

## ***Chapter 2***

### **Introduction to the Medical Evidence**

#### **I. Generally**

Benefits are awarded to miners or their survivors if the miner is totally disabled due to coal workers' pneumoconiosis or died due to pneumoconiosis. Thus, entitlement to benefits under any of the regulatory schemes requires that, in a living miner's claim, the following four elements must be established by either operation of presumption or a preponderance of the evidence, as appropriate: (1) the miner suffers from pneumoconiosis; (2) the pneumoconiosis arose out of coal mine employment; (3) the miner is totally disabled; and (4) his or her total disability is due to pneumoconiosis. A survivor's claim requires the claimant to demonstrate that: (1) the miner suffered from pneumoconiosis; (2) his pneumoconiosis arose out of coal mine employment; and (3) coal workers' pneumoconiosis caused, or contributed to, his death.

This Chapter is devoted to presenting a general understanding of the medical evidence submitted in black lung claims, including an explanation of the chest roentgenogram reports on the ILO form, pulmonary function (ventilatory) studies, and blood gas studies. An administrative law judge may draw reasonable inferences from the evidence presented, but is not empowered to substitute his or her judgment for that of the medical expert. For a discussion of principles of weighing medical evidence, see Chapter 3.

For a discussion of the evidentiary limitations under the amended regulations, see Chapter 4.

#### **II. The chest roentgenogram or x-ray**

##### **A. Generally**

A chest x-ray may indicate the presence or absence of pneumoconiosis as well as its etiology. The minimum interpretation that qualifies as positive for presence of pneumoconiosis under 20 C.F.R. § 718.102(b) (2008) is Category 1/0.

Chest x-ray evidence is not utilized to determine whether the miner is totally disabled, unless complicated pneumoconiosis is indicated. Complicated pneumoconiosis means that the miner has at least one opacity in his/her lungs that is categorized as an A, B, or C mass on the ILO form, which means that

the mass is greater than one centimeter in diameter. In such cases, the regulatory provisions at 20 C.F.R. § 718.304 (2008) provide an irrebuttable presumption of total disability and/or death due to pneumoconiosis. For further discussion of complicated pneumoconiosis, see Chapter 11.

If a chest x-ray is positive for the existence of pneumoconiosis, then the x-ray report should indicate the size, type, and quantity of opacities in the lungs. The larger and/or more plentiful opacities indicate that the disease is at a more advanced stage. Most x-ray reports used in black lung litigation will be recorded on the official ILO-U/CC classification form, also known as a Form CM-933. The following discussion refers to box numbers on the Department of Labor's standardized x-ray report form.<sup>1</sup>

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<sup>1</sup> Sometimes, an x-ray report will be in narrative form (such as for treatment and hospitalization records), or embedded in a medical report. The fact that the x-ray interpretation is not on the official ILO form does not mean that it is excluded from consideration, but it should be given weight according to its compliance with the quality standards for x-rays.

## U.S. Department of Labor

Employment Standards Administration  
Office of Workers' Compensation Programs  
Division of Coal Mine Workers' Compensation



**NOTE:** This report is authorized by law (30 U.S.C., 901 et. seq.) and required to obtain a benefit. The results of this interpretation will aid in determining the miner's eligibility for black lung benefits. Disclosure of a social security number is voluntary. The failure to disclose such number will not result in the denial of any right, benefit, or privilege to which the claimant may be entitled. This method of collecting information complies with the Freedom of information Act, the Privacy Act of 1974, and OMB Cir. No. 108.

OMB No. 1215-0090  
Expires: 07-31-2008

Please record your interpretation of a single film by placing "X" in the appropriate boxes on the form and return it promptly to the office that requested the interpretation. The form must be completed as per instructions, signed by a physician, and contain the miner's name, and social security number. The Department of Labor will pay only for films of acceptable quality (1, 2 and 3). Films of inferior quality (U/R) must be retaken without cost to the Department.

