISCUSSION

Asbestos is a generic term applied to the naturally occurring hydrated mineral silicates incombustible in air and separable into filaments. The particulate matter in asbestos dust is composed of broken fibers of crystalline magnesium silicate containing traces of iron, nickel, calcium and aluminum. The workers of North American Rockwell Brake Division are exposed to chrysotile, a fibrous form of serpentine. The extent of this exposure is unknown to this examiner, but has been measured and is apparently extremely low and effectively controlled.

Pulmonary asbestosis is an occupational disease which can effect any person working in a factory or industry dealing with asbestos or its products, or living in the vicinity of such an establishment. The development of asbestosis depends upon the degree of exposure and the duration of exposure. The asbestos fibers apparently cause mechanical irritation in the terminal and respiratory bronchioles initially surrounded by a gelatinous precipitated protein and resulting in both parenchymal and pleural fibrosis. Far advanced pulmonary asbestosis results in profound cardio-respiratory insufficiency, disability and failure. An increased incidence of bronchogenic and gastrointestinal carcinoma appears present. An increased incidence of pleural mesothelioma is also noted. There appears to be a synergistic effect between cigaret smoking and exposure to asbestos, with an increased incidence of neoplasia resulting.

The most common symptom is dyspnea and clinical evaluation suggests pulmonary insufficiency with basilar pulmonary rales, distant breath sounds, and limitation of respiratory excursion with finger clubbing.

The roentgenographic appearance of asbestosis is that of interstitial fibrosis and pleural thickening. An early sign is limitation of costal and diaphragmatic excursion. The pulmonary function derangement is that of restrictive disease with a decrease in vital capacity and residual volume. The most sensitive index appears to be the diffusing capacity of the lung and this parameter is the earliest affected. Correlation between x-ray and pulmonary function studies is poor. The x-ray may be abnormal and the pulmonary function study normal. The converse is also true.

A definite diagnosis of asbestosis cannot be established in any of the cases reviewed, as this would necessitate histological confirmation. The most prevalent finding was that of chronic bronchitis, which can be attributed to the general environment and the smoking habits of the employees. Since there appears to be a synergistic carcinogenic effect between asbestos exposure and cigaret smoking, an effect should be extended to encourage the workers to cease the practice of cigaret smoking.

As can be determined from the tables, incidental disease was encountered, which included hypertension, hepatomegaly, inguinal hernia, pulmonary granuloma (proven), and cervical and prescalene lymphadenopathy. Findings suggestive of pulmonary asbestosis were not encountered in any individual studied.

NEW RECOMMENDATIONS

After thorough review of this study, the following recommendations are suggested to North American Rockwell Brake Division in Ashtabula, Ohio.

1. An educational campaign be instituted to decrease the incidence of cigaret smoking.
2. Encourage the use of respirators in those exposed to asbestos.
3. Reevaluate each individual on a yearly basis. More meaningful information would be obtained by comparing the individual with his own baseline values than by comparison with predicted normal values. Early detection of abnormality would result and correction could be made.
4. Each parameter of the medical evaluation program is considered important if the goal of early detection of abnormality is paramount. Detection of far advanced lung disease at an uncontrollable stage would serve no useful preventative purpose. Because of this, a comprehensive, rather than a cursory evaluation was utilized.

Clinical evaluation through correlation of the past medical history, industrial exposure and physiological examination aid in the detection of not only chronic lung disease, but other coexisting abnormalities. Radiological evaluation correlated with the clinical picture increases the accuracy of detection of early disease and the three separate roentgenographic studies are considered paramount to this approach. Physiological pulmonary function testing correlated with both the clinical and radiological pictures again enhances the accuracy of early detection of abnormality. The parameters of this physiological testing were selected as those being most affected by early abnormality. In addition to the basic parameters now being evaluated, it is strongly recommended that pulmonary diffusion studies be included.

