

Chapter 2

Introduction to the Medical Evidence

I. Generally

Benefits are awarded to miners who are totally disabled due to coal workers' pneumoconiosis, and to survivors of miners who died due to the disease. In a living miner's claim, the following four elements must be established by either operation of presumption, or by a preponderance of the evidence: (1) the miner suffers from pneumoconiosis; (2) the pneumoconiosis arose out of coal mine employment; (3) the miner suffers from a totally disabling respiratory impairment; and (4) his or her total disability is due to pneumoconiosis. A survivor's claim requires evidence establishing: (1) the miner suffered from pneumoconiosis; (2) the pneumoconiosis arose out of coal mine employment; and (3) coal workers' pneumoconiosis caused, or contributed to, the miner's 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 x-rays and use of 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. Interpretation of the chest x-ray study

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) is Category 1/0. 20 C.F.R. §§ 718.102 and 718.202. An interpretation of Category 1 means that the physician has diagnosed *simple* clinical pneumoconiosis. It is important to keep in mind that the term "pneumoconiosis" means "a chronic dust disease of the lungs." So, if it is determined that the x-ray evidence demonstrates the presence of clinical pneumoconiosis (*i.e.* Category 1, 2, or 3, and/or A, B, or C), then the Administrative Law Judge must make a

finding as to the cause of the opacities observed (*i.e.* coal mining, uranium mining, asbestos exposure as a pipefitter at a shipyard). Miners and their survivors are entitled to benefits under the Black Lung Benefits Act only if it is demonstrated through a preponderance of the medical evidence, or by operation of a presumption, that pneumoconiosis arose from coal dust exposure.

Chest x-ray evidence is not utilized to determine whether the miner is totally disabled, unless complicated pneumoconiosis is indicated. For complicated pneumoconiosis, the miner has one or more opacities in his/her lungs, which are categorized as an A, B, or C mass on the ILO form. An A, B, or C designation means that the mass is greater than one centimeter in diameter. This is the most advanced form of pneumoconiosis and, in such cases, the regulatory provisions at 20 C.F.R. § 718.304 provide an irrebuttable presumption of total disability and/or death due to pneumoconiosis.

For further discussion of weighing evidence in a claim involving complicated pneumoconiosis, see Chapter 11.

If a chest x-ray is positive for the existence of clinical pneumoconiosis (either simple or complicated), then the x-ray report should indicate the size, type, and quantity of opacities in the lungs. Larger and/or more plentiful opacities indicate that the disease is progressing.

Sometimes, an x-ray interpretation will be in narrative form (typically in 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 (1) its compliance with the quality standards for x-rays, (2) whether the interpreting physician specifies Category 1, 2, or 3 simple pneumoconiosis, or size A, B, or C complicated pneumoconiosis, and (3) the qualifications of the interpreting physician.

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.



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 Mo. DAY YR.	1B. Miner's Social Security Number	1C. Film Quality (If not Grade 1. Give Reason): 1 2 3 U/R
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1D. Is Film Completely Negative? YES Proceed to Section 5 NO Complete Section 2A

2A. Any Parenchymal Abnormalities Consistent with Pneumoconiosis? YES Complete 2B and 2C NO Proceed to Section 3

2B. SMALL OPACITIES a. SHAPE/SIZE PRIMARY SECONDARY <table style="display: inline-table; margin-right: 20px;"> <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> <table style="display: inline-table; margin-right: 20px;"> <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> b. ZONES <table style="display: inline-table;"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td>R</td><td>L</td></tr> </table>	p	s	q	t	r	u	p	s	q	t	r	u					R	L	c. PROFUSION <table style="font-size: small;"> <tr><td>0/</td><td>00</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>	0/	00	0/1	1/0	1/1	1/2	2/1	2/2	2/3	3/2	3/3	3/+	2C. LARGE OPACITIES SIZE: <table style="display: inline-table;"><tr><td></td><td>A</td><td>B</td><td>C</td></tr></table> Proceed to Section 3		A	B	C
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3A. ANY PLEURAL ABNORMALITIES CONSISTENT WITH PNEUMOCOONOSIS? YES Complete 3B, 3C and 3D NO Proceed to Section 4