1. Miner's Name (Print)		1A. Date of X-ray <table border="1" style="display: inline-table; width: 100px; height: 20px;"> <tr><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>Mo.</td><td>DAY</td><td>YR.</td><td></td><td></td></tr> </table>							Mo.	DAY	YR.			11B. Miner's Social Security Number <table border="1" style="display: inline-table; width: 150px; height: 20px;"> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>												1C. Film Quality (If not Grade 1, Give Reason): <table border="1" style="display: inline-table; width: 100px; height: 20px;"> <tr><td>1</td><td>2</td><td>3</td><td>U/R</td></tr> </table>		1	2	3	U/R											
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1D. Is Film Completely Negative? YES <input type="checkbox"/> Proceed to Section 5      NO <input type="checkbox"/> Complete Section 2A				2A. Any Parenchymal Abnormalities Consistent with Pneumoconiosis? YES <input type="checkbox"/> Complete 2B and 2C      NO <input type="checkbox"/> Proceed to Section 3																																						
2B. SMALL OPACITIES <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>a. SHAPE/SIZE</p> <table border="1" style="display: inline-table; width: 100px; height: 100px;"> <tr><td>P</td><td>S</td></tr> <tr><td>q</td><td>t</td></tr> <tr><td>r</td><td>u</td></tr> </table> <p>SECONDARY</p> <table border="1" style="display: inline-table; width: 100px; height: 100px;"> <tr><td>P</td><td>S</td></tr> <tr><td>q</td><td>t</td></tr> <tr><td>r</td><td>u</td></tr> </table> <p>b. ZONES</p> <table border="1" style="display: inline-table; width: 100px; height: 100px;"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </table> <p>R L</p> </div> <div style="width: 45%;"> <p>c. PROFUSION</p> <table border="1" style="display: inline-table; width: 100px; height: 100px;"> <tr><td>0/</td><td>0/0</td><td>0/1</td></tr> <tr><td>1/0</td><td>1/1</td><td>1/2</td></tr> <tr><td>2/1</td><td>2/2</td><td>2/3</td></tr> <tr><td>3/2</td><td>3/3</td><td>3/+</td></tr> </table> </div> </div>				P	S	q	t	r	u	P	S	q	t	r	u							0/	0/0	0/1	1/0	1/1	1/2	2/1	2/2	2/3	3/2	3/3	3/+	2C. LARGE OPACITIES <div style="display: flex; justify-content: space-between; align-items: center;"> <div>SIZE</div> <table border="1" style="display: inline-table; width: 100px; height: 20px;"> <tr><td></td><td></td><td></td><td></td><td></td></tr> </table> <div>Proceed to Section 3</div> </div>								
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3A. ANY PLEURAL ABNORMALITIES CONSISTENT WITH PNEUMOCONIOSIS? YES <input type="checkbox"/> Complete 3B, 3C and 3D      NO <input type="checkbox"/> Proceed to Section 4																																										
3B. PLEURAL THICKENING a. Diaphragm (plaque) SITE <table border="1" style="display: inline-table; width: 100px; height: 20px;"> <tr><td>O</td><td>R</td><td>L</td></tr> </table>		O	R	L	a. CIRCUMSCRIBED (plaque) SITE In Profile <table border="1" style="display: inline-table; width: 100px; height: 20px;"> <tr><td>O</td><td>A</td><td>B</td><td>C</td></tr> </table> i. Width <table border="1" style="display: inline-table; width: 100px; height: 20px;"> <tr><td>0</td><td>1</td><td>2</td><td>3</td></tr> </table> ii. Extent Face On <table border="1" style="display: inline-table; width: 100px; height: 20px;"> <tr><td>0</td><td>1</td><td>2</td><td>3</td></tr> </table> iii. Extent <table border="1" style="display: inline-table; width: 100px; height: 20px;"> <tr><td>0</td><td>1</td><td>2</td><td>3</td></tr> </table>		O	A	B	C	0	1	2	3	0	1	2	3	0	1	2	3	3C. PLEURAL THICKENING ... Chest Wall b. Diffuse SITE In Profile <table border="1" style="display: inline-table; width: 100px; height: 20px;"> <tr><td>O</td><td>A</td><td>B</td><td>C</td></tr> </table> i. Width <table border="1" style="display: inline-table; width: 100px; height: 20px;"> <tr><td>0</td><td>1</td><td>2</td><td>3</td></tr> </table> ii. Extent Face On <table border="1" style="display: inline-table; width: 100px; height: 20px;"> <tr><td>0</td><td>1</td><td>2</td><td>3</td></tr> </table> iii. Extent <table border="1" style="display: inline-table; width: 100px; height: 20px;"> <tr><td>0</td><td>1</td><td>2</td><td>3</td></tr> </table>		O	A	B	C	0	1	2	3	0	1	2	3	0	1	2	3		
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4A. ANY OTHER ABNORMALITIES? YES <input type="checkbox"/> Complete 4B and 4C      NO <input type="checkbox"/> Proceed to Section 5																																										
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4C. OTHER COMMENTS _____																																										
SHOULD WORKER SEE PERSONAL PHYSICIAN BECAUSE OF COMMENTS IN SECTION 4C? YES <input type="checkbox"/> NO <input type="checkbox"/> Proceed to Section 5																																										
5A. FACILITY PROVIDING ROENTGENOGRAPHIC EXAMINATION: _____ DOL Medical Provider Number (if applicable): _____ Was film taken by a registered radiographer/radiographic technologist? <input type="checkbox"/> Yes <input type="checkbox"/> No _____ State _____ Name _____ Registration No. _____																																										
5B. Physician Interpreting Film (Print Name): _____ Are you: Board-certified Radiologist? <input type="checkbox"/> Yes <input type="checkbox"/> No. Board-eligible radiologist? <input type="checkbox"/> Yes <input type="checkbox"/> No. B-reader? <input type="checkbox"/> Yes <input type="checkbox"/> No.																																										
5C. I certify that this film has been interpreted in accordance with the instructions provided on Form CM-954a and/or 20 CFR 718, Subpart B, 718.102 and Appendix A. I also certify that the information furnished is correct and am aware that my signature attests to the accuracy of the results reported. I am aware that any person who willfully makes any false or misleading statements or representation in support of an application for benefits under Title 30 USC 941 shall be guilty of a misdemeanor and subject to a fine of up to \$1,000, or to imprisonment for up to one year, or both.																																										
<div style="display: flex; justify-content: space-between;"> <div>PHYSICIAN'S SIGNATURE _____</div> <div>DATE OF READING _____ (Mo., Day, Yr.)</div> </div>																																										