This is being recommended since abnormality in diffusion appears to be the earliest function to be affected by asbestos pneumoconiosis. Since chronic lung disease is such a prevalent abnormality throughout the United States with its end stage resulting in crippling disability, which for the most part is irreversible, detection and reversal of the early stage is a most significant preventative measure. It is felt that this recommended approach will satisfy the requirements and will offer an exceptional medical surveillance program to the employees of North American Rockwell Brake Division of Ashtabula, Ohio.

NORTH AMERICAN ROCKWELL - PULMONARY FUNCTION

1973

X-RAY NO.	AGE	SEX	X-RAY NO.	AGE	SEX
1. 7770	27	M	31. 7644	29	M
2. 7545	26	M	32. 7700	35	M
3. 7753	26	M	33. 7716	49	M
4. 3218	29	M	34. 7512	49	M
5. 7576	30	M	35. 7566	52	M
6. 7603	22	M	36. 7720	42	M
7. 7672	26	M	37. 7775	32	M
8. 8124	23	M	38. 5523	31	M
9. 7577	25	M	39. 7495	20	M
10. 7487	29	M	40. 7426	49	M
11. 7587	21	M	41. 7778	43	M
12. 7636	35	M	42. 7599	38	M
13. 7579	33	M	43. 7626	42	M
14. 928	30	M	44. 7642	20	M
15. 7447	39	M	45. 7698	28	M
16. 8508	30	M	46. 7633	45	M
17. 7568	29	M	47. 7561	28	M
18. 7616	39	M	48. 7779	37	M
19. 7504	30	M	49. 7996	30	M
20. 7635	44	M	50. 7554	38	M
21. 307	41	M	51. 5371	43	M
22. 7481	50	M	52. 7513	33	M
23. 7168	29	M	53. 7655	32	M
24. 7743	33	M	54. 7480	55	M
25. 7970	42	M	55. 7476	33	M
26. 1764	57	M	56. 4411	41	M
27. 7617	35	M	57. 7556	27	M
28. 7050	27	M	58. 7622	42	M
29. 8290	25	M	59. 7503	54	M
30. 7560	30	M	60. 2127	32	M

TYPE OF WORKLENGTH OF EXPERIENCE

1. Machine operator - riveter	3 years
2. Machine operator	20 months
3. Assembly	2 years
4. Assembly	7 1/2 years
5. Machine operator	1 1/2 years
6. Riveter	1 1/2 years
7. Grinder	6 years
8. Grinder	1 1/2 years
9. Grinder	4 years
10. Machine operator	?
11. Riveter	1 1/2 years
12. Paint line	5 years
13. Machine operator	11 years
14. Grinder	7 1/2 years
15. Grinder	6 weeks
16. Riveter	1 1/2 years
17. Grinder	9 years
18. Riveter	9 years
19. ?	?
20. Assembly	10 years
21. Assembly	6 years
22. ?	?
23. Grinder	6 1/2 years
24. Grinder	7 1/2 years
25. Machine operator	4 years
26. Assembly	8 1/2 years
27. Assembly	10 years
28. Riveter	1 year
29. Riveter	1 year 8 months
30. Paint line - grinder	7 1/2 years
31. Assembly	1 1/2 years
32. Riveter	7 1/2 years
33. Machine operator	11 years
34. ?	?
35. Riveter	7 years
36. Assembly	1 1/2 years
37. Riveter	2 months
38. Riveter	6 1/2 years
39. ?	?
40. ?	?
41. Shift supertendent	25 years
42. Paint line	10 years
43. Machine operator	6 years
44. Machine operator	2 years
45. Grinder	3 months

<u>TYPE OF WORK</u>	<u>LENGTH OF EXPERIENCE</u>
46. Milling machine - grinder	25 years
47. Grinder	6 years
48. Machine operator - grinder	8 years
49. Riveter	2 years
50. Machine operator	10 years
51. Lift operator	6 1/2 years
52. ?	?
53. Grinder	1 month
54. ?	?
55. ?	?
56. Machine operator	3 years
57. Grinder	8 years
58. Foreman	7 1/2 years
59. ?	?
60. ?	?