3B. PLEURAL THICKENING a. Diaphragm (plaque) SITE: <table style="display: inline-table;"><tr><td>O</td><td>R</td><td>L</td></tr></table> b. Costophrenic Angle SITE: <table style="display: inline-table;"><tr><td>O</td><td>R</td><td>L</td></tr></table>	O	R	L	O	R	L	a. CIRCUMSCRIBED (plaque) SITE: <table style="display: inline-table;"><tr><td>O</td><td>R</td></tr></table> In Profile: <table style="display: inline-table;"><tr><td>O</td><td>A</td><td>B</td><td>C</td></tr></table> i. Width: <table style="display: inline-table;"><tr><td>O</td><td>1</td><td>2</td><td>3</td></tr></table> ii. Extent: <table style="display: inline-table;"><tr><td>O</td><td>1</td><td>2</td><td>3</td></tr></table> Face On: <table style="display: inline-table;"><tr><td>O</td><td>1</td><td>2</td><td>3</td></tr></table>	O	R	O	A	B	C	O	1	2	3	O	1	2	3	O	1	2	3	3C. PLEURAL THICKENING ... Chest Wall b. Diffuse SITE: <table style="display: inline-table;"><tr><td>O</td><td>R</td></tr></table> In Profile: <table style="display: inline-table;"><tr><td>O</td><td>A</td><td>B</td><td>C</td></tr></table> i. Width: <table style="display: inline-table;"><tr><td>O</td><td>1</td><td>2</td><td>3</td></tr></table> ii. Extent: <table style="display: inline-table;"><tr><td>O</td><td>1</td><td>2</td><td>3</td></tr></table> Face On: <table style="display: inline-table;"><tr><td>O</td><td>1</td><td>2</td><td>3</td></tr></table>	O	R	O	A	B	C	O	1	2	3	O	1	2	3	O	1	2	3
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3D. PLEURAL CALCIFICATION a. Diaphragm SITE: <table style="display: inline-table;"><tr><td>O</td><td>R</td></tr></table> EXTENT: <table style="display: inline-table;"><tr><td>O</td><td>1</td><td>2</td><td>3</td></tr></table> b. Wall SITE: <table style="display: inline-table;"><tr><td>O</td><td>1</td><td>2</td><td>3</td></tr></table> c. Other Sites SITE: <table style="display: inline-table;"><tr><td>O</td><td>1</td><td>2</td><td>3</td></tr></table>	O	R	O	1	2	3	O	1	2	3	O	1	2	3	a. Diaphragm SITE: <table style="display: inline-table;"><tr><td>O</td><td>L</td></tr></table> EXTENT: <table style="display: inline-table;"><tr><td>O</td><td>1</td><td>2</td><td>3</td></tr></table> b. Wall SITE: <table style="display: inline-table;"><tr><td>O</td><td>1</td><td>2</td><td>3</td></tr></table> c. Other Sites SITE: <table style="display: inline-table;"><tr><td>O</td><td>1</td><td>2</td><td>3</td></tr></table> Proceed to Section 4	O	L	O	1	2	3	O	1	2	3	O	1	2	3
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4A. ANY OTHER ABNORMALITIES? YES Complete 4B and 4C NO Proceed to Section 5

4B. OTHER SYMBOLS (OBLIGATORY)

O	ax	bu	ca	cn	cc	cp	cv	di	ef	em	es	fr	hi	ho	id	ih	kl	pl	px	rp	tb
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REPORT ITEMS WHICH MAY BE OF PRESENT CLINICAL SIGNIFICANCE IN THIS SECTION. (Specify) _____ Date Personal Physician notified?

Mo.	Day	Yr.
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4C. OTHER COMMENTS _____

SHOULD WORKER SEE PERSONAL PHYSICIAN BECAUSE OF COMMENTS IN SECTION 4C? Yes No Proceed to Section 5

5A. FACILITY PROVIDING ROENTGENOGRAPHIC EXAMINATION: _____
 DOL Medical Provider Number (if applicable) _____
 Was film taken by a registered radiographer/radiographic technologist? Yes No State _____
 Name _____ Registration No. _____

5B. Physician Interpreting Film (Print Name): _____
 Are you: Board-certified Radiologist? Yes No Board-eligible radiologist? Yes No B-reader? Yes 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.

PHYSICIAN'S SIGNATURE _____ DATE OF READING _____ (Mo., Day, Yr.)