## Public Burden Statement

We estimate that it will take an average of 5 minutes to complete this information collection, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the information. If you have any comments regarding these estimates or any other aspect of this survey, including suggestions for reducing this burden, send them to the Division of Coal Mine Workers' Compensation, U.S. Department of Labor, Room N-3464, 200 Constitution Avenue, N.W., Washington, D.C. 20210.

**DO NOT SEND THE COMPLETED FORM TO THIS OFFICE**

NOTE: Persons are not required to respond to this collection of information unless it displays a currently valid OMB control number.

Form CM-933  
Rev. Nov. 1996

For Purposes of Coding for the Department of Labor, the following criteria will be used  
ILO 1960 INTERNATIONAL CLASSIFICATION OF RADIOGRAPHS OF THE PNEUMOCONIOSES

FEATURES		CODES		DEFINITIONS
Technical Quality		1 2 3 4		Good. Acceptable with no technical defect likely to impair classification of the radiograph for pneumoconiosis. Poor, with some technical defect but still acceptable for classification purposes. Unacceptable. The category of profusion is based on the assessment of concentration of opacities by comparison with the standard radiographs.
Parenchymal Abnormalities Small Opacities	Profusion	0+ 0/0 0/1 1/0 1/1 1/2 2/1 2/2 2/3 3/2 3/3 3/4 RU RM RL LU LM ILL		Category 0 - small opacities absent or less profuse than the lower limit of Category 1. Categories 1, 2 and 3 - represent increasing profusion of small opacities as defined by the corresponding standard radiographs. The zones in which the opacities are seen are recorded. The right (R) and left (L) thorax are both divided into three zones - upper (U), middle (M) and lower (L). The category of profusion is determined by considering the profusion as a whole over the affected zones of the lung and by comparing this with the standard radiographs.
	Extent	p/p q/q r/r		The letters p, q and r denote the presence of small rounded opacities. Three sizes are defined by the appearances on standard radiographs. o = diameter up to about 1.5 mm. q = diameter exceeding about 1.5 mm and up to about 3 mm. r = diameter exceeding about 3 mm and up to about 10 mm.
	Shape and Size rounded	s/s t/t u/u		The letters s, t and u denote the presence of small irregular opacities. Three sizes are defined by the appearance on standard radiographs. s = width up to about 1.5 mm. t = width exceeding about 1.5 mm and up to about 3 mm. u = width exceeding 3 mm and up to about 10 mm.
	Irregular	p/s p/t p/u p/q p/r q/s q/t q/u q/p q/r r/s r/t r/u r/p r/q s/p s/q s/r s/t s/u t/p t/q t/r t/s t/u u/p u/q u/r u/s u/t		For mixed shapes (or sizes) of small opacities the predominant shape and size is recorded first. The presence of a significant number or another shape and size is recorded after the oblique stroke.
	Mixed			
Large Opacities		A B C		The categories are defined in terms of dimensions of the opacities. Category A - an opacity having a greatest diameter exceeding about 10 mm and up to and including 50 mm, or several opacities each greater than about 10 mm, the sum of whose greatest diameters does not exceed 50 mm. Category B - one or more opacities larger or more numerous than those in category A whose combined area does not exceed the equivalent of the right upper zone. Category C - one or more opacities whose combined area does not exceed the equivalent of the right upper zone.