RESPIRATORCIGARETTE SMOKER

1. No	No
2. No	Yes 1/day
3. No	Yes 1/day 7 years
4. No	Yes 1/day 15 years
5. No	No
6. No	No
7. No	Yes 2/day 13 years
8. Yes	No
9. No	No
10. No	No
11. Yes	No Pipe
12. No	No Pipe
13. No	No
14. Yes	Yes 2/day 12 years
15. Yes	Yes 1 1/2 day 20 years
16. No	Yes 1 1/2-2/day 15 years
17. ?	?
18. No	No Cigar
19. No	No
20. No	Yes 1/day
21. Yes	No
22. No	Yes 2/day
23. No	Yes 1/2/day 10 years
24. No	Yes 1/day 15 years
25. No	Yes 1/day 30 years
26. No	Yes 1 1/2/day 40 years
27. No	No Cigar
28. No	Yes 1-2/day 7 years
29. No	Yes 1/day 10 years
30. No	Yes (quit 1 year ago)

RESPIRATOR

31. No
32. No
33. No
34. ?
35. Yes
36. No
37. Yes
38. No
39. No
40. ?
41. No
42. No
43. No
44. No
45. Yes
46. No
47. Yes
48. No
49. Yes
50. No
51. No
52. No
53. Yes
54. No
55. No
56. No
57. No
58. No
59. No
60. No

CIGARETTE SMOKER

No
Yes 1 1/2 day 20 years
Yes 1/day 25-30 years
Yes 1/day
Non smoker
Yes 1/day 22 years
Yes 1/day
?
Yes 1-1 1/2/day
?
No
No
Yes 1/2/day
No
No (quit)
No
Yes 1/day
Yes 1 1/2/day 20 years
No
Yes 1-2/day
Yes 1/day
No
Yes 2/day 20 years
Yes 1-1 1/2/day
?
No (quit 3 years ago)
Yes 1/day
Cigar
Yes 1 1/2/day
?

PAST MEDICAL HISTORY

SYSTEMIC REVIEW

- | | | |
|-----|----------------------------------|--------------------------|
| 1. | Negative | Negative |
| 2. | Negative | Negative |
| 3. | Allergy | Negative |
| 4. | Negative | Negative |
| 5. | Pneumonia, age 16 | Negative |
| 6. | Negative | Negative |
| 7. | Negative | Productive cough |
| 8. | Negative | Negative |
| 9. | Negative | Negative |
| 10. | Negative | Negative |
| 11. | Negative | Negative |
| 12. | Pneumonia, age 27 | Negative |
| 13. | Negative | Negative |
| 14. | Mild asthma | Negative |
| 15. | Negative | Negative |
| 16. | Negative | Negative |
| 17. | Pneumonia, child | Negative |
| 18. | Negative | Negative |
| 19. | Negative | Negative |
| 20. | Hiatal hernia, gall bladder | Negative |
| 21. | Pneumonia, age 33 | Chest pain |
| 22. | Negative | Chronic productive cough |
| 23. | Negative | Negative |
| 24. | Negative | Negative |
| 25. | Negative | Chronic cough |
| 26. | Pleural effusion, 40 years ago | Negative |
| 27. | Pneumonia, age 12 | Negative |
| 28. | Negative | Negative |
| 29. | Negative | Mild cough |
| 30. | Negative | Negative |
| 31. | Negative | Negative |
| 32. | Negative | Negative |
| 33. | Pleurisy, age 29 | Negative |
| 34. | Negative | Negative |
| 35. | Negative | Minimal cough |
| 36. | Negative | Negative |
| 37. | Negative | Negative |
| 38. | Spontaneous pneumothorax, age 27 | Negative |
| 39. | Negative | Negative |
| 40. | Negative | Negative |
| 41. | Pneumonia, child | Negative |
| 42. | Negative | Negative |
| 43. | Negative | Negative |
| 44. | Allergic asthma | Negative |
| 45. | Carcinoma, testes | Negative |