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 1980 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.
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/+		The category of profusion is based on the assessment of concentration of opacities by comparison with the standard radiographs. 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	RU RM RL LU LM LL		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	p/p q/q r/r		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	s/s t/t u/u		For mixed shapes (or sizes) of small opacities the predominant shape and size is recorded first. The presence of a significant number of another shape and size is recorded after the oblique stroke.
	mixed	p/s p/t p/u p/q p/r q/w 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		
Ledge 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			Two types of pleural thickening of the chest wall are recognized: circumscribed (plaques) and diffuse. Both types may occur together.
	Site	R L		Pleural thickening of the chest wall is recorded separately for the right (R) and left (L) thorax.
	Width	A B C		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-pleura 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.
	Face on	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.
	Extent	1 2 3		Extent of pleural thickening is defined in terms of the maximum length of pleural involvement or as the sum of maximum lengths, whichever 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.
Diaphragm Costophrenic Angle	Presence Site Presence	Y N R L Y N		A plaque involving the diaphragmatic pleura is recorded as present (Y) or absent (N) separately for the right (R) or left (L) thorax. 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.
Pleural classification	Site	R L		If the thickening extends up the chest wall then both costophrenic angle obliteration and pleura thickening should be recorded.
	Site chest wall diaphragm other	R R R L L L		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.
	extent	1 2 3		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.
Comments	Presence	ax		- coalescence of small pneumoconiotic opacities
		bu		- bullae
		ca		- cancer of lung or pleura
		ch		- 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
hl		- enlargement of hilar or mediastinal lymph nodes		
ho		- honeycomb lung		
id		- ill defined diaphragm		
ih		- ill defined heart outline		
il		- septal (Kerley) lines		
od		- other significant abnormality		
pl		- pleural thickening in the interlobar fissure or mediastinum		
px		- pneumothorax		
rp		- rheumatoid pneumoconiosis		
tb		- tuberculosis		
		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 together with the original reading of the same study to determine whether the presence of pneumoconiosis is indicated for that particular study.

2. Qualifications of the physician

The probative weight accorded a particular x-ray report is dependent, in large part, on 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 also may consider *curriculum vitae* of the physician, if it is properly admitted into the record. 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.¹

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

¹ Administrative Law Judges have differing philosophies in determining physicians' qualifications. Some Administrative Law Judge 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 official 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. 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).

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 (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); 42 C.F.R. § 37.51(b)(2). During this examination, the physician must evaluate x-ray studies for quality and must use the ILO-U/C classification system.

The National Institute of Occupational Safety and Health (NIOSH) maintains a list of certified B-readers. This list may be accessed through the "Black Lung" library at www.oalj.dol.gov. A B-reader certification is not permanent; rather, the physician must take this examination every two years to maintain his or her B-reader status.

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). 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 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 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. 20 C.F.R. § 718.202(a)(1)(ii)(D).

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, 2, or 3 means the study is readable, 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, generally (but not always) results in the formation of rounded opacities. Larger and more numerous opacities usually result in greater lung impairment. The Administrative Law Judge must, as the finder-of-fact, weigh expert medical opinions to determine whether x-ray changes represent findings of pneumoconiosis, or some other disease process.

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 opacities that are smaller in diameter (p or s designation) to opacities that are larger 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 under 20 C.F.R. § 718.304, 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 the presence of obstruction and/or restriction in the

lungs. Increased resistance to the flow of air, or increased scarring of lung tissue, constitutes evidence of deteriorating lung function. 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. However, keep in mind that medical experts may cite to pulmonary function study results in support of their views that any lung disease suffered by the miner is, or is not, due to coal dust exposure. The Administrative Law Judge, as the fact-finder, must resolve conflicting opinions on this issue.

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).

The regulations require that a ventilatory study be conducted three times to assess whether the miner exerted optimal effort among trials. However, in a pre-amendment claim, the Board held that a ventilatory study, which is accompanied by only two tracings, may be in "substantial compliance" with the quality standards 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 FEV₁ 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. A "non-qualifying" study exceeds those values. 20 C.F.R. § 718.204(b)(2)(i), Appendix B.

C. The forced expiratory volume (FEV₁)

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 FEV₁. An abnormal decrease in the FEV₁ 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 due to scarring of the lung tissue.

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, non-disabling values, this often will indicate the presence of asthma, or another 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 sometimes 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 (PO₂) and the percentage of carbon dioxide (PCO₂) 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. § 718.204.204(b)(2)(ii), Appendix C.

Pulmonary function studies and blood gas studies measure different types of impairment. Therefore, one set of studies may yield qualifying results and demonstrate a totally disabling respiratory impairment, whereas another set of studies may not be qualifying. For example, in *Gurule v. Director, OWCP*, 2 B.L.R. 1-772 (1979), the Board cited to 20 C.F.R. § 410.426(a), which provides that a miner may be found totally disabled pursuant to blood gas testing notwithstanding negative x-ray evidence and non-qualifying pulmonary function testing:

. . . an impairment in the transfer of oxygen from the lung alveoli to cellular level can exist in an individual even though his chest roentgenogram (X-ray) or ventilatory function tests are normal.

Id. at 1-778. The Board held:

[P]ulmonary function studies measure an entirely separate pulmonary function than do blood gas studies. Pulmonary function studies only measure the lungs' ability to take in and expire air. A blood gas study is a more exacting test which measures gas exchange between the lung alveoli and the blood thus reflecting the lungs' ability to take oxygen from the air and get it into the bloodstream in utilizable form. (citation omitted). Results from these two tests may consistently have no correlation since coal workers' pneumoconiosis may manifest itself in different types of impairment.

Id. at 1-777 to 1-778.