Resources Safety & Health
Queensland

Mine Dust Lung Disease Clinical Pathways Guideline

Purpose

The Mine Dust Lung Disease (MDLD) Clinical Pathways Guideline (the Guideline) documents the recommended process for follow-up investigation of mine and quarry workers with abnormal screening results on respiratory examinations.

The Guideline aims to assist in reaching a diagnosis on potential cases of MDLD in a reasonable timeframe, reducing worker anxiety and providing more consistent outcomes for Queensland coal mine, mineral mine, and quarry workers.

Background

The Guideline was first published in 2017 in response to the re-identification of MDLD and was recommended following an independent review of the Coal Mine Workers' Health Scheme (CMWHS) by Monash University in collaboration with the University of Illinois at Chicago.

The Guideline has been reviewed and updated to incorporate legislative amendments, audit learnings, and feedback from stakeholders. The Resources Medical Advisory Committee, appointed by the Minister for Resources in 2021, has endorsed the revised Guideline.

Payment

Employers must cover the costs of all follow-up investigations, if required, to complete the respiratory health examination, e.g., to confirm a diagnosis or inform a fitness for work decision. This includes reasonable travel expenses. Employers are not responsible for paying treatment costs under the mandatory health surveillance programs for mine and quarry workers. Workers diagnosed with an occupational condition should be provided with a work capacity certificate and referred to the workers' compensation scheme where compensation for medical and rehabilitation costs can be considered. For non-occupational conditions, the worker should be referred to their regular health care provider for treatment under the public or private health care system.

Implementation

Doctors with responsibility for respiratory health surveillance for Queensland mine and quarry workers must follow the Guideline unless there is sufficient clinical justification for an alternate course of action. This applies to Supervising Doctors registered under the CMWHS that are engaged as Appointed Medical Advisers (AMA) under the Coal Mining Safety and Health Regulations 2017, and Appropriate Doctors (AD) under the Mining and Quarrying Safety and Health Regulation 2017.

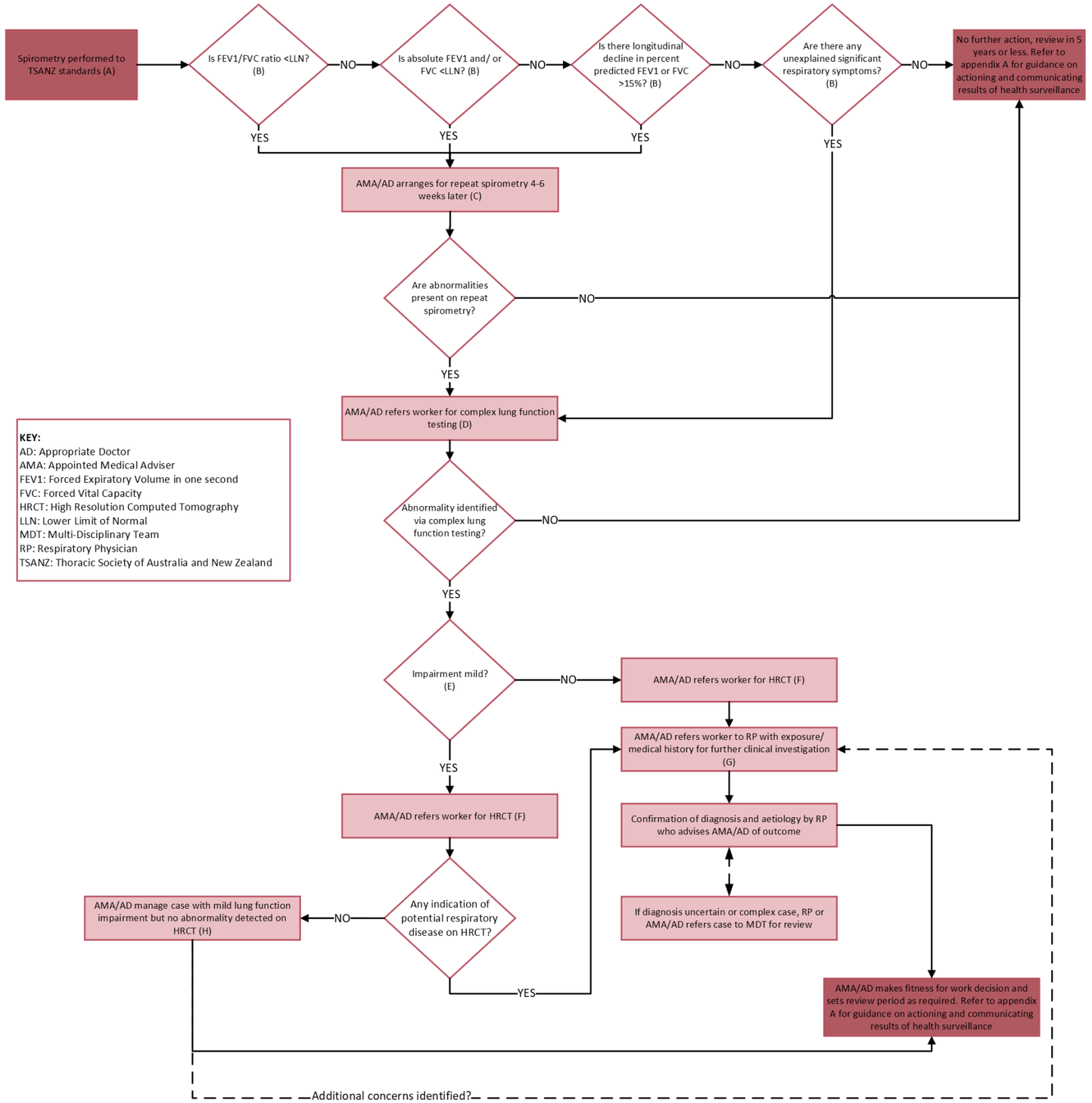
Where the Guideline is not followed due to a clinically justifiable reason, doctors must provide relevant explanatory detail in the medical examination documentation. This will avoid unnecessary action by Resources Safety and Health Queensland (RSHQ) where audit findings are unable to identify evidence the Guideline has been followed. Where the Guideline has not been followed and no justifiable medical reason can be determined, the relevant doctor must take corrective action. Enforcement action may result from non-conformance.