PAST MEDICAL HISTORY

46. Negative
47. Negative
48. Pneumonia, child
49. Negative
50. Negative
51. No chest disease
52. Negative
53. Negative
54. Negative
55. Negative
56. Negative
57. Negative
58. Negative
59. Negative
60. Negative

SYSTEMIC REVIEW

Negative
Negative
Negative
Negative
Negative
Negative
Negative
Negative
Cough, dyspnea
Negative
Negative
Negative
Negative
Negative
Negative

PHYSICAL EXAMINATION

- | | |
|--|-----------------------------------|
| 1. Normal | 31. Normal |
| 2. Normal | 32. Chronic otitis media |
| 3. Normal | 33. Normal, chest scar |
| 4. Normal | 34. Normal |
| 5. Normal | 35. Left prescalene nodes |
| 6. Normal | 36. Normal |
| 7. Normal | 37. Normal |
| 8. Inguinal hernia, right | 38. Normal |
| 9. Normal | 39. Normal |
| 10. Normal | 40. Normal |
| 11. Normal | 41. Normal |
| 12. Normal | 42. Normal |
| 13. Normal | 43. Normal |
| 14. Normal | 44. Normal |
| 15. Normal | 45. Absent right testes, old scar |
| 16. Normal | 46. Normal |
| 17. Normal | 47. Normal, left inguinal hernia |
| 18. Normal | 48. Normal, cough |
| 19. Normal | 49. Normal |
| 20. Normal | 50. Normal |
| 21. Normal | 51. Normal |
| 22. Normal | 52. Normal |
| 23. Normal | 53. Normal |
| 24. Normal | 54. Normal |
| 25. Normal | 55. Normal |
| 26. Normal, with questionable liver and increased blood pressure | 56. Normal |
| 27. Normal | 57. Normal |
| 28. Normal | 58. Undescended left testes |
| 29. Normal, cough | 59. Occasional extrasystoles |
| 30. Normal | 60. Normal |

CHEST X-RAY

- | | |
|---|---------------------------------------|
| 1. Normal | 31. Normal |
| 2. Residuals of remote disease,
no active disease. | 32. Minimal fibrosis |
| 3. Normal | 33. Pulmonary fibrosis |
| 4. Basilar fibrosis | 34. Normal |
| 5. Normal | 35. Questionable hilar mass, fibrosis |
| 6. Normal | 36. Minimal fibrosis |
| 7. Normal | 37. Normal |
| 8. Minimal bronchitis | 38. Normal |
| 9. Normal | 39. Normal |
| 10. Normal | 40. Minimal fibrosis |
| 11. Normal | 41. Normal |
| 12. Normal | 42. Normal |
| 13. Normal | 43. Normal |
| 14. Minimal bronchitis | 44. Normal |
| 15. Normal | 45. Normal |
| 16. Normal, bifid rib | 46. Wide retrosternal air space |
| 17. Normal | 47. Normal |
| 18. Normal | 48. Normal |
| 19. Minimal pulmonary fibrosis | 49. Normal |
| 20. Normal | 50. Normal |
| 21. Chronic bronchitis, minimal
fibrosis. | 51. Normal |
| 22. Normal | 52. Normal |
| 23. Normal | 53. Chronic bronchitis |
| 24. Residuals of remote disease | 54. Solitary node (proven granuloma) |
| 25. Normal | 55. Normal |
| 26. Pulmonary fibrosis, minimal | 56. Normal |
| 27. Normal | 57. Normal |
| 28. Normal | 58. Normal |
| 29. Normal | 59. Widened retrosternal air space |
| 30. Normal | 60. Normal |