Pleural Abnormalities	Pleural Thickening Chest wall	Type Site Width	R L A B C	Two types of pleural thickening of the chest wall are recognized: circumscribed (plaques) and diffuse. Both types may occur together. Pleural thickening of the chest wall is recorded separately for the right (R) and left (L) thorax. For pleural thickening seen along the lateral chest wall the measurement of maximum width is made from the inner line of the chest wall to the inner margin of the shadow seen most sharply at the parenchymal-pleural boundary. The maximum width usually occurs at the inner margin of the rib shadow at its outermost point. a = maximum width up to about 5 mm. b = maximum width over about 5 mm and up to about 10 mm. c = maximum width over about 10 mm.
	Diaphragm	Presence	Y N	The presence of pleural thickening seen face-on is recorded even if it can be seen also in profile. If pleural thickening is seen face-on only, width can not usually be measured.
	Costophrenic Angle	Site Presence	Y N Y N	Extent of pleural thickening is defined in terms of the maximum length of pleural involvement or as the sum of maximum lengths, whether seen in profile or face-on. 1 = total length equivalent up to one quarter of the projection of the lateral chest wall. 2 = total length exceed one quarter but not one half of the projection of the lateral chest wall. 3 = total length exceeding one half of the projection of the lateral chest wall. A plaque involving the diaphragmatic pleura is recorded as present (Y) or absent (N) separately for the right (R) or left (L) thorax.
	Pleural classification	Site chest wall diaphragm other	R L R L R L	The presence (Y) or absence (N) of costophrenic angle obliteration is recorded separately from thickening over other areas for the right (R) and left (L) thorax. The lower limit for the obliteration is defined by a standard radiograph. If the thickening extends up the chest wall then both costophrenic angle obliteration and pleura thickening should be recorded.
	extent	1 2 3		The site and extent of pleural calcification are recorded separately for the two lungs, and the extent defined in terms of dimensions. "Other" includes calcification of the mediastinal and pericardial pleura. 1 = an area of calcified pleura with greatest diameter up to about 20 mm or a number of such areas the sum of whose greatest diameters does not exceed about 20 mm. 2 = an area of calcified pleura with greatest diameter exceeding about 20 mm and up to about 100 mm or a number of such areas the sum of whose greatest diameters exceeds about 20 mm but does not exceed about 100 mm. 3 = an area of calcified pleura with greatest diameter exceeding about 100 mm or a number of such areas whose sum of greatest diameters exceeds about 100 mm.
Symbols				It is to be taken that the definition of such of the symbols is preceded by an appropriate word or phrase such as "suspect", "pneumoconiotic changes suggestive of", or "opacities suggestive of", etc. ax - coalescence of small pneumoconiotic opacities bu - bullae ca - cancer of lung or pleura cn - calcification in small pneumoconiotic opacities co - abnormality of cardiac size or shape cp - cor pulmonale cv - cavity di - marked distortion of the intrathoracic organs ef - effusion em - definite emphysema es - eggshell calcification of hilar or mediastinal lymph nodes fr - fractured ribs hi - enlargement of hilar or mediastinal lymph nodes ho - honeycomb lung id - ill defined diaphragm ih - ill defined heart outline kl - septal (balley) lines od - other significant abnormality pl - pleural thickening in the interlobar fissure or mediastinum pn - pneumothorax rp - rheumatoid pneumoconiosis tb - tuberculosis
Comments	Presence	Y N		Comments should be recorded pertaining to the classification of the radiograph particularly if some other cause is thought to be responsible for a shadow.