Components of the Guideline

The following pages describe the clinical pathways for respiratory health surveillance, including:

- lung function examinations and accompanying supporting information
- radiology examinations and accompanying supporting information
- information on actioning and communicating the results of respiratory health surveillance (**Appendix A**)
- guide on estimating occupational contribution to workers with smoking history diagnosed with chronic obstructive pulmonary disease (COPD) (**Appendix B**).

Mine Dust Lung Disease - Clinical Pathways Guideline: Spirometry



KEY:
AD: Appropriate Doctor
AMA: Appointed Medical Adviser
FEV1: Forced Expiratory Volume in one second
FVC: Forced Vital Capacity
HRCT: High Resolution Computed Tomography
LLN: Lower Limit of Normal
MDT: Multi-Disciplinary Team
RP: Respiratory Physician
TSANZ: Thoracic Society of Australia and New Zealand

Supporting notes to the MDLD Clinical Pathways Guideline: Spirometry

A. When conducting spirometry for the purpose of respiratory health surveillance

- Under the CMWHS, spirometry must only be carried out by providers approved by RSHQ.[1] These providers have been accredited against the *TSANZ Standards for the delivery of spirometry for resource sector workers (TSANZ Standards)*[2] and undertaken approved training courses.
- For Queensland mineral mine and quarry workers, spirometry clinics that meet the requirements stated in *QGL04 Guideline for respiratory health surveillance of workers in Queensland mineral mines and quarries (QGL04)*[3] must be used. RSHQ's register of approved providers meet these requirements.
- The reference ranges of the Global Lung Initiative (GLI) must be used when determining the spirometry escalation triggers referred to in the Guideline, which are pre-bronchodilator. Use of bronchodilator responsiveness testing should be considered when asthma or other obstructive conditions are suspected, or when pre-bronchodilator spirometry reveals a FEV1, FVC, or FEV1/FVC less than the lower limit of normal, in line with the *TSANZ Standards.*
- Only acceptable and repeatable spirometry results should be used for interpretation. If acceptable and repeatable results could not be obtained, repeat testing within 4 – 6 weeks may be appropriate.

B. Considerations when determining further clinical investigation

- When acting on the results of spirometry, in the context of the worker's exposure and medical history (including results of prior health surveillance, further investigations and specialist reports), the responsible doctor may deviate from the Guideline where there is sufficient clinical justification. Any deviations from the Guideline must be explained and documented in the health assessment form and may be subject to review by RSHQ.
- An AMA/ AD may delay part of a health assessment or request re-testing if a worker presents with a temporary respiratory condition such as a chest infection, which would impact on their ability to adequately perform spirometry. The assessment may also be delayed when the AMA/ AD considers the risk to the worker from delaying the assessment to be lower than the risk of an adverse health effect from the examination, e.g., delaying spirometry for a worker with a recent pneumothorax. The testing must be carried out within one year after originally required. Simply noting the condition as a reason for the abnormal or missing results, without subsequent follow up, is not considered a correct application of the Guideline. If an assessment is delayed, the last health assessment is taken to have been carried out at the time of the examinations that were not delayed.

[1] CMWHS Register of doctors and medical providers: https://www.business.qld.gov.au/industries/mining-energy-water/resources/safety-health/mining/medicals/register-providers.
[2] TSANZ Standards for the delivery of spirometry for resource sector workers: https://thoracic.org.au/resources/resources-worker-health/spirometry/.
[3] QGL04 - Guideline for respiratory health surveillance of workers in Queensland mineral mines and quarries: https://www.rshq.qld.gov.au/resources/documents/occupational-health-and-hygiene/qgl04-guideline.pdf.

- When looking for meaningful longitudinal decline in the percent predicted FEV1 or FVC, the recommendation is to assess the change in lung function from baseline percent predicted FEV1, which is the earliest record available. Previous tests entered into RSHQ's digital health records platform 'ResHealth' can be available when completing assessments in this online system. Where doctors don't hold these records themselves, they can also contact RSHQ's Health Surveillance Unit to request copies of available spirometry records performed under the CMWHS. However, some historic records can take longer to retrieve, and these can be considered at a subsequent assessment if required. The timeframe for this subsequent assessment should be as soon after the expected receipt of the historic records as is practical, and no more than 4 – 6 weeks, to ensure timely identification of any abnormal results.
- Results showing a significant bronchodilator response (using GLI predicted values) in accordance with the *TSANZ Standards,*[4] will require the AMA/ AD to determine if this response indicates a diagnosis of asthma and whether the worker requires further evaluation through the pathway.
- Where spirometry test results are normal, the doctor must still consider any unexplained significant symptoms, such as unexplained coughing, wheezing, haemoptysis, recurrent phlegm production or shortness of breath, and should refer these for further investigation.

C. Referring the worker for further clinical investigation

- Where clinical investigations indicate potential abnormality, the doctor responsible for the assessment must act on the results.
- The AMA/ AD may refer a worker directly to complex lung function testing after the initial spirometry if the worker's spirometry findings, medical or exposure history suggest escalation along the clinical pathway is appropriate. Deviations from the clinical pathway should be explained and documented in the health assessment form.

D. Where the clinical pathway indicates that complex lung function testing is required

- Consideration should be given to utilising TSANZ accredited respiratory function laboratories.[5]
- Where access to complex lung function testing is limited and cannot be completed within three months, the AMA/ AD may consider progressing to the next stage of the clinical pathway where this avoids delaying the assessment. For example, where the worker needs to travel to access complex lung function testing, the AMA/ AD may consider organising HRCT locally if available, or if HRCT not available locally, at the same location as the complex lung function testing.

[4] TSANZ Standards: https://thoracic.org.au/resources/resources-worker-health/spirometry/.
[5] TSANZ List of Accredited Labs: https://www.thoracic.org.au/respiratorylaboratoryaccreditation/australia.

- Complex lung function testing includes single breath carbon monoxide diffusing lung capacity (DLCO) and lung volume measurements. These tests should be performed in line with the most recent *ERS/ATS standards*.[6] These include:
    - Standards for single-breath carbon monoxide uptake in the lung, and
    - Standardisation of the measurement of lung volumes.

E. Early or mild lung function impairment

- Early or mild lung function impairment is defined as meeting all the criteria from one or more of the following options:

1. Rapid decline:
    - longitudinal decline since baseline in percent predicted FEV1 or FVC > 15%,[7] and
    - absolute FEV1 ≥ LLN.
2. Isolated mild diffusion impairment:
    - DLCO > 60% of reference and < LLN.
3. Early obstructive abnormality:
    - absolute FEV1/FVC ratio < LLN, and
    - absolute FEV1 ≥ LLN, and
    - absolute FVC ≥ LLN.
4. Mild obstructive abnormality:
    - absolute FEV1/FVC ratio < LLN, and
    - absolute FEV1 < LLN, and
    - percent predicted FEV1 > 70% reference, and
    - absolute FVC ≥ LLN.
5. Mild mixed obstructive abnormality/restrictive pattern:
    - absolute FEV1/FVC ratio < LLN, and
    - absolute FEV1 < LLN, and
    - percent predicted FEV1 > 70% reference, and
    - absolute FVC < LLN.

[6] Official ERS guidelines, statements, and technical standards: https://www.ersnet.org/guidelines/; American Thoracic Society official documents – Statements, guidelines & reports: https://www.thoracic.org/statements/index.php.

[7] Redlich CA, Tarlo SM, Hankinson JL, Townsend MC, Eschenbacher WL, Von Essen SG, et al. Official American Thoracic Society technical standards: spirometry in the occupational setting. *Am J Respir Crit Care Med.* 2014; 189: 983-993.

6. Mild restrictive pattern:
    - absolute FEV1/FVC ratio ≥ LLN, and
    - absolute FVC < LLN, and
    - absolute FEV1 normal or < LLN, and
    - percent predicted FEV1 > 70% reference.

      Notes:
      - *confirmed restriction if absolute TLC < LLN*
      - *non-specific ventilatory impairment if absolute TLC ≥ LLN.*

The above criteria are summarised in the following table for easier reference.

	1. Rapid decline	**2. Isolated mild diffusion impairment**	**3. Early obstructive abnormality**	**4. Mild obstructive abnormality**	**5. Mild mixed obstructive abnormality/ restrictive pattern**	**6. Mild restrictive pattern**
Longitudinal decline since baseline in percent predicted FEV1 or FVC > 15%.	✓					
Absolute FEV1 ≥ LLN	✓		✓			
DLCO > 60% of reference and < LLN		✓				
Absolute FEV1/FVC ratio < LLN			✓	✓	✓	
Absolute FVC ≥ LLN			✓	✓		
Absolute FEV1 < LLN				✓	✓	
Percent predicted FEV1 > 70% reference				✓	✓	✓
Absolute FVC < LLN					✓	✓
Absolute FEV1 normal or < LLN						✓
Absolute FEV1/FVC ratio ≥ LLN						✓

F. Referral for HRCT

- HRCT is required to inform respiratory physician review. For mild lung function impairment identified on spirometry and complex lung function testing, the HRCT is to provide further clinical insight and determine if respiratory physician review is required. Refer to section C and D of the Radiology supporting notes for requirements regarding acquiring and reading HRCT.

G. Cases requiring referral to a respiratory physician

- If the clinical pathway indicates that a referral to a respiratory physician is required, consideration should be given to utilising respiratory physicians on the *TSANZ Register of Physicians for Resource Sector Workers' Health (TSANZ Register)*[8] and/or with appropriate experience in occupational lung disease. Specific reasons for referral, along with work and exposure history, should be provided to inform the respiratory physician's assessment. The respiratory physician can seek further clarification on workplace exposures and job role requirements and consult with the AMA/ AD and/or an occupational physician in determining diagnosis and causality.

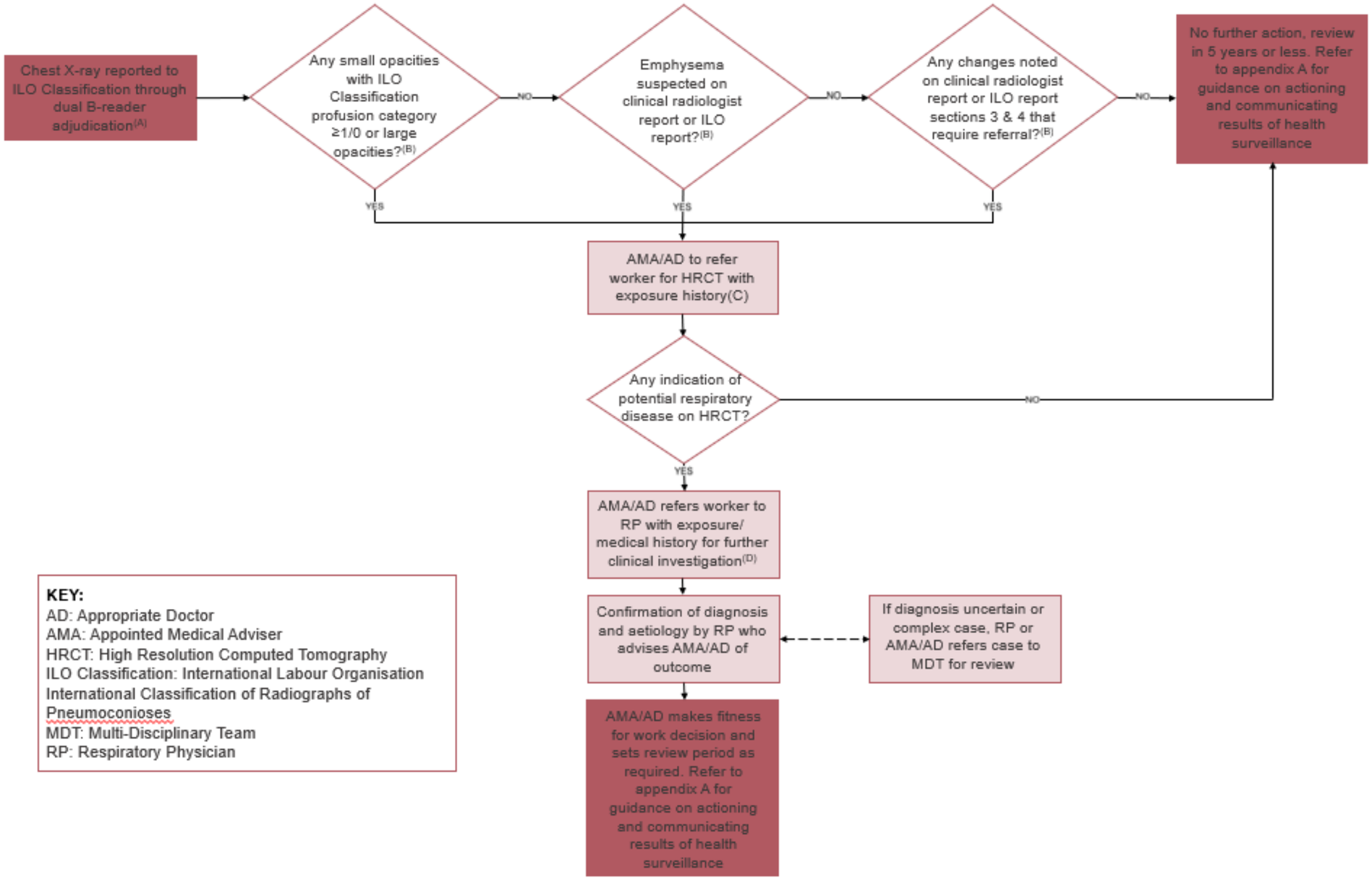
H. Cases managed by AMA/ AD

- Cases with mild lung function impairment but no abnormality detected on HRCT may be managed by the AMA/ AD. If the AMA/AD diagnoses the worker with a MDLD, the AMA/AD should record this on the health assessment form.
- Careful consideration should be given to work restrictions suggested by the Queensland Office of Industrial Relations' (OIR) *Returning workers with mine dust lung diseases to the workplace* guidelines,[9] including recommendations for enhanced medical surveillance and appropriate review periods. These guidelines also provide advice on consulting with an occupational physician to support management of work-related exposure.
- Workers should be advised to seek further advice as to the treatment/ management of their medical condition from their treating medical practitioner. Where indicated, this should include an emphasis on cessation of smoking and other lifestyle exposures (e.g. e-cigarettes, vaping, other drugs etc.), avoidance of any other environmental or avocational respiratory hazards, and weight management support.
- The AMA/ AD may refer the worker with mild lung function impairment to a respiratory physician if uncertain or a complex case. Specific reasons for referral should be provided to inform the respiratory physician's assessment.
- If follow-up complex lung function testing shows progression of impairment into the moderate category (percent predicted FEV1 60 – 69% and DLCO 40 – 60% of reference) or if an accelerated rate of decline continues, the worker should be referred to a respiratory physician in accordance with this Guideline.

[8] TSANZ Register of Physicians for Occupational Lung Disease: https://thoracic.org.au/resources/resources-worker-health/register-of-physicians/.
[9] Returning workers with mine dust lung diseases to the workplace: https://www.worksafe.qld.gov.au/__data/assets/pdf_file/0029/88913/mine-dust-lung-disease-guidelines.pdf.

- Refer to **Appendix B** for guidance on estimating occupational contribution to workers with smoking history diagnosed with chronic obstructive pulmonary disease.

Mine Dust Lung Disease – Clinical Pathways Guideline: Radiology



KEY:
AD: Appropriate Doctor
AMA: Appointed Medical Adviser
HRCT: High Resolution Computed Tomography
ILO Classification: International Labour Organisation International Classification of Radiographs of Pneumoconioses
MDT: Multi-Disciplinary Team
RP: Respiratory Physician

Supporting notes to MDLD Clinical Pathways Guideline: Radiology

A. When conducting chest X-rays for the purpose of respiratory health surveillance

- Under the CMWHS, imaging clinics must be approved by RSHQ. Chest X-rays must be classified using the International Labour Organization International Classification of Radiographs of Pneumoconioses (ILO classification) by at least two National Institute for Occupational Safety and Health (NIOSH) certified B-readers approved by RSHQ, with the provider engaged by RSHQ completing the second read, adjudication, and final report.[10]
- For Queensland mineral mine and quarry workers, imaging clinics and radiologists that meet the requirements stated in *QGL04*[11] must be used. RSHQ's register of approved providers and radiology providers that RSHQ has validated to deliver further reading services meet these requirements.

B. Acting on the results of the chest X-ray

- In the context of the worker's exposure and medical history, the responsible doctor may deviate from the Guideline where there is sufficient clinical justification. Any deviations from the Guideline must be explained and documented in the health assessment form and may be subject to review by RSHQ.
- If a worker has a negative chest X-ray (i.e., ILO <1/0) but reports significant, unexplained respiratory symptoms, such as unexplained coughing, wheezing, haemoptysis, recurrent phlegm production, or shortness of breath, this should also trigger a review in accordance with the spirometry component of the Guideline.
- The ILO classification report and the clinical radiologist report may indicate other findings that may require follow up. These diseases/conditions include, but are not limited to cardiac abnormalities, skeletal conditions, lung infections, and the identification of foreign bodies. These conditions should be considered in the context of the worker's role and medical history, with the responsible doctor deciding what appropriate action is required for any issues identified, including any follow-up and/ or treatment.
- An AMA/ AD may delay part of a health assessment for up to one year if they consider the risk of an adverse health effect to any person from delaying the assessment to be lower than the risk to the person undergoing the assessment. For example, the AMA/ AD may consider the risk to a pregnant worker of delaying a chest X-ray or HRCT scan to be lower than the risk of an adverse health effect for the worker if the chest X-ray or HRCT is performed. If an assessment is delayed, the last health assessment is taken to have been carried out at the time of the examinations that were not delayed.

[10] Further information on the process for radiology assessments for chest X-rays under the CMWHS: https://www.business.qld.gov.au/industries/mining-energy-water/resources/safety-health/mining/medicals/coal-workers-health/radiology-assessments-chest-x-rays.

[11] QGL04: https://www.rshq.qld.gov.au/resources/documents/occupational-health-and-hygiene/qgl04-guideline.pdf.

C. Referral for HRCT

- Information about occupational and non-occupational exposures associated with an increased risk of lung disease should be included in the clinical details provided on referrals, along with a reference to the HRCT reporting requirements outlined below and relevant medical history. Relevant medical history could include previous respiratory studies, previous chest imaging reports, chest images if available, and diagnoses.
- HRCT technique should be in accordance with the current Royal Australian and New Zealand College of Radiologists *Silicosis Position Statement (RANZCR Statement).*[12]
- The International Classification of HRCT for Occupational and Environmental Respiratory Diseases[13] (ICOERD) system must be used for classifying HRCTs. The ICOERD classification relates to the dust exposure components of the HRCT study.
- The reporting of HRCT using the ICOERD system must be completed independently by two NIOSH certified B-reader radiologists registered with RSHQ,[14] who can demonstrate ongoing CPD activities specific to the imaging of interstitial lung disease, with relevant experience, including the reporting of HRCT for occupational lung disease as part of their regular clinical practice.
- A consensus meeting should be held, if required, to resolve any disagreement related to the ICOERD component of the study (including rounded opacities, irregular opacities, ground glass opacity, honeycombing, emphysema, and the presence/absence of large opacities, inhomogeneous attenuation, and pleural abnormality). A further blinded adjudication by another B-reader radiologist is not required.
- If there is agreement between the B-readers that small opacities (rounded and/or irregular) are present, the average of the highest score per reader can be calculated, rounded up to the nearest integer, and used as the consensus score.
- Both B-reader radiologist names must be included on the final report.
- In addition, the remainder of the study (not covered by the ICOERD classification) must be read in accordance with standard clinical practice. This is likely to be done by one of the B-readers and does not need to be dual read.
- The ICOERD report should also include content recommended by the *RANZCR Statement*[15] standard report template detailed in appendix two of that document.

[12] RANZCR Silicosis Position Statement: https://www.ranzcr.com/college/document-library/silicosis-position-statement.
[13] International Classification of HRCT for Occupational and Environmental Respiratory Diseases: https://link.springer.com/book/10.1007/4-431-27512-6#about.
[14] CMWHS Register of doctors and medical providers: https://www.business.qld.gov.au/industries/mining-energy-water/resources/safety-health/mining/medicals/register-providers.
[15] RANZCR Statement: https://www.ranzcr.com/college/document-library/silicosis-position-statement.

- If, at subsequent health assessments, the same abnormalities are identified as during the previous assessment, the Guideline must still be followed unless there is sufficient clinical justification for an alternate course of action.

D. Indication of an abnormality on HRCT

- Where the HRCT indicates an abnormality, the doctor responsible for the assessment acts on the results.
- If the clinical pathway indicates that a referral to a respiratory physician is required, consideration should be given to utilising respiratory physicians on the *TSANZ Register*[16] and/or with appropriate experience in occupational lung disease.
- Specific reasons for referral, along with work and exposure history, should be provided to inform the respiratory physician's assessment. The respiratory physician can seek further clarification on workplace exposures and job role requirements and consult with the AMA/ AD and/or an occupational physician in determining diagnosis and causality.

[16] TSANZ Register: https://thoracic.org.au/resources/resources-worker-health/register-of-physicians/.

Appendix A – Additional requirements

A. Referrals to other medical providers

- Generally, a worker should not be referred to their GP or other medical provider outside the health assessment process for examinations that are relevant to informing decisions on potential disease or condition diagnosis and subsequent fitness for work decisions by the AMA/ AD (regardless of work-relatedness).
- However, where a worker is referred to their GP or other medical provider for treatment and the outcome of which needs to inform the health assessment process in relation to fitness for work, the cost of any assessment and related report to the AMA/ AD must be paid for by the employer. The reasons for the referral should be clearly documented in the examination section of the health assessment form and explained clearly to the worker. Any treatment component is not the employer's responsibility to pay.
- For any other matters detected not requiring further consideration by the AMA/ AD, the worker should be referred to their GP or other health provider. The reasons for this referral should be clearly documented in the examination section of the health assessment form.

B. Occupational lung multidisciplinary team (MDT)

- An MDT provides an important forum where a case conference can occur, involving a range of health professionals from a variety of disciplines, working together to provide formal input into case review. For the purposes of the Guideline, the occupational lung disease MDT should include specialists with experience and qualifications in occupational lung disease, such as occupational medicine physicians, radiologists and respiratory physicians, occupational health nurses, occupational hygienists, and other specialists as required. At the request of one of the evaluating health professionals, particularly when there is diagnostic uncertainty, it may be appropriate to convene or consult with the required specialists as part of an occupational lung MDT.
- Where a respiratory physician is considering referral to an MDT, this should be in discussion with the AMA/ AD as the physician responsible to the employer for arranging the assessment. Employers are to cover the costs of the MDT as part of the costs of investigation.

C. Actioning the results of surveillance activities

- Ascertain diagnosis and determine the worker's fitness for work. Consult an occupational physician where required to support decisions on fitness for work and restrictions to ensure the best outcome for the worker.
- OIR's *Returning workers with mine dust lung diseases to the workplace* guidelines[17] are beneficial to facilitate discussion about return to work between a worker and their family, employer, insurer, and medical specialists, under the guidance of occupational and respiratory physicians.

[17] Returning workers with mine dust lung diseases to the workplace: https://www.worksafe.qld.gov.au/__data/assets/pdf_file/0029/88913/mine-dust-lung-disease-guidelines.pdf.

- Identify a date for the next periodic health assessment, considering requirements for symptom evaluation by questionnaires, spirometry, chest X-ray and any additional enhanced medical surveillance required at clinically appropriate and regulated intervals.
- Where a respiratory disease is diagnosed, which is not a MDLD (e.g. infection with COVID-19, established lung scarring from a previous infection), this should be recorded and the worker advised to seek further advice as to the treatment/ management of their medical condition from their treating medical practitioner. Clinical judgement should be used to determine the worker's fitness for work, restrictions and future health assessment or enhanced medical surveillance requirements, in consultation with occupational and respiratory physicians where required. This should consider the nature and extent of respiratory impairment and the likelihood and extent of ongoing workplace exposures that could exacerbate symptoms or disease progression.

D. Ongoing assessments

- Where there are prior health assessment records, including further investigations and reports, these should be considered at subsequent health assessments.
- If, at subsequent health assessments, the same abnormalities are identified as during the previous assessment, the Guideline must still be followed unless there is sufficient clinical justification for an alternate course of action.
- Ongoing assessment is particularly important to ascertain any disease progression where a related change in fitness for work restrictions should be considered. Conversely, unnecessary referrals should be avoided where conditions are stable with low risk of progression.
- The AMA/ AD should exercise their clinical judgement in these cases and provide clear explanation of their decision not to follow the Guideline in the health assessment form and explain the reasons to the worker.

E. Communicating to the worker

- Communicate sufficient information to ensure the worker is appropriately informed throughout the process, including the purpose of surveillance activities and the results.
- For workers that may be concerned during the process, urge them to seek support for their psychological wellbeing available through their employer, GP or other providers (e.g., Mates in Mining – 1300 642 111). The Queensland Government's Mine Dust Health Support Service also provides confidential help for current and former workers with understanding the screening and diagnostic process, their compensation rights and how to access ongoing support, including psychological support. The service can be contacted either by calling 1300 445 715 or by email: info@minedusthealthsupport.com.
- Provide the worker with an explanation of results and any restrictions required to minimise risk and prevent further injury or illness (if applicable), including consideration of dust exposures.
- Advise the worker to seek further advice as to the treatment/ management of their medical condition from their treating medical practitioner.

- Where a worker is diagnosed with a respiratory injury, they should be advised of the workers' compensation application process under the *Workers' Compensation and Rehabilitation Act 2003* (Qld) within a timely manner. This includes providing the worker with a copy of the current version of the Mine dust lung diseases and workers' compensation in Queensland factsheet[18] or another related document advised by RSHQ from time to time, as well as informing the worker on how to access the Mine Dust Health Support Service.

F. Reporting requirements

- For the CMWHS, promptly forward or upload the completed health assessment form and other required documentation to the RSHQ Health Surveillance Unit, in the approved way stated on the RSHQ website, within 28 days. Health assessments can now be completed on ResHealth[19]. ResHealth is RSHQ's online platform for completing coal mine workers' health assessments and submitting to RSHQ.
- For mineral mine and quarry workers, the AD must provide a copy of the respiratory health surveillance report (not the full assessment) to the site senior executive and worker. The AD is encouraged to