PULMONARY FUNCTION

<u>TOTAL LUNG CAPACITY</u>	<u>VITAL CAPACITY</u>	<u>RESIDUAL VOLUME</u>
1. Normal	Normal	Normal
2. Normal	Normal	Normal
3. Normal	Normal	Moderate increase
4. Normal	Slight decrease	Normal
5. Normal	Normal	Normal
6. Normal	Normal	Normal
7. Normal	Normal	Normal
8. Normal	Slight decrease	Normal
9. Normal	Slight decrease	Normal
10. Normal	Slight decrease	Normal
11. Slight decrease	Moderate decrease	Moderate decrease
12. Normal	Normal	Moderate increase
13. Normal	Slight decrease	Normal
14. Normal	Normal	Normal
15. Normal	Normal	Slight increase
16. Normal	Normal	Slight decrease
17. Normal	Normal	Normal
18. Normal	Normal	Normal
19. Normal	Normal	Normal
20. Slight decrease	Moderate decrease	Normal
21. Normal	Normal	Moderate Increase
22. Slight decrease	Slight decrease	Normal
23. Normal	Normal	Slight decrease
24. Normal	Normal	Slight increase
25. Normal	Normal	Normal
26. Slight decrease	Slight decrease	Normal
27. Normal	Normal	Slight decrease
28. Normal	Normal	Normal
29. Slight decrease	Slight decrease	Moderate decrease
30. Normal	Normal	Normal
31. Slight decrease	Slight decrease	Slight decrease
32. Normal	Normal	Normal
33. Moderate decrease	Moderate decrease	Moderate decrease
34. Normal	Normal	Normal
35. Normal	Normal	Normal
36. Normal	Normal	Normal
37. Normal	Normal	Normal
38. Normal	Normal	Slight decrease
39. Slight decrease	Slight decrease	Slight decrease
40. Slight decrease	Moderate decrease	Normal
41. Normal	Normal	Slight decrease
42. Normal	Normal	Normal
43. Normal	Normal	Normal
44. Normal	Normal	Normal
45. Normal	Normal	Slight increase

PULMONARY FUNCTION

TOTAL LUNG CAPACITY

VITAL CAPACITY

RESIDUAL VOLUME

46. Normal	Normal	Normal
47. Normal	Normal	Slight increase
48. Normal	Normal	Normal
49. Normal	Normal	Normal
50. Normal	Slight decrease	Normal
51. Normal	Slight decrease	Moderate increase
52. Normal	Normal	Normal
53. Normal	Normal	Moderate increase
54. Normal	Normal	Moderate increase
55. Normal	Normal	Normal
56. Normal	Normal	Slight increase
57. Normal	Normal	Normal
58. Normal	Normal	Slight decrease
59. Normal	Moderate decrease	Slight increase
60. Normal	Normal	Normal

MAXIMAL VOLUNTARY VENTILATION

ROCK 0006716

FORCED EXPIRATORY VOLUME

41. Normal
42. Normal
43. Normal
44. Normal
45. Normal
46. Normal
47. Normal
48. Slight decrease
49. Normal
50. Normal
51. Slight decrease
52. Normal
53. Normal
54. Normal
55. Normal
56. Normal
57. Normal
58. Normal
59. Normal
60. Normal

MAXIMAL VOLUNTARY VENTILATION

Normal
Slight decrease
Slight decrease
Moderate decrease
Moderate decrease
Normal
Normal
Slight decrease
Normal
Slight decrease
Slight decrease
Normal
Slight decrease
Normal
Slight decrease
Normal
Normal
Normal
Slight decrease

