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FOREWORD

During the past 50 years the International Labour Office has promoted discussion and published a series of guidelines on ways of classifying chest radiographs of persons with pneumoconiosis. The aim has been to standardise classification methods and facilitate international comparisons of pneumoconiosis statistics and research reports. The ILO 1980 INTERNATIONAL CLASSIFICATION OF RADIOGRAPHS OF PNEUMOCONIOSES is a further development towards this objective. It retains the same basic principles embodied in former editions of ILO classifications (i.e. those of 1950, 1958, 1968 and 1971 editions); it clarifies some ambiguities in the earlier texts; it consolidates advances made previously; and it introduces a few modifications which permit more detailed documentation of radiographic features characteristic of pneumoconiosis. The present classification covers the radiological appearances seen in all types of pneumoconiosis.

These improvements have been based on a careful review of international experience in the use of earlier classifications. The review involved active contributions of numerous experts, organisations and institutions at various national and international meetings. Particular recognition should be given to the work accomplished by the International Workshop on the ILO/UC 1971 Classification System, sponsored by the Task Force on Pneumoconioses of the American College of Radiology with the support of the National Institute of Occupational Safety and Health, U.S. Department of Health, Education and Welfare and with the co-operation of the ILO (Washington, D.C., September, 1978). A valuable contribution has been provided by the detailed technical discussions organised by the Working Group on Radiodiagnosis under the auspices of the Commission of European Communities in Luxembourg, London and Hasselt. At the Fifth International Pneumoconioses Conference, convened by the ILO in Caracas (Venezuela) from 29 October to 3 November 1978, a Working Group on Radiological Classification examined the final recommendations on the text of the revised classification and the selection of standard radiographs illustrating it.

The ILO 1980 Classification is accompanied by a new set of standard radiographs illustrating, and in some cases defining, the features described. The standard radiographs were selected following several controlled trials which involved more than 40 experts from different countries. The films include some that were distributed by the ILO in 1971, and others have been added. There has been no change in the level of profusion of small opacities depicted by the standards which now define the four main categories of profusion; but, with the assistance of the American College of Radiology, a greatly improved photocopying technique has been used to produce the films. The standard radiographs are now available from the ILO.

The intensive international activity which preceded publication of these guidelines has involved so many notable experts, institutions and organisations that it would be invidious to single out particular names, with one exception. Professor George Jacobson* died on 18 March 1979, a few days after making the last of his many vigorous contributions to the preparatory work on the classfication. The publication of this booklet is an appropriate occasion to record his devotion to the aims of the ILO Classification and to radiology of pneumoconioses.

The ILO extends its warm thanks to all concerned for their valuable assistance. The aim has always been to improve the understanding of pneumoconioses problems. The advances represented by the 1980 Classification are expected to further assist the continuing struggle to protect the health of workers occupationally exposed to airborne dusts.

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CONTENTS

ILO 1980 INTERNATIONAL CLASSIFICATION OF RADIOGRAPHS OF THE PNEUMOCONIOSES

INTRODUCTION

Scope of the Classification

This Classification provides a means for recording systematically the radiographic abnormalities in the chest provoked by the inhalation of dusts. The scheme is designed for classifying the appearances of postero-anterior chest radiographs (Note 1).

Object of the Classification

The object of the Classification is to codify the radiographic abnormalities of pneumoconiosis in a simple reproducible manner. The Classification does not define pathological entities, nor take into account working capacity. The Classification does not imply legal definitions of pneumoconiosis for compensation purposes, nor set nor imply a level at which compensation is payable.

Complete and Short Classification

There are Complete and Short Classifications which are complementary and compatible.

Uses of the Classification

The Complete Classification has been found to have wider uses than anticipated in 1971. It is now extensively used internationally for epidemiological research, for the surveillance of those in dusty occupations and for clinical purposes. Use of the scheme may lead to better international comparability of pneumoconiosis statistics. It is also used for recording in a systematic way part of the information needed for assessing compensation.

The Short Classification is intended for clinical and other uses to which the 1950, 1958, 1968 and 1971 (short) ILO Classifications have been put.

The Complete and Short Classifications are arranged so that it is possible to use any combination of them to suit

particular needs. For example, in coal workers' pneumoconiosis where pleural changes are relatively uncommon but a full classification of rounded opacities may be needed, it is possible to use the Complete Classification for the small opacities and the Short Classification for the pleural change.

In the interest of international comparability and to assist in the interpretation of publications on pneumoconiosis where this Classification is used, it is desirable to specify whether the Complete or Short Classification was employed; and also which set of standard radiographs was used. (Note 2).

Standard radiographs and written definitions

The Classification is based on a set of standard radiographs, a written text and a set of notes. In some parts of the scheme the standard radiographs take precedence over the text for the definitions; the text makes it clear when this is so. (Note 3).

GENERAL INSTRUCTIONS FOR THE USE OF THE CLASSIFICATION

There are no features to be seen in a chest radiograph which are pathognomonic of dust exposure. But the following recommendations are made for the classification of a postero-anterior radiograph:

1. if any of the appearances of the pleura or the parenchyma are consistent with pneumoconiosis, proceed with the Classification. Do not classify any appearances which are definitely not pneumoconiosis, but record these using Symbols and Comments (Note 4);

2. if it is probable that all the appearances seen are the result of some other aetiology, do not classify, but record opinion using appropriate Symbols and Comments (Note 4);

3. if the appearances might be due to pneumoconiosis, record the observations according to the Classification, but note also what other aetiology was considered.

COMPLETE CLASSIFICATION

Recording technical quality

Four grades of technical quality are used:-

1. Good.

2. Acceptable, with no technical defect likely to impair classification of the radiograph for pneumoconiosis.

3. Poor, with some technical defect but still acceptable for classification purposes.

4. Unacceptable.

If technical quality is not Grade 1, a comment should be made about the technical defects (Note 5).

Parenchymal abnormalities

Small Opacities

Profusion

The category of profusion is based on assessment of the concentration of opacities (Note 6) by comparison with the standard radiographs. For profusion the written definitions are a guide, but the standard radiographs take precedence (Note 7).

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.

By using the 12-point scale of profusion, the Classification recognises the existence of a continuity of change from no small opacities to the most advanced category. While still retaining the four major categories, 0, 1, 2 and 3, as defined by the standard radiographs, this scale

readily permits subdivision into more categories and provides extra information. The instructions for using this 12-point scale are:- The radiograph is classified in the usual way into one of the four major categories by comparison with the standard radiographs. If during the process the major category above or below is seriously considered as an alternative, this is recorded. Thus, category 2/1 is profusion of major category 2, but with category 1 having been seriously considered as an alternative. Profusion which is without serious doubt category 2, that is, near the middle of the major category, should be classified 2/2.

In radiographs within category 0, a subdivision is also possible. Thus category 0/1 is profusion of category 0, but category 1 was seriously considered. Category 0/0 is a radiograph in which there are no small opacities, or if a few are thought to be present they are not sufficiently definite or numerous for category 1 to be considered. If the absence of small opacities is particularly obvious, the profusion should be recorded as 0/-. Within category 3 a radiograph showing markedly higher profusion than would be classified as 3/3 should be recorded as 3/+. Thus, the short four-point scale becomes the complete twelve-point scale: 0/-, 0/0, 0/1; 1/0, 1/1, 1/2; 2/1, 2/2, 2/3; 3/2, 3/3, 3/+. (Note 8). It must be emphasised that other abnormalities may be present regardless of the category of profusion of small opacities.

Extent

The zones in which the opacities are seen are recorded. The lungs are divided into six zones - upper, middle, and lower, right and left - by horizontal lines drawn at one-third and two-thirds of the vertical distance between the lung apices and the domes of the diaphragm.

The category of profusion of small opacities is determined by considering the profusion as a whole over the affected zones of the lung, and by comparing this with the standard radiographs. Where there is a marked (three minor categories or more) difference in profusion in different zones of the lung, then the zone or zones showing this marked lesser degree of profusion are ignored for the purpose of classifying the profusion (Note 9).

Shape and size

The shape and size (Note 10) of small opacities are recorded. Two kinds of shape are recognised: rounded and irregular. In each case, three sizes are differentiated. They are illustrated by standard radiographs which take precedence over the following written definitions. The letters p, q, r denote the presence of small rounded opacities, where

p = 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.

The letters s, t, u denote the presence of small irregular opacities, where

s = width up to about 1.5 mm;

t = width exceeding 1.5 mm and up to about 3 mm;

u = width exceeding 3 mm and up to about 10 mm.

To record shape and size, two letters must be used. Thus if the reader considers that all or virtually all opacities seen are of one shape and size, then this should be noted by recording the symbol twice, separated by an oblique stroke (for example, q/q). If, however, another shape (or size) is seen, then this should be recorded as the second letter (for example, q/t). 'q/t' would mean that the predominant small opacity is round and of size q, but that there are significant numbers of small irregular opacities present of size t. In this way any combination of small opacities may be recorded (Note 11).

Standard radiographs illustrating both rounded and irregular shapes should be used for comparisons when the shape of opacity is in doubt or when both shapes are present.

Large Opacities

The examples of large opacities in the standard radiographs show abnormal opacities greater than 10 mm in diameter. 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 about 50 mm, or several opacities each greater than about 10 mm the sum of whose greatest diameters does not exceed about 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 exceeds the equivalent of the right upper zone.

Pleural abnormalities

Pleural Thickening

Site (chest wall, diaphragm, costophrenic angle), width and extent of pleural thickening are recorded separately and defined in the text below (Note 12).

Chest Wall

Types: Circumscribed (plaques), and/or diffuse (Note 12).

Site: Pleural thickening of the chest wall is recorded separately for the right and left chest walls.

Width: For pleural thickening seen along the lateral chest wall the measurement of the maximum width of the shadow 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.

For pleural thickening seen face on (en face), the presence is recorded, even if it can also be seen in profile. If pleural thickening is seen face on only, width usually can not be measured.

Extent: Extent 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 to up to one quarter of the projection of the lateral chest wall.

2 = total length exceeding 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

A plaque involving the diaphragmatic pleura is recorded separately as present or absent, right or left. This is illustrated by an example in the standard radiographs (Note 13).

Costophrenic angle obliteration

The lower limit for this obliteration is defined by the standard radiograph showing profusion category 1/1 t/t. Such thickening is recorded separately from thickening over other areas (Note 14). If the thickening extends further up the chest wall, the radiograph should be classified as costophrenic angle obliteration and pleural thickening on the chest wall, if the latter is extent 1 or greater. Costophrenic angle obliteration is recorded as absent or present. The site, right or left, is specified.

Pleural Calcification

Site and extent are recorded for the two lungs separately. The following numerical definitions of extent take precedence over the examples in the standard radiographs (Note 15).

Site: Chest wall, diaphragm, and other. The latter includes calcification of the mediastinal and pericardial pleura.

Extent: 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.

Extent: 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

Symbols to record radiographic features of importance are listed below. Their use is obligatory. Examples are included in the standard radiographs and in the diagrams (Note 16).

It is to be taken that the definition of each of the Symbols is preceded by an appropriate word or phrase, such as "suspect", "changes suggestive of", "opacities suggestive of", etc.

The Symbols are:

ax - coalescence of small pneumoconiotic opacities (Note 16)

bu - bulla(e)

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 rib(s)

hi - enlargement of hilar or mediastinal lymph nodes

ho - honeycomb lung

id - ill defined diaphragm (Note 16)

ih - ill defined heart outline (Note 16)

kl - septal (Kerley) lines

od - other significant abnormality

pi - pleural thickening in the interlobar fissure or mediastinum

px - pneumothorax

rp - rheumatoid pneumoconiosis

tb - tuberculosis

The calcified primary complex of tuberculosis or other granulomatous processes, such as coccidioidomycosis or histoplasmosis should not be coded under tb. Such appearances should be noted under Comments.

Comments

Comments should be recorded pertaining to the classification of the radiograph, particularly if some other cause is thought to be responsible for a shadow which could be thought by others to have been due to pneumoconiosis; also to identify radiographs for which the technical quality may have affected the reading materially.

SHORT CLASSIFICATION

The detailed rules of how the Short Classification is to be used are as in the Complete Classification but with simplification. The details recorded are as follows:

Technical Quality

Technical quality is recorded 1, 2, 3 or 4 as for the Complete Classification (page 4).

Small Opacities

Profusion by comparison with standard radiographs into the four principal categories: 0, 1, 2 and 3 (page 4).

Shape and size by comparison of the predominant opacity pattern with standard radiographs.

If rounded, p, q or r.

If irregular, s, t or u as for Complete Classification (page 6).

Large Opacities

Category A, B or C as for Complete Classification (page 6).

Pleural Changes

Pleural thickening is recorded as symbol pt.
Pleural calcification is recorded as symbol pc.

Symbols

As for Complete Classification, together with pt and pc. All are obligatory (page 9).

Comments

Comments should be recorded as for Complete Classification (page 10).

EXPLANATORY NOTES

These notes are to assist in the understanding of the principles and use of the Classification. They do not take precedence over the written text but are intended to reduce ambiguities and differences in its use. They are based on experience with the previous Classifications.

Note 1 Scope

The Classification now covers all types of pneumoconiosis. It is designed for use with postero-anterior chest radiographs. This is not to say that other views should not be considered in the full clinical assessment of any individual.

Note 2 Standard Radiographs

The 1980 Classification is accompanied by a new set of standard radiographs which were selected after international trials. The trials were designed to obtain better illustrations of features described in the Classification.

Note 3 Definitions

In the past it has not been quite clear whether the standard radiographs or the text takes precedence in terms of definition. This is now clarified throughout.

Note 4 General Instructions

Comments must be recorded about appearances which are definitely or probably not pneumoconiosis. This may permit the resolution of apparent major discrepancies between readers.

Note 5 Technical Quality

It has been suggested that for epidemiological studies (when it may not be possible to replace a technically poor radiograph by a better one) more detail should be recorded about technical defects. In particular, if the parenchyma is

visible and the pleura not, or vice versa, only part of a complete reading may be usefully available for statistical analysis. However, no specific recommendation about such recording is made at this time.

Note 6 Small opacities - order of recording

Profusion relates better than size to indices of exposure within any one occupational group. Since 1971 profusion has been recorded first.

Note 7 Standard radiographs for profusion of small opacities

Current research on the use of the Classification includes trials designed to test the validity and utility of additional standard radiographs for profusion. These are expected to illustrate (a) the boundary points on the continuum of profusion between the four major categories, and (b) the profusion characteristic of mid-categories, using only sections of the lung. The text describing the Classification has been prepared so that it may be used unchanged if trials are completed successfully and additional standard radiographs become available. (See also Appendix C).

In the Classifications from 1950 to 1971 the definitions in the text of the categories of profusion of small opacities included reference to the degree of obscuration of the normal vascular pattern of the lung - no obscuration in Category 1, sometimes and partially in Category 2, and usually, partly or totally in Category 3. In the 1980 Classification this information is omitted in the text but will be apparent from inspection of the standard films. The degree of obscuration may be of assistance in deciding the category of small opacities.

Note 8 Twelve-point scale for profusion of small opacities

The twelve categories of the complete Classification represent divisions on a continuous scale of profusion of small opacities. In practice it is no more difficult to use than the four categories of the short Classification. On the contrary, most readers find that the 12-point scale is helpful because it enables them to codify the appearances of

radiographs that are not obviously similar to the standards. For instance, categories 0/1 and 1/0 may be used to represent "suspect" pneumoconiosis.

The twelve categories range from an exceptionally "normal" radiograph at one end of the scale (0/-) to an advanced Category 3 at the other (3/+). The intermediate ten categories are arbitrary divisions of increasing profusion between these two extremes. The concept of a continuum of radiological abnormality is consistent with results from extensive epidemiological research on relationships between radiological classifications and (a) cumulative dust exposures, and (b) the dust content of post-mortem lungs; it is supported also by studies of the variability between different readers' classifications of the same radiographs.

Note 9 Determining profusion over different zones

Classification of a radiograph for profusion of small opacities requires a mental process of integrating profusion over the affected zones. Earlier Classifications referred to this process as "averaging". This might be confused with arithmetical averaging of the numbers which symbolise the categories. Therefore the word "averaging" is not used in the 1980 Classification.

Note 10 Shape and size of small opacities

The 1980 Classification distinguishes between the concepts Shape and Size of small opacities. The symbols used are the same as those defined in previous Classifications under the general heading Type.

For small opacities shape and size are both known to be important. For example, in coalworkers' pneumoconiosis, profusion of p and q opacities relates better to dust content of the lung than the profusion of size r opacities. Also men with small p opacities tend to have lower values of gas transfer of carbon monoxide. Asbestos workers with a "u" pattern have worse prognosis.

Note 11 Mixtures of shapes and sizes

The 1980 Classification permits recordings of mixtures of shapes and sizes of small opacities on the same radiograph. When, as usually occurs, only one shape (and size) is seen,

the symbol denoting that shape and size must be recorded twice on the reading sheet (for example, record p/p when only small rounded opacities of size p are seen). This rule avoids ambiguities on the written records and emphasises that not all radiographs with small opacities show mixtures of shapes.

Note 12 Pleural Thickening

Shadows are produced by thickening of the visceral and parietal layers of the pleura. Confident identification of which surface is thickened may not always be possible using the postero-anterior radiograph. But separation may be useful because there may be differing aetiologies, natural histories and relations to disability.

Pleural thickening occurs in two principal forms, the different appearances of which are illustrated in the standard radiographs. Both types may occur together. Separation of the two types is usually, but not always possible. In some cases small peripheral shadows of indeterminate type occur.

(a) Circumscribed shadows (non-calcified hyaline plaques)

The standard radiographs include an example of the characteristic appearance of these shadows. They are normally the result of thickening of the parietal pleura, and are the precursors of calcified plaques.

The extent of these shadows in relation to the length of the lateral chest wall provides a rough measure of their size. But a postero-anterior radiograph may reveal only a small proportion of their full extent. The width of the shadow measured between the inner edge and the chest wall is highly influenced by the precise position of the plaque on the chest wall, so that this measurement may not be an indication of severity.

(b) Diffuse shadows

The standard radiographs include examples of the appearances of these shadows. This is the well recognised type of pleural thickening seen also in many non-pneumoconiotic conditions. It is probably the result of thickening of the visceral pleura. It is less specific to asbestos and other

fibrous mineral dust exposure, but it is a feature in some cases of severe asbestosis. The word 'diffuse' refers to the tendency to produce a general veiling of lung parenchymal detail. In some cases the shadow produces a sharply defined line along the chest wall due to it being seen in profile (edge on). When this appearance is well developed the maximum width of the shadow is recordable. The extent is recorded as for circumscribed shadows. These two measurements may provide the best index of the severity of visceral pleural involvement.

Note 13 Diaphragm

Circumscribed thickening (plaque) of the diaphragmatic pleura is considered by some as highly specific to exposure to asbestos and other fibrous dusts. The shadows are identifiable most easily when shaped like a crater. Diffuse thickening is less specific to past dust exposure and accompanies costophrenic angle obliteration. If it is extensive, it should be recorded using the symbol id (see Note 16).

Note 14 Costophrenic angle obliteration

This is recorded separately from other pleural thickening because it frequently occurs, at least unilaterally, in those not exposed to asbestos or other dust. Costophrenic angle obliteration is, however, of special relevance in asbestos exposed people. "Leafing" of the diaphragm should not be recorded as filling of the angle even though it leads to obscuration of the costophrenic angle.

Note 15 Pleural calcification

Pleural calcification may be due to trauma, old infections, or exposure to asbestos, talc and some other minerals. The mineral dusts tend to produce bilateral changes. The calcification varies from just detectable spicules a few millimetres long to large areas covering nearly the whole lung. The large plaques have "rolled" edges and have been likened in appearance to holly leaves or candlewax.

Note 16 Symbols

It is highly desirable that the reading sheet should contain the full list of Symbols, as it is only by doing this that a check can be made of the completeness of recording. Failure to use all the Symbols and Comments in statistical analyses is likely to lead to unnecessary unexplained differences between observers.

Attention is drawn to the following points.

The Symbol ax (coalescence of small opacities) may be recorded in the presence of large opacities.

The Symbol id (ill-defined diaphragm) should only be recorded if more than one-third of one hemidiaphragm is affected.

The Symbol ih (ill-defined heart outline) should only be recorded if the length of border affected is more than one-third on the left cardiac border.

USING THE CLASSIFICATION

Efficient use of the Classification requires good viewing and recording conditions. It is assumed that readers have good vision (with the aid of spectacles if necessary). The following recommendations are particularly important for epidemiological studies.

Viewing

The viewing boxes on which the radiograph to be classified and the standards are to be displayed need to be near enough for the observer to see shadows only 1 mm in diameter, that is about 250 mm distance, but it must also be possible to view the whole radiograph from about twice this distance. The observer should be seated and not have to lean uncomfortably far forward to view the radiograph closely. (In some departments of radiology the viewing boxes are too far from the edge of the table to provide satisfactory conditions.)

The minimum number of viewing spaces on a viewing box is two and the optimum probably five. It is recommended that the radiograph to be classified is placed in the middle, and the more commonly used standard radiographs on either side. Whatever the arrangement, it is important to make it easy to select and put up the standard radiographs for comparison. Failure to do this discourages readers from regular use of standards, and this is thought to be one of the causes of inter-observer variability.

The viewing boxes must be clean. The intensity of illumination should be uniform over the whole surface and visually identical over the areas where the comparisons are being made. A pair of well matched single viewing boxes is adequate but a longer box, about 1600 mm x 400 mm is preferable.

(A box with two standard sized 1500 mm colour matched 80w fluorescent tubes mounted 100 mm behind an opal plastic screen 3 mm thick will give a very uniform and well illuminated screen of 1600 x 400 mm to hold four 400 x 400 mm radiographs.)

The general illumination in the room should be low without direct daylight. The room should be quiet, comfortable and free from distractions.

Epidemiological reading protocols

When classifying radiographs for epidemiological purposes it is essential that the reader does not consider any information about the individuals concerned, other than the radiographs themselves. Awareness of supplementary details specific to individuals can introduce bias into results. If the epidemiological objective is to make comparisons between two or more groups, then the radiographs from all groups should be mixed, and presented to the reader in random order. Failure to observe these principles may invalidate conclusions from the study.

Recording

Recording of results should be standardised and systematic. If the results are to be analysed with the help of a computer then the proforma should be designed accordingly. In all cases, it is important to make provision for recording definitely the absence of any feature not seen, and whether or not any Comments are being made on the radiograph concerned. This avoids ambiguity in the interpretation of blanks on the pro-forma. Clerical help for recording results is valuable when classifying large numbers of radiographs. The assistant should then be asked to remind the reader of failure to report the presence or absence of any feature included on the proforma.

Reading rates

The number of radiographs classifiable per unit time can vary greatly. Factors influencing reading rates include the prevalence of abnormalities on the radiographs, their technical quality, the experience of the reader, the purpose of the reading exercise, and the length of the reading session. Some readers can work comfortably for two or two-and-a-half hours with no break. With clerical help they may classify several hundred radiographs in that time if the abnormality rate is low. Others prefer to arrange their work as a series of shorter sessions (perhaps one or one-and-a-quarter hours each), with intervals for rest.

Number of readers

It is recognised that there is considerable variation in repeated readings of the same radiograph, not only from reader to reader, but also between readings by the same reader. It is strongly recommended that at least two, and preferably three independent readings are made for each radiograph.

When many radiographs are being read, intra-observer variation (that is, variation in repeated readings by the same reader) should also be assessed.

APPENDICES

These have been prepared by various experts to assist understanding of the principles and development of the Classification. Some of the views expressed may be controversial. The Appendices are not a part of the text of the ILO 1980 INTERNATIONAL CLASSIFICATION OF RADIOGRAPHS OF THE PNEUMOCONIOSES.

APPENDIX A

EQUIPMENT AND TECHNOLOGY : GUIDANCE NOTES*

It has long been recognised that the exposures received by radiographs of the chest have a marked influence on the radiographic appearance of lesions of pneumoconiosis. Consequently, readers of radiographs which demonstrate evidence of pneumoconiosis will find difficulty in applying the ILO 1980 Classification for reporting the characteristics of this disease unless the exposures used in making the radiographs are maintained within an optimum range. Application of the system will only be as satisfactory as radiographic technical quality is good.

The importance of image density and radiation exposure to technical excellence in chest radiography is difficult to over-emphasise. It is known that by far the greatest causes of poor technical quality in chest radiographs (well over ninety percent) are over-exposure and under-exposure, unsatisfactory gross image contrast, poor screen-film contact and fog. Medical training should include the fundamentals of radiographic technique so that physicians are able to determine the causes of poor technical quality when encountered. Some technologists work without adequate supervision by knowledgeable physicians, and, until recently, convenient densitometric instruments have not been available with which the quality of each radiograph can be measured at the time it is made.

What is clearly needed are (1) improved training programmes in radiographic technology for both physicians and technologists; (2) closer liaison between physicians and technologists in

* Prepared by H. Bohlig, Y. Hosoda, G. Jacobson (deceased) and R. Morgan.

day-to-day practice, and (3) widespread use of the recently available pocket densitometers to determine the technical quality of each chest radiograph when it is made.

Using subjective criteria, the most desirable chest radiograph for the detection of abnormalities of the pneumoconioses is one in which the pulmonary parenchymal markings are shown in greatest detail, the costopleural junctions are clearly seen, and the major pulmonary vessels are visible through the cardiac shadow. While it is important to visualise the details of the mediastinal structure as well, this is usually not possible on a radiograph made for assessment of pneumoconiosis.

On physical grounds, a radiograph of satisfactory technical quality may be defined as one in which the exposure has been such that the optical densities of the images of interest fall between 0.3 and 1.7 and in which the difference in optical density between the darkest image of interest and the lightest is 1.0 or more. The inherent contrast (i.e. the density vs log exposure gradient) of radiographs falls off rapidly as optical densities descend below 0.3 and hence, image quality becomes increasingly unsatisfactory as this occurs. Above an optical density of 1.7, the inherent contrast of radiographs remains good but extraneous light entering the observer's eyes from light sources other than the x-ray viewing boxes tends to impair the contrast of the radiographic image when projected on the retinae. Hence, technical quality deteriorates for images having optical densities much above 1.7 density units. (See also Appendix C, paragraph 8).

Equipment

The installation and maintenance of the radiographic equipment is of the greatest importance. The electric power source should be independent of other users. It must be of adequate capacity, for example, having a resistance of not more than 0.1 Ω and should be subject to no more than 5 per cent fluctuation. The voltage drop between the main supply and the x-ray unit when the unit is at its maximum output should not exceed 10 per cent. The radiographic unit must be carefully calibrated at the time of installation and should be recalibrated periodically. Preventive maintenance at regular intervals is strongly recommended.

The generator should have a minimum capacity of 300 mA at 125 kV. The generator must be full-wave rectified. It should be equipped with an accurate timer (± 1 per cent) capable of

minimum exposure of no more than 10 ms. Ideally, three-phase generators should be used for both fixed and mobile units. However, in the case of mobile units, when it may not be feasible to use three-phase generators, condensor-discharge units may be the apparatus of choice.

A rotating anode tube is essential. It should have as small a focal spot as feasible for the anticipated load, but in no instance should this exceed 2 mm in diameter.

The total filtration, added and inherent, of the primary x-ray beam should be the equivalent of 2 mm of aluminium.

The radiation should be confined by means of a collimator to the portion of the subject to be examined. This will not only decrease radiation hazard, but also will improve detail by reducing scattered radiation. The collimator should have adjustable diaphragms, a light beam for centring, and be designed so that the projected field cannot exceed the size of the film. Evidence of collimation should be visible at the edges of the film as "cone cuts".

Medium speed (par speed) intensifying screens should be used. They provide the best compromise between sharp definition and short exposure. The cassettes in use should contain screens of the same speed. Both films and screens should be tested and matched for speed, and cassettes should be checked periodically for screen cleanliness, contact and defects.

The x-ray film should be of a general purpose type and of medium sensitivity. High speed film is not recommended. To improve collimation, the film should be no larger than needed to cover both lungs, including the costophrenic angles.

When using kilovoltages of 80 and above, reduction of secondary radiation by a grid or other means is essential. A 10:1, 100-line per inch fixed grid or an air-gap of 200 mm with a 2.5 m focal spot-film distance may be used.

Automatic processing should be employed whenever possible. If only manual processing is available, a constant time-temperature technique must be followed meticulously. An improper exposure cannot be corrected by improper processing.

Technique

Correct centring of the x-ray tube and careful positioning of the subject are of great importance for the proper visualisation of anatomic structures and comparison of serial examinations. For the PA projection, the x-ray tube should be centred to the centre of the film and the x-ray beam directed horizontally. The shoulders should be positioned so that the scapulae are outside the lung fields. The exposure should be made at full inspiration and immediately after this has been reached, to avoid the Valsalva effect. It is desirable, but not essential, that all the clothes above the waist be removed.

The focal spot-film distance should be fixed at 1.8 m (6 feet) and should not be less than 1.5 m (5 feet).

For reasons given above, a variable high kilovoltage, constant milliampere-second technique is recommended. Exposure factors employed may vary somewhat with each generator and tube. The highest range of kilovoltage and shortest range of milliamperes-seconds obtainable should be used. For the average subject, with an AP chest diameter between 210 and 230 mm, the usual exposure factors will be 5 mAs at approximately 125 kV. The recommended exposure time is 1/60 (0.017) s; not exceeding 1/30 (0.03) s. (Based on 60 Hz current. For 50 Hz current, exposure times are 1/50 (0.02) and 1/25 (0.04) s respectively.)

With larger diameters of the chest, additional exposure is obtained by increasing the kilovoltage. The milliampere-second product is increased only when the kilovoltage required to give a proper exposure exceeds the capability of the generator or x-ray tube. With focal spot-film distances of less than 1.8 m (6 feet) the technique should be adjusted by decreasing the milliampere-second product.

When using a lower kilovoltage technique, the exposure factors for an average subject will be approximately 300 mA, 0.05 s (15 mAs) at 75 kV. For larger subjects, greater amounts of radiation are obtained by increasing either the milliampere-second product or the kilovoltage.

It is recognised however that the question of optimal radiographic technique remains a controversial matter among experts internationally.

Physical criteria for excellence of technical quality in chest radiographs

A. Optical density

1. Hilar regions should exhibit a minimum of 0.2 units of optical density above fog.

2. Parenchymal regions should exhibit a maximum of 1.8 units of optical density above fog.

B. Gross image contrast* should fall within the range of 1.0 and 1.4 units of optical density.

C. X-rays tube potentials and use of grids

1. Potentials of 70 to 100 kVp: use grids for all subjects whose posteroanterior dimension exceeds 220 mm.

2. Potentials over 100 kVp: use grid for all subjects.

D. Exposure time

Not greater than 0.1 s, and preferably 0.05 s or less.

E. Film-screen combination

Use medium-speed films and screens to assure adequate image detail. Good screen-film contact is essential with periodic testing mandatory.

F. Processing

Maintain strength and temperature of processing chemicals within limits recommended by manufacturer.

G. Assumptions

1. Cleanliness of films and screens and of processing fluids and equipment is maintained.

2. Care in subject positioning is taken.

3. Subject movement is prevented.

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* The difference in optical density between the darkest segment of the lung parenchyma and the lightest portions of the hilar regions.

APPENDIX B

CHANGES FROM THE ILO U/C 1971 CLASSIFICATION*

Title and Scope

U/C is omitted from the title. This stood for UICC/Cincinnati and was included in the 1971 title to draw attention to its incorporation of the UICC/Cincinnati 1970 Classification devised to cover asbestosis which was not covered in the ILO 1968 scheme. The Classification now covers all types of pneumoconiosis so reference to specific types is no longer necessary.

Object and Uses of the Classification

These have been separated and slightly modified.

General Instructions

The wording has been clarified and a reminder is added to record other conditions not thought to be due to pneumoconiosis. This additional information in the Symbols and Comments can assist in resolving some discrepancies between observers.

Recording Radiographic Quality

This is now formally part of the Classification. This permits comparisons of the general quality of radiographs in different surveys. It also allows exclusion from analysis of data referring to radiographs of quality too poor to permit satisfactory classification.

Use of Standard Radiographs

In earlier versions of the Classification it was not always clear whether the appearances to be classified were defined primarily by the standard radiographs or by the text which describes the system. The 1980 Classification states specifically, for each feature, which method of definition has precedence and which should be regarded as providing supplementary information.

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* Prepared by J.C. Gilson and C.E. Rossiter.

Profusion of small opacities

The degree of obscuration of the normal vascular pattern is no longer included as part of the definition of small opacities as profusion is now defined by comparison with the standard radiographs. However, it is included in Note 7.

Profusion and Type (Shape)

Experience using the 1971 scheme has shown that while some radiographs are classified consistently by all readers as 'rounded' and others as 'irregular', there are many radiographs for which some readers record 'rounded' and others 'irregular'. There are also radiographs where both types are recorded. This has caused serious difficulties in interpretation and analysis.

The 1980 Classification provides a means of reducing these difficulties and obtaining more information without loss of continuity with the 1971 scheme and without the introduction of new standards or definitions of the types of opacities.

Profusion

In the 1971 scheme recording of combined profusion was optional. In the 1980 scheme a single measure of profusion is recorded first using the appropriate standard radiographs. This places emphasis on the usually more important index, because the profusion of small opacities relates much better to intensity of past dust exposure than does the type of opacity.

The twelve-point scale for measuring profusion is retained unaltered except that the symbol 3/+ replaces the earlier symbol 3/4. (There is no category 4.)

The wording of the method used for deciding on the category of profusion has been amended to remove any suggestion that arithmetical averaging of profusion in different zones is required.

Type (Shape and Size)

In the 1971 Classification the Type referred to a complex of shape (roundness or irregularity) of the opacity and its size. Type and size were defined by standard radiographs and for

rounded opacities (p, q, r) by an approximate measurement of the diameter (up to 1.5 mm; 1.5 - 3 mm; up to 10 mm). Dimensions for the irregular opacities were not provided but it was intended in the UICC/Cincinnati 1970 Classification that s, t, u irregular opacities should approximately 'match' the p, q, r rounded opacities for size.

In the 1980 scheme shape and size are defined by the standard radiographs using the same letters p, q and r for rounded opacities and s, t and u for irregular opacities. However, in the text s, t and u are given approximate sizes, in terms of width of opacity, to formalise the match of the rounded opacities:

s = width up to about 1.5 mm.

t = width exceeding 1.5 mm and up to about 3 mm.

u = width exceeding 3 mm and up to about 10 mm.

It is required to use two of the letters describing shape and size, thus providing a means for recording systematically the shape and size of small opacities which are a mixture of rounded and irregular. As two letters have to be used, a repetition of the same letter affirms positively that the opacities are all or predominantly of one shape and one size.

Rounded and irregular opacities clearly have different significance in relation to the type of mineral dust to which exposure has occurred. For example, coal produces mainly rounded opacities and asbestos mainly irregular. Future research will show whether the degree of roundness - irregularity relates to prognosis in minerals producing a mixed pattern.

In summary: the 1980 scheme provides for recording a single measure of profusion on a 12-point scale and for recording opacities of different shapes and/or sizes, while retaining a high measure of comparability with the 1971 scheme.

Large Opacities

No changes are made in the definition of A, B and C, but the qualifying words well defined (wd) and ill defined (id) are no longer used.

Pleural abnormalities

These are now recorded separately right (R) and left (L). This was recommended because in practice each is assessed separately and the recording of the two independently provides more information for no extra effort.

Thickening; Chest Wall

Type

Pleural thickening is divided into two types, circumscribed (plaques) and diffuse, and their appearances are exemplified in the standard radiographs.

Width

The definitions have been slightly altered to bring them in accord with other dimensions in the classification. The word 'grade' is omitted. It is also made clear that the width is measured from the inner line of the chest wall to the inner margin of the shadow seen most sharply at the parenchymal-pleural boundary (the cross-sectional width) and not its less well defined edge extending over the surface of the lung. The classification also requires the presence of pleural thickening seen face on to be recorded even if the width can not be measured.

Extent

An extra subdivision of extent has been included to provide more information about lesser changes. The word 'grade' has been omitted. Pleural thickening seen face on is included in the assessment of extent:

1. total length equivalent to up to one quarter of the projection of the lateral chest wall;

2. total length exceeding 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.

In the 1971 scheme it was not clear whether pleural thickening on the diaphragm - pleural plaques - should be added to that on the chest wall in assessing extent. In the 1980 scheme

they are specifically excluded from the assessment of extent, but their presence is recorded.

Ill-defined Diaphragm and Cardiac Outline

These are no longer recorded in the main Classification but their presence noted without grades or lower limit standards in the Symbols, but using as lower limits the definitions in the 1971 Classification.

They were omitted from the main Classification because of their relatively low prevalence and great rarity as the sole evidence of exposure to dusts.

Symbols

The use of all Symbols is now obligatory. All are now two letters only to facilitate recording and computing. The additions and modifications are:

fr = fractured rib(s)

id = ill defined diaphragm

ih = ill defined heart outline

kl = septal (Kerley) lines - previously k

pi = thickening of interlobar fissure

rp = rheumatoid pneumoconiosis - previously rl

tb = tuberculosis (excluding primary focus). This replaces tba and tbu.

Comments

Comments were optional in previous Classifications. They should now always be added; for example, when there are technical faults making it difficult or impossible to classify the films adequately; also when there are features which might be included or excluded in the Classification by other observers. Thus, causes of big observer variation might become identifiable.

APPENDIX C

RECOMMENDATIONS FOR FUTURE RESEARCH*

Discussions at the meetings of experts which advised the ILO on the preparation of the 1980 Classification were based on wide experience in the use of earlier versions of the Classification. The experts identified several areas where additional information would be expected to lead to further improvements. Recommendations for continuing research on the classification of radiographic appearances of the pneumoconioses included the following.

1. Assessment of the 1980 Classification

Changes in the present (1980) Classification, as compared with the ILO U/C 1971 Classification, have been summarised in Appendix B. Quantitative studies aimed at describing the effects of changes in the procedures will assist interpretation of future pneumoconiosis statistics and research reports. Whenever possible, designs for such studies should be specific to particular changes that have been adopted.

2. Standard "boundary" radiographs

The 1980 standard radiographs show patterns of profusion of small opacities which are typical of appearances classifiable as near the middle of the four main categories defined by the scheme (so-called "mid-category standards"). It is possible that classification might be easier, and that precision would be increased, if there were available standard radiographs which define the three boundaries between the four main categories. The existence of such "boundary standards" would constitute an improvement in the definitions of categories of profusion, and would be particularly useful in helping to distinguish between categories 0/1 and 1/0. Some experts feel that, in the first place, research on the usefulness of boundary radiographs should be concentrated on this region of the continuum of abnormality.

International trials which preceded the selection of the 1980 set of "mid-category standards" identified several radiographs which might be regarded as "boundary standards": expert opinion was divided fairly evenly on whether they

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Prepared by J.C. Gilson and M. Jacobsen

should be classified into one or the other sub-category adjacent to a boundary between two main categories. It is desirable to continue research on boundary standards to get better knowledge on how they are to be used. Each experimental set will be accompanied by suggestions on how they may be used and tested.

3. Sectional and composite standard radiographs

Some readers find that the present standard radiographs are inconvenient in practice because of their size and number. There have been experiments with small copies of sections of standard radiographs, and with composite reproductions of these copies. It is recommended that this work should continue. Tests are required to determine the optimal area for a section and to assess the effects of using such standards rather than the present set.

4. Profusion of small opacities

The 1980 Classification requires that the profusion of small opacities should be determined by comparison with the standard and by integrating the profusion seen over the affected zones of the lung. It includes provision for indicating which of (six) zones are affected. It may be easier, and more reproducible, to record profusion separately for each of the four quadrants of the lung. Composite standard radiographs incorporating images of the four quadrants might assist such a change in procedure. It is recommended that the suggested change in the method for recording profusion might be tested in parallel with research on the production of composite standard radiographs.

5. Large opacities

Several reports indicate surprisingly poor between-reader agreement in recording the presence of large opacities. Identification and systematic documentation of the reasons for such inconsistency would be valuable.

6. Pleural thickening

It is difficult to distinguish clearly between abnormal thickening of the parietal and visceral layers of the pleura, and there are problems of nomenclature. Yet the distinction may be important pathologically, and it is thought by some to have aeteological significance. Further consideration needs to be given to how to improve the method for recording radiological evidence of pleural abnormalities. (See also Note 12.)

7. Shape and size of small opacities

The 1980 Classification clarifies the difference between the concepts shape and size of small rounded opacities. There is provision also for recording the presence of mixtures of shapes (and sizes). This opens the way for further research on the prognostic and aetiologic significance of different combinations of shapes. The new convention will also facilitate studies of whether different sizes of small irregular opacities represent real pathological distinctions or whether they are merely radiological reflections of different degrees of profusion of the smallest lesions recognisable as irregular opacities.

8. Technical quality of radiographs

The present system for recording technical quality does not include a standardized notation to indicate the nature or suspected cause of the inadequacies observed. Yet it is known that readers differ in their assessments of quality, and that their assessments affect their classifications. More studies are required to determine the way in which different imperfections influence readers' use of various parts of the Classification, and on how their judgement of quality can be recorded in a standard way. Use of quantitative measurements of film density may provide an objective index to assist quality assessments. This could lead to raising radiographic standards and to a better understanding of factors influencing subjective assessments of radiographic quality.

9. Non-pneumoconiotic shadows

The General Instructions for the use of the 1980 Classification (page 3) preserves the principle from earlier Classifications that radiographic appearances regarded as "definitely not pneumoconiosis" are not to be classified; but the use of Symbols and Comments are now obligatory in such cases. Differences between readers in what they regard as "definitely not pneumoconiosis" and "probably the result of some other aetiology" should be studied.

Some experts believe that application of the Classification for epidemiological purposes would be more objective if the descriptive notation defined by the Classification were used in all cases where the shadows seen are consistent with the appearances of the standard radiographs and the definitions in the text (pp. 4 to 10), irrespective of whether the appearances are thought to be due to pneumoconiosis. Obligatory use of Symbols

and Comments would ensure that a reader's opinion that the shadows classified are not due to dust exposure would be recorded and available for statistical analysis. It is recommended that research should continue on this matter.

APPENDIX D

READING SHEET

The section on USING THE CLASSIFICATION (pp 18 to 20) gives guidance on the conditions and procedures which are particularly important for epidemiological studies involving the radiology of the pneumoconioses. An example of a reading sheet which may be used to record systematically all the information required by the Complete Classification is provided as a further aid. The word example is emphasised. Alternative designs may often be appropriate for particular applications.

The sheet illustrated can be used easily to transfer data into a form suitable for machine processing. If this intended then it will be helpful to use capital letters (rather than lower-case letters) to record all features and Symbols. Permissible symbols are indicated in brackets ( ), using lower-case letters consistent with the text describing the Classification.

The letters Y and N are used on the sheet to represent the words "Yes" and "No". Alternative symbols may be desirable if reading sheets are prepared in languages other than English.

Note that there may be no blanks to the right of the dashed line. This provides a useful visual aid to verify that a radiograph has been classified properly before it is removed from the viewing box.

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* Prepared by M. Jacobsen and C.E. Rossiter.

READING SHEET

* suitable for use with the ILO 1980 INTERNATIONAL CLASSIFICATION OF RADIOGRAPHS OF THE PNEUMOCONIOSES

IDENTIFICATION DATA

FILM

READER

READING DATE

FILM QUALITY	Grade (1, 2, 3, 4)	
	Comment made (Y, N)	
SMALL OPACITIES	Profusion (12-point scale)	
	Extent	R L
	(✓ appropriate zones)	
	Shape and size (2 of p,q,r,s,t,u; or repeated symbol)	
LARGE OPACITIES	Presence (Y, N)	
	Size (A, B, C)	
PLEURAL THICKENING CHEST WALL - CIRCUMSCRIBED [PLAQUES]	Presence (Y, N)	
		R L
	Face on (Y, N)	
	Width (a, b, c)	
	Extent (1, 2, 3)	
- DIFFUSE	Presence (Y, N)	
	Face on (Y, N)	
	Width (a, b, c)	
	Extent (1, 2, 3)	
DIAPHRAGM	Presence (Y, N)	
	Site (✓ site)	
COSTOPHRENIC ANGLE OBLITERATION	Presence (Y, N)	
	Site (✓ site)	
PLEURAL CALCIFICATION	Presence (Y, N)	
		R L
CHEST WALL	Site (✓ site)	
DIAPHRAGM	Site (✓ site)	
OTHER	Site (✓ site)	
	Extent (1, 2, 3)	
SYMBOLS	Used ? (Y, N)	
up to 6† from	{ ax bu ca cn co cp cv di ef em es fr hi ho id ih kl od pi px rp tb }	

(† Record further symbols in COMMENTS section)

COMMENTS (Write comments)	Made ? (Y, N)	

* NO BLANKS ARE PERMISSIBLE TO THE RIGHT OF THE DASHED LINE

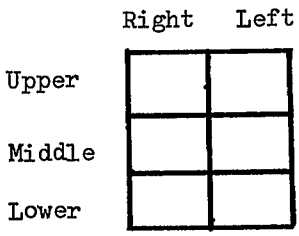
APPENDIX E

DESCRIPTIONS OF STANDARD RADIOGRAPHS*
(1980 Revision)

The standard radiographs accompanying the ILO 1980 International Classification of Radiographs of the Pneumoconioses consist of 22 films.

Two radiographs illustrate the appearance classifiable as category 0/0 for profusion of small opacities.

Eighteen radiographs depict appearances classifiable as categories 1/1 through 3/3 for profusion and p/p through t/t for shape and size of small opacities and as categories A through C for size of large opacities. Descriptions of these radiographs are given in the accompanying tables, with notation defined in the Classification and with additional Comments as appropriate. The site of small opacities is shown by a tick in the boxes symbolizing the zones of the lungs as follows:



The two remaining radiographs are composite reproductions of sections. One depicts the increasing profusion of irregular small opacities of size "u". The other illustrates various types of pleural abnormality.

Note that the Technical Quality of eight of these radiographs has been judged as meriting grade 2 only. This is because the international trials which preceded the selection of the 1980 set of standards did not yield any better quality examples of the features concerned.

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* Prepared by C. Amoudru, H. Bohlig, J.A. Dick, J.C. Gilson, A. Minette and R. Morgan

DESCRIPTIONS OF STANDARD RADIOGRAPHS

1980 STANDARD RADIOGRAPHS SHOWING	TECHNICAL QUALITY	SMALL OPACITIES: PROFUSION	SMALL OPACITIES: SHAPE-SIZE	SMALL OPACITIES: EXTENT	LARGE OPACITIES	PLEURAL THICKENING: CHEST WALL: CIRCUMSCRIBED (PLAQUES)	PLEURAL THICKENING: CHEST WALL: DIFFUSE	PLEURAL THICKENING: DIAPHRAGM	PLEURAL THICKENING: COSTOPHRENIC ANGLE OBLITERATION	PLEURAL CALCIFICATION	SYMBOLS	COMMENTS
0/0 (example 1)	1	0/0	-	-	No	No	No	No	No	No	None	Vascular pattern is well illustrated.
0/0 (example 2)	1	0/0	-	-	No	No	No	No	No	No	None	Also shows vascular pattern, but not as clearly as example 1.
1/1; p/p	1	1/1	p/p	R L ✓ ✓ / ✓ ✓ / ✓ ✓	A	No	No	No	No	No	rp-	Rheumatoid pneumoconiosis in left lower zone. Small opacities are present in all zones, but the profusion in the right-upper zone is typical of (some would say a little more profuse than) that classifiable as category 1/1.
2/2; p/p	2	2/2	p/p	R L ✓ ✓ / ✓ ✓ / ✓ ✓	No	No	No	No	No	No	pi; tb.	Quality defect: radiograph is too light.
3/3; p/p	1	3/3	p/p	R L ✓ ✓ / ✓ ✓ / ✓ ✓	No	No	No	No	Yes R L ✓	No	ax.	None
1/1; q/q	1	1/1	q/q	R L ✓ ✓ / ✓ ✓ /	No	No	No	No	No	No	None	Illustrates profusion 1/1 better than shape or size.
2/2; q/q	1	2/2	q/q	R L ✓ ✓ / ✓ ✓ / ✓ ✓	No	No	Yes R L ✓ ✓ Width: a 1 Extent: a 1	No	Yes R L ✓ ✓	No	None	None

DESCRIPTIONS OF STANDARD RADIOGRAPHS (continued)

1980 STANDARD RADIOGRAPHS SHOWING	TECHNICAL QUALITY	SMALL OPACITIES			LARGE OPACITIES	PLEURAL THICKENING				PLEURAL CALCIFICATION	SYMBOLS	COMMENTS
						CHEST WALL		DIAPHRAGM	COSTOPHRENIC ANGLE OBLITERATION			
		PROFUSION	SHAPE-SIZE	EXTENT		CIRCUMSCRIBED (PLAQUES)	DIFFUSE					
3/3; q/q	2	3/3	q/q	R L ✓ ✓ ✓ ✓ ✓ ✓	No	No	No	No	No	No	pi.	Quality defects: poor definition of pleura and cut basal angles.
1/1; r/r	2	1/1	r/r	R L ✓ ✓ ✓ ✓ 	No	No	No	No	Yes R L ✓	No	None	Quality defect: subject movement. Profusion of small opacities is more marked in right lung.
2/2; r/r	2	2/2	r/r	R L ✓ ✓ ✓ ✓ ✓ ✓	No	No	No	No	No	No	None	Quality defects: radiograph too light and contrast too high. The heart shadow is slightly displaced to the left.
3/3; r/r	1	3/3	r/r	R L ✓ ✓ ✓ ✓ ✓ ✓	No	No	No	No	No	No	ax; ih.	None
1/1; s/t	2	1/1	s/t	R L ✓ ✓ ✓ ✓ ✓	No	No	No	No	No	No	kl.	Quality defect: cut bases. Kerley lines in lower right zone.
2/2; s/s	2	2/2	s/s	R L ✓ ✓ ✓ ✓	No	No	No	No	No	No	em.	Quality defect: distortion of bases due to shrinking. Emphysema in upper zones.

DESCRIPTIONS OF STANDARD RADIOGRAPHS (continued)

1980 STANDARD RADIOGRAPHS SHOWING	TECHNICAL QUALITY	SMALL OPACITIES			LARGE OPACITIES	PLEURAL THICKENING		DIAPHRAGM	COSTOPHRENIC ANGLE OBLITERATION	PLEURAL CALCIFICATION	SYMBOLS	COMMENTS
		PROFUSION	SHAPE-SIZE	EXTENT		CHEST WALL: CIRCUMSCRIBED (PLAQUES)	CHEST WALL: DIFFUSE					
3/3; s/s	2	3/3	s/s	R L ✓ ✓ ✓ ✓ ✓ ✓	No	No	Yes R L ✓ ✓ Width: a; a; Extent: 3; 3;	No	No	No	ho; ih; pi.	Quality defect: radiograph is too light. Honeycomb lung appearance is not marked.
1/1; t/t Costophrenic angle obliteration	1	1/1	t/t	R L ✓ ✓ ✓ ✓	No	No	Yes R L ✓ ✓ Width: a; a; Extent: 2; 2;	No	Yes R L ✓	Yes R L ✓ Extent: 2	None	This radiograph defines the lower limit for costophrenic angle obliteration. Note shrinkage in lower lung fields.
2/2; t/t	1	2/2	t/t	R L ✓ ✓ ✓ ✓ ✓ ✓	No	No	Yes R L ✓ ✓ Width: a; a; Extent: 1; 1;	No	No	No	ih.	Pleural thickening is present in the apices of the lung.
3/3; t/t	1	3/3	t/t	R L ✓ ✓ ✓ ✓ ✓ ✓	No	No	No	No	No	No	hi; ho; id; ih; tb.	None
1/1; u/u 2/2; u/u 3/3; u/u	-	-	-	-	-	-	-	-	-	-	-	This composite radiograph illustrates the mid-categories of profusion of small opacities classifiable for shape and size as u/u.
A	2	2/2	p/q	R L ✓ ✓ ✓ ✓ ✓ ✓	A	No	No	No	No	No	None	Quality defects: radiograph is too light and pleural definition is poor.

DESCRIPTIONS OF STANDARD RADIOGRAPHS (continued)

1980 STANDARD RADIOGRAPHS SHOWING	TECHNICAL QUALITY	SMALL OPACITIES			LARGE OPACITIES	PLEURAL THICKENING				PLEURAL CALCIFICATION	SYMBOLS	COMMENTS
		PROFUSION	SHAPE-SIZE	EXTENT		CHEST WALL		DIAPHRAGM	COSTOPHRENIC ANGLE OBLITERATION			
						CIRCUMSCRIBED (PLAQUES)	DIFFUSE					
B	1	1/2	p/q	R L ✓ ✓ ✓ ✓ ✓ ✓	B	No	No	No	No	No	ax; co.	Definition of pleura is slightly imperfect.
C	1	2/1	q/t	R L ✓ ✓ ✓ ✓ ✓ ✓	C	No	No	No	No	No	bu; di; em; es; hi; ih.	The small opacities are difficult to classify because of the presence of the large opacities. Note the left costophrenic angle obliteration. This is not classifiable because it does not reach the lower limit defined by the standard radiograph 1/1; t/t.
Pleural thickening (circumscribed)	-	-	-	-	-	Yes	No	No	No	No	-	The pleural thickening present face on, is of indeterminate width, and extent 2.
Pleural thickening (diffuse)	-	-	-	-	-	No	Yes	No	No	Yes	-	The pleural thickening present in profile, is of width a, and extent 2. Not associated small calcifications.
Pleural thickening (calcification) diaphragm	-	-	-	-	-	No	No	Yes	No	Yes	-	Circumscribed, calcified pleural thickening of extent 2.
Pleural thickening (calcification) chest wall	-	-	-	-	-	Yes	No	No	No	Yes	-	Calcified and uncalcified pleural thickening present face on, is of indeterminate width, and extent 2.

APPENDIX F

DIAGRAMS*

The diagrams on the following pages are intended only to provide a pictorial aide memoire to the definitions of the Complete Classification and they do not subsitute for the standard radiographs or the written text.

The diagrams representing the symbols provide simple reminders of the symbols to be used, particularly for those whose main language is not English. It is recognised that these diagrams can not possibly illustrate all the manifestations of many of the symbols, for example ca, cp, od.

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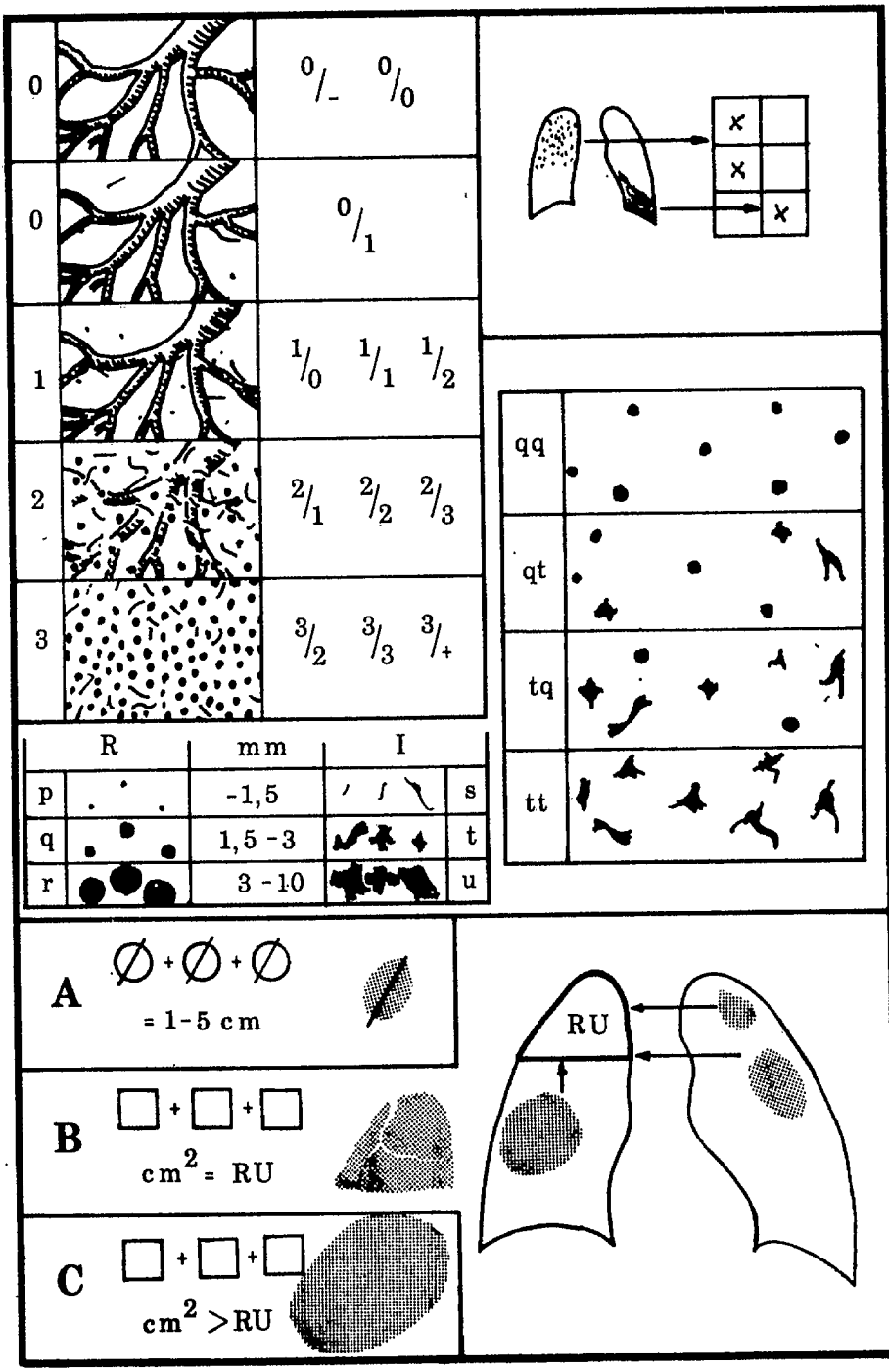
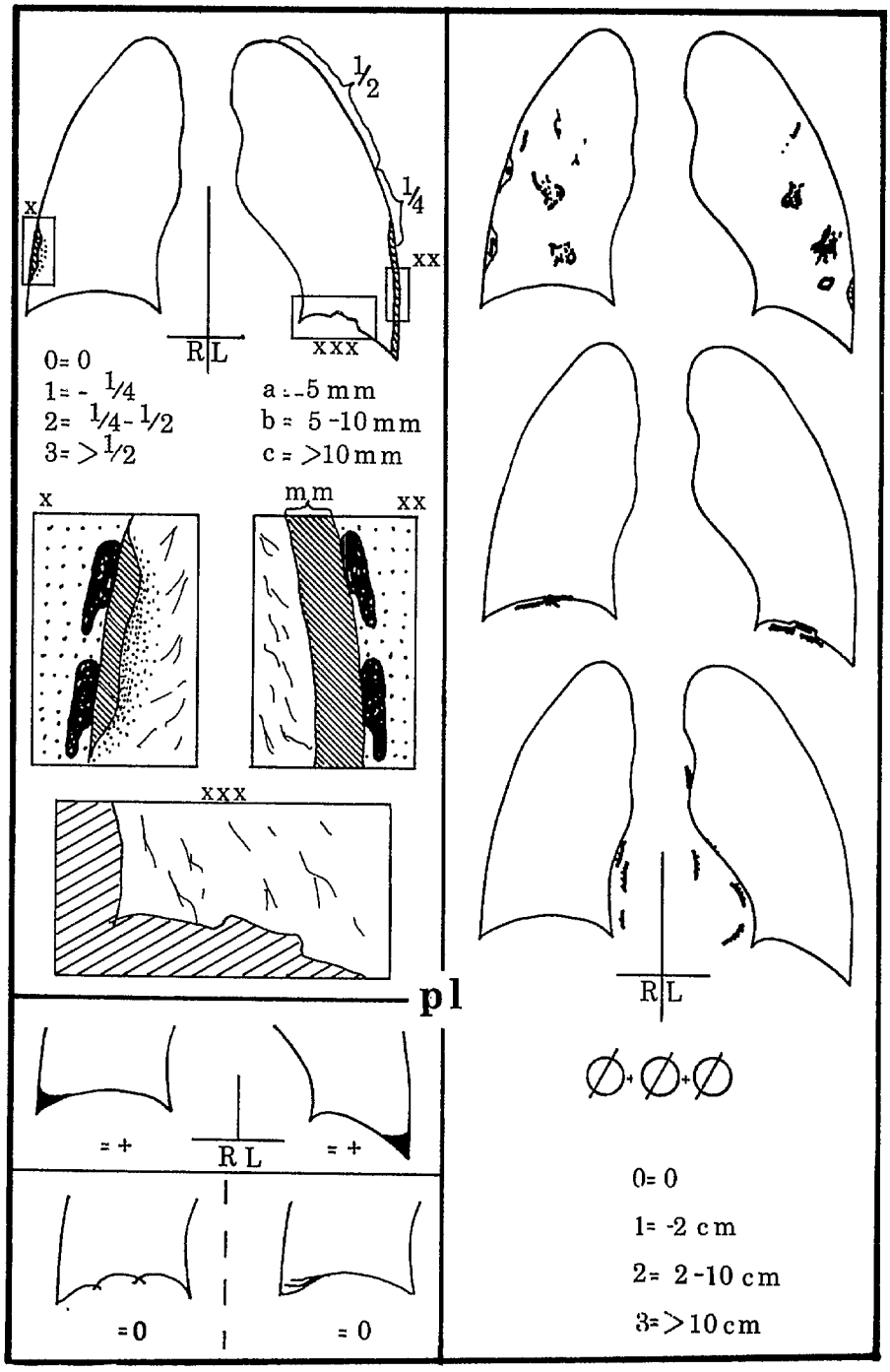
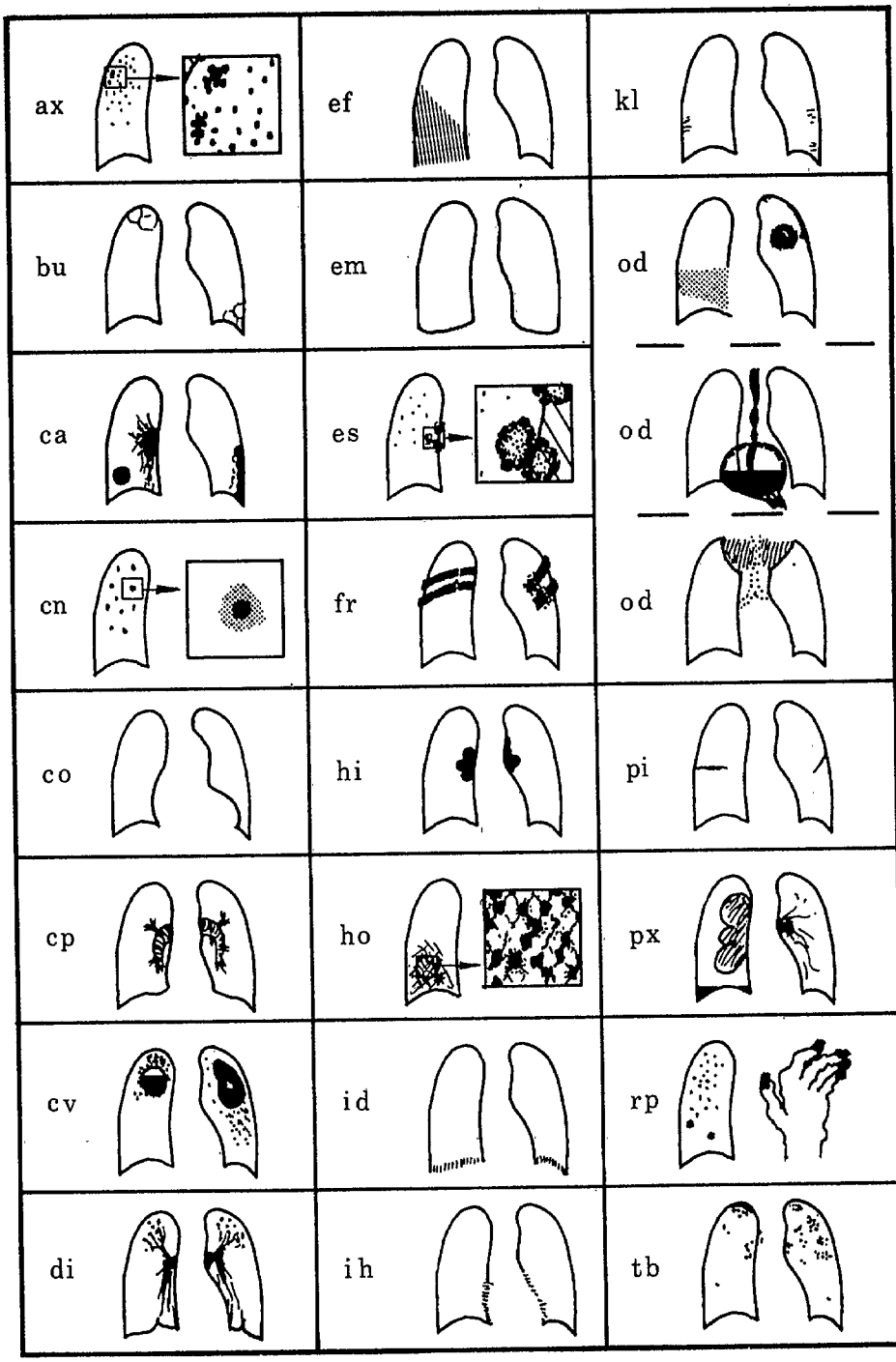
* Prepared by H. Bohlig and R. Kiviluoto.


0
0
1
2
3
0/- 0/0
0/1
1/0 1/1 1/2
2/1 2/2 2/3
3/2 3/3 3/+
R
mm
I
p
q
r
-1,5
1,5 -3
3 -10
s
t
u
qq
qt
tq
tt
A
= 1-5 cm
B
cm2 = RU
C
cm2 >RU
RU


x
1/2
1/4
xx
xxx
R L
0= 0
1= - 1/4
2= 1/4 - 1/2
3= > 1/2
a = -5 mm
b = 5 -10 mm
c = >10 mm
x
mm
xx
xxx
pl
= +
R L
= +
=0
= 0
R L
0= 0
1= -2 cm
2= 2 -10 cm
3= >10 cm


ax
ef
kl
bu
em
od
ca
es
od
cn
fr
od
co
hi
pi
cp
ho
px
cv
id
rp
di
ih
tb

APPENDIX G

ILO 1980 INTERNATIONAL CLASSIFICATION OF RADIOGRAPHS OF THE PNEUMOCONIOSES

SUMMARY OF DETAILS OF CLASSIFICATION

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		The category of profusion is based on assessment of the concentration of opacities by comparison with the standard radiographs.
		0/- 0/0 0/1 1/0 1/1 1/2 2/1 2/2 2/3 3/2 3/3 3/+	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.
	Extent	RU RM RL LU LM LL	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.
	Shape and Size		
	rounded	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. p = diameter up to about 1.5mm. q = diameter exceeding about 1.5mm and up to about 3mm. r = diameter exceeding about 3mm and up to about 10mm.
	irregular	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 appearances on standard radiographs. s = width up to about to 1.5mm. t = width exceeding about 1.5mm and up to about 3mm. u = width exceeding 3mm and up to about 10mm.
	mixed	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 of another shape and size is recorded after the oblique stroke.

FEATURES		CODES	DEFINITIONS
Large opacities		A B C	The categories are defined in terms of the dimensions of the opacities. Category A - an opacity having a greatest diameter exceeding about 10mm and up to and including 50mm, or several opacities each greater than about 10mm, the sum of whose greatest diameters does not exceed about 50mm. 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 exceeds the equivalent of the right upper zone.
PLEURAL ABNORMALITIES			
Pleural Thickening			
Chest wall	Type		Two types of pleural thickening of the chest wall are recognised: 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-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 5mm. b = maximum width over about 5mm and up to about 10mm. c = maximum width over about 10mm.
	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, 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 exceeding 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	Presence	Y N	A plaque involving the diaphragmatic pleura is recorded as present (Y) or absent (N), separately for the right (R) and left (L) thorax.
	Site	R L	

FEATURES		CODES	DEFINITIONS
Costophrenic angle obliteration	Presence	Y N	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 this obliteration is defined by a standard radiograph.
	Site	R L	If the thickening extends up the chest wall then both costophrenic angle obliteration and pleural thickening should be recorded.
Pleural calcification			The site and extent of pleural calcification are recorded separately for the two lungs, and the extent defined in terms of dimensions.
	Site		
	chest wall	R L	
	diaphragm	R L	
	other	R L	"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 20mm, or a number of such areas the sum of whose greatest diameters does not exceed about 20mm.
			2 = an area of calcified pleura with greatest diameter exceeding about 20mm and up to about 100mm, or a number of such areas the sum of whose greatest diameters exceeds about 20mm but does not exceed about 100mm.
			3 = an area of calcified pleura with greatest diameter exceeding about 100mm, or a number of such areas whose sum of greatest diameters exceeds about 100mm.
SYMBOLS			It is to be taken that the definition of each of the Symbols is preceded by an appropriate word or phrase such as "suspect", "changes suggestive of", or "opacities suggestive of", etc.
		ax	- coalescence of small pneumoconiotic opacities
		bu	- bulla(e)
		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 rib(s)
		hi	- enlargement of hilar or mediastinal lymph nodes
		ho	- honeycomb lung
		id	- ill-defined diaphragm
		ih	- ill-defined heart outline
		kl	- septal (Kerley) lines
		od	- other significant abnormality
		pi	- pleural thickening in the interlobar fissure or mediastinum
		px	- 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 which could be thought by others to have been due to pneumoconiosis; also to identify radiographs for which the technical qunlity may have affected the reading materially.