## **B. Elements of the x-ray report**

### **1. Date of the x-ray study and date of the reading**

The date on which the miner undergoes x-ray testing is located near the top of the form in box 1A and constitutes the date of the x-ray study. The date on which the study is read by the physician is located at the bottom of the form next to the physician's signature and constitutes the date of the x-ray reading or interpretation. Often, a single x-ray study will be read several times by different physicians. These re-readings are weighed, along with the original reading of the same study, to determine whether the presence of pneumoconiosis is indicated for that study.

### **2. Qualifications of the physician**

The probative weight accorded a particular x-ray report is dependent, in large part, upon the qualifications of the physician who interpreted the study. On most x-ray forms, there are a series of boxes on line 5B, wherein the physician may indicate his or her qualifications. The fact finder may also consider *curriculum vitae* of the physician if it is properly admitted into the record and some administrative law judges will take notice of a publication prepared by the National Institute for Occupational Safety and Health (NIOSH), or similar databases of physicians' qualifications.<sup>2</sup>

Physicians are classified into five categories of readers: (1) C-reader; (2) B-reader; (3) Board-certified radiologist; (4) A-reader; and (5) Board-eligible radiologist.

#### **a. The C-reader**

This is the highest qualification available to an x-ray reader and it is a closed classification. The group of C-readers designates only those highly regarded individuals who developed the widely used International Labor Organization (ILO) system for classifying x-rays. It is rare to encounter a C-reader in our black lung cases. *Alley v. Riley Hall Coal Co.*, 6 B.L.R. 1-376

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<sup>2</sup> Administrative law judges have differing philosophies in determining physicians' qualifications. Some judges will look only to the "four corners" of the record to determine a physician's qualifications with the view that each party bears the responsibility of ensuring that such information is provided. Other judges, however, may take judicial notice of a physician's qualifications based on information received from other sources such as the list of NIOSH approved B-readers found at [www.oalj.dol.gov/libbla](http://www.oalj.dol.gov/libbla). If the administrative law judge utilizes information outside the official record, then the parties must be given notice and an opportunity to be heard. *Maddaleni v. Pittsburgh & Midway Coal Mining Co.*, 14 B.L.R. 1-135 (1990).

(1983).

#### **b. The B-reader**

The B-reader is also known as the "final" reader and is more qualified than the A-reader. As with the A-reader, there is no requirement that the B-reader be a radiologist. However, a B-reader must demonstrate proficiency in assessing and classifying x-ray evidence for pneumoconiosis by successful completion of an examination conducted by, or on behalf of, the Appalachian Laboratory for Occupational Safety and Health (ALOSH). 20 C.F.R. § 718.202(a)(1)(ii)(E) (2008); 42 C.F.R. § 37.51(b)(2). In the examination, the physician must evaluate x-ray studies for quality and must use the ILO-U/C classification system.

The NIOSH and the Office of Workers' Compensation Programs at the Department of Labor maintain the NIOSH B-reader Lists of certified B-readers along with the dates of their certifications. This List may be accessed through the Office's website library at [www.oalj.dol.gov](http://www.oalj.dol.gov).

#### **c. The Board-certified radiologist**

A Board-certified radiologist is certified in radiology or diagnostic roentgenology by the American Board of Radiology or the American Osteopathic Association. 20 C.F.R. § 718.202(a)(1)(ii)(C) (2008). Requirements for this classification include four years of postgraduate training followed by successful completion of comprehensive written and oral examinations. A portion of the oral examination is devoted to testing the candidate's proficiency in diagnosing diseases of the lungs.

#### **d. The A-reader**

This reader is also known as the "first" reader. The requirements for an A-reader are established by the National Institute of Safety and Health (NIOSH). To become a certified A-reader, the physician (although not necessarily a radiologist) must submit six sample x-rays from his or her own files to the Appalachian Laboratory for Occupational Safety and Health (ALOSH) consisting of two x-rays negative for pneumoconiosis, two x-rays which are positive for simple pneumoconiosis, and two x-rays showing complicated pneumoconiosis. Alternatively, a physician seeking an "A" rating may take a course approved by ALOSH in the classification systems for diagnosing pneumoconiosis.

#### **e. The Board-eligible radiologist**

A reader in this category must have successfully completed a formal accredited residency program in radiology or diagnostic roentgenology. 20 C.F.R. § 718.202(a)(1)(ii)(D) (2008).

### **3. Film quality**

On most x-ray reports, the film quality will be noted in box 1C, which is located in the upper, right corner of the x-ray report. A film quality of "1" is good whereas a "U/R" designates that the x-ray film was unreadable. If a physician marks "U/R," then the x-ray study may be accorded little or no probative value as it is of very poor quality.

### **4. The quantity of opacities**

Box 2B(c) of the x-ray form indicates the quantity of opacities in the lung and, therefore, the presence or absence of pneumoconiosis. The more opacities noted in the lung, the more advanced the disease. The categories are:

- 0** = small opacities absent or less profuse than in category 1.
- 1** = small opacities definitely present but few in number.
- 2** = small opacities numerous but normal lung markings still visible.
- 3** = small opacities very numerous and normal lung markings are usually partly or totally obscured.

If no categories are chosen, then the x-ray report is not classified according to the standards adopted by the regulations and cannot, therefore, support a finding of pneumoconiosis. Likewise, an x-ray interpreted as Category 0 (--/0, 0/0, 0/1) will not support a finding of pneumoconiosis under the Act or regulations.

If the physician determines that the study is Category 1 (1/0, 1/1, 1/2), Category 2 (2/1, 2/2, 2/3), or Category 3 (3/2, 3/3, 3/+), then there is a definite presence of opacities in the lung and the x-ray report may be used as evidence of the existence of pneumoconiosis. An interpretation of 1/0 is the minimum reading under the regulations that will support a finding of pneumoconiosis. This reading (1/0) indicates that the physician has determined that the x-ray is Category 1, but s/he seriously considered Category 0. As another example, a reading of 2/2 indicates that the physician determined that the x-ray was Category 2 and Category 2 was the only other category seriously considered by the physician.

## 5. The size and type of opacities

Opacities in the lung come in a variety of sizes, but are of only two types -- rounded and irregular. Irregularly shaped opacities are most often (but not always) associated with exposure to dust particles other than those from a coal mine. For example, inhalation of asbestos or silicon particles may result in irregularly shaped opacities in the lung. The inhalation of coal dust, on the other hand, will generally result in the formation of rounded opacities. Larger and more numerous opacities usually result in greater lung impairment.

An indication of the size and type of opacities in the lung is located at box 2B(a) on the x-ray report. A designation of p, q, or r is for ***rounded opacities***, whereas a designation of s, t, or u indicates the presence of ***irregularly shaped opacities***. The letter designations also represent the increasing size of opacities from less than 1.5 millimeters in diameter (p or s designation) up to 10 millimeters in diameter (r or u designation).

Finally, box 2C of the x-ray report contains the letters O, A, B, and C. If the physician checks A, B, or C, the x-ray yields evidence that the miner suffers from complicated pneumoconiosis. A mark of "O" indicates that complicated pneumoconiosis is not present. Complicated pneumoconiosis under the regulations requires finding one or more opacities greater than one centimeter in diameter (size A). Size B and C opacities are larger in diameter than size A. Complicated pneumoconiosis is an extremely advanced stage of the lung disease, and a miner who suffers from complicated pneumoconiosis will be entitled to certain presumptions regarding total disability and death arising from the disease under some of the applicable regulatory schemes.

For further discussion of the criteria for establishing complicated pneumoconiosis, see Chapter 11.

### III. The pulmonary function (ventilatory) study

#### A. Generally

The pulmonary function study, also referred to as a ventilatory study or spirometry, measures obstruction in the airways of the lungs. Increased resistance to the flow of air produces a more severe lung impairment. A pulmonary function study is not used to establish the existence of pneumoconiosis; rather, it is utilized to measure the level of the miner's disability.

In performing the study, the miner is required to blow hard into a mouthpiece, which is connected to a flowmeter. A spirometer records the



amount of air expired through the flowmeter over a period of time onto tracings. Tracings for each of the three trials (as well as a "flow-volume loop" for studies conducted after January 19, 2001) must be included in the record. 20 C.F.R. § 718.103(b) (2008).

The regulations require that a ventilatory study be conducted three times to assess whether the miner exerted optimal effort among trials, but the Board has held that a ventilatory study, which is accompanied by only two tracings, is in "substantial compliance" with the quality standards under the old regulations at 20 C.F.R. § 718.204(c)(1) (2000). *Defore v. Alabama By-Products Corp.*, 12 B.L.R. 1-27 (1988). For further discussion of the quality standards, see Chapter 3.

The values from the FEV<sub>1</sub> as well as the MVV or FVC must be in the record, and the highest values under each category from the trials are used to determine the level of the miner's disability. It is important to realize that, if the miner does have a pulmonary or respiratory impairment, undergoing this test may be very difficult, and the miner may be unable to complete the test due to coughing or shortness of breath.

## **B. Height, age, and gender of the miner**

As an individual ages, his or her lung capacity lessens. Differences in lung volume have also been noted between women and men of the same age and height. As a result, tables of data based on the miner's age, height, and gender are used to determine whether the study has produced qualifying results. A "qualifying" pulmonary function study yields values that are equal to or less than the appropriate values set out in the tables at 20 C.F.R. Part 718, Appendices B and C. A "non-qualifying" study exceeds those values. 20 C.F.R. § 718.204(c)(1) (2000); 20 C.F.R. § 718.204(b)(2)(i) (2008).

## **C. The forced expiratory volume (FEV<sub>1</sub>)**

To ascertain the forced expiratory volume, the miner inspires maximally, pauses, and then expires as forcefully and rapidly as possible. The volume of air expired over a period of one second is the FEV<sub>1</sub>. An abnormal decrease in the FEV<sub>1</sub> value is the result of a decrease in air flow which, in turn, is considered by some physicians to indicate the existence of an **obstructive** airway disease.

#### **D. The forced vital capacity (FVC) and the maximum voluntary volume (MVV)**

The forced vital capacity (FVC) is the total lung capacity minus any residual volume of air in the lung after expiration. The maximum voluntary volume (MVV) is the volume of air expired over a 15 second period where the miner breathes as rapidly and deeply as possible. A decrease in the FVC and/or MVV values is considered by some physicians to indicate the presence of a **restrictive** airway disease or a loss of lung volume.

#### **E. The use of bronchodilators**

Sometimes, a bronchodilator will be administered prior to conducting the study to clear the miner's airways. If the use of a bronchodilator results in higher values, this will often indicate the presence of asthma or other reversible condition as opposed to pneumoconiosis, which is considered an irreversible disease process.

### **IV. The blood gas studies**

A blood gas study is designed to measure the ability of the lung to oxygenate blood. The initial indication of a miner's impairment will most likely manifest itself in the clogging of alveoli, as opposed to airway passages, thus rendering the blood gas study a valuable tool in the assessment of disability.

Alveoli are air sacs lining the lungs in a honeycomb pattern. Oxygen passes through the alveoli into the bloodstream on inspiration and carbon dioxide is released from the bloodstream on expiration. A lower level of oxygen compared to carbon dioxide in the blood indicates a deficiency in the transfer of gases through the alveoli, which will leave the miner disabled.

In performing the study, a blood sample is taken from the miner at rest and, if possible, after exercise. As with the pulmonary function study, the requirement that the miner exercise may be difficult, and the miner may not complete the test due to shortness of breath and coughing. A blood sample taken on exercise, however, is very helpful in the diagnosis because exercise requires that the body be able to oxygenate blood more quickly. Consequently, an insufficiency in gas transfers may be noted after exercise before it is evident at rest.

The blood sample is analyzed for the percentage of oxygen (PO<sub>2</sub>) and the percentage of carbon dioxide (PCO<sub>2</sub>) in the blood. Tables are provided in the regulations for determining whether the study yields qualifying values, thus lending support for a finding that the miner is totally disabled. 20 C.F.R. §

718.204(c)(2) (2000) and Appendix C; 20 C.F.R. § 718.204.204(b)(2)(ii) (2008) and Appendix C.