CONCLUSION OF STUDY

- | | |
|---|--|
| 1. Normal | 41. Slight bronchitis |
| 2. Normal | 42. Normal |
| 3. Minimal degree of obstruction
Bronchial disease | 43. Minimal chronic bronchitis |
| 4. Minimal chronic bronchitis | 44. Slight obstructive disease |
| 5. Normal | 45. Normal. History of cancer, testes |
| 6. Normal | 46. Normal |
| 7. Normal | 47. Normal |
| 8. Normal. Inguinal hernia | 48. Chronic bronchitis. |
| 9. Normal | 49. Normal |
| 10. Normal | 50. Normal |
| 11. Slight bronchitis | 51. Bronchitis |
| 12. Minimal bronchitis | 52. Normal |
| 13. Normal | 53. Chronic bronchitis. Questionable
early emphysema. |
| 14. Minimal chronic bronchitis | 54. Early emphysema. Granuloma |
| 15. Normal | 55. Normal |
| 16. Normal | 56. Normal |
| 17. Normal | 57. Normal |
| 18. Normal | 58. Normal |
| 19. Normal | 59. Early emphysema |
| 20. Moderate restrictive disease | 60. Normal |
| 21. Normal. Slight increase of
respiratory volume | |
| 22. Minimal bronchitis | |
| 23. Normal | |
| 24. Minimal chronic bronchitis | |
| 25. Normal | |
| 26. Slight restrictive disease,
bronchitis | |
| 27. Normal | |
| 28. Normal | |
| 29. Chronic bronchitis | |
| 30. Normal | |
| 31. Normal | |
| 32. Normal | |
| 33. Slight restrictive disease,
old trauma | |
| 34. Normal | |
| 35. Abnormal physical and x-ray exam. | |
| 36. Normal | |
| 37. Normal | |
| 38. Normal | |
| 39. Chronic bronchitis | |
| 40. Minimal destructive disease | |

NORTH AMERICAN ROCKWELL - PULMONARY FUNCTION

1973

X-RAY NO.	AGE	SEX	X-RAY NO.	AGE	SEX
1. 7770	27	M M. Agnaro	31. 7644	29	M a. Metlicka
2. 7545	26	M B. Oll	32. 7700	35	M H. Miller
3. 7753	26	M B. Beckman	33. 7716	49	M W. Mann
4. 3218	29	M R. Bivens	34. 7512	49	M
5. 7576	30	M m. Blakely	35. 7566	52	M R. Pearson
6. 7603	22	M C. Brown	36. 7720	42	M C. Perry
7. 7672	26	M R. Chernick	37. 7775	32	M O. Peterson
8. 8124	23	M J. Coleman	38. 5523	31	M
9. 7577	25	M m. Cooper	39. 7495	20	M
10. 7487	29	M	40. 7426	49	M E. Rotzki
11. 7587	21	M n. De Bont	41. 7778	43	M m. Roe
12. 7636	35	M B. Dell	42. 7599	38	M
13. 7579	33	M D. Detric	43. 7626	42	M R. Schmitt
14. 928	30	M H. Eaton	44. 7642	20	M J. Sietmon
15. 7447	39	M R. Enders	45. 7698	28	M J. Simon
16. 8508	30	M L. Givinsky	46. 7633	45	M d. Smith
17. 7568	29	M D. Givinsky	47. 7561	28	M D. Smith
18. 7616	39	M J. Guiney	48. 7779	37	M R. Smith
19. 7504	30	M	49. 7996	30	M R. Snyder
20. 7635	44	M a. Hastings	50. 7554	38	M C. Steifenswald
21. 307	41	M J. Holm	51. 5371	43	M J. Steiner
22. 7481	50	M	52. 7513	33	M
23. 7168	29	M	53. 7655	32	M W. Seltzer
24. 7743	33	M H. Kolt	54. 7480	55	M a. Swales
25. 7970	42	M J. Kurkowski	55. 7476	33	M
26. 1764	57	M P. Lestrada	56. 4411	41	M C. Wilson
27. 7617	35	M H. Leach	57. 7556	27	M D. Wintz
28. 7050	27	M W. McClimans	58. 7622	42	M R. Wright
29. 8290	25	M	59. 7503	54	M
30. 7560	30	M D. Mitchell	60. 2127	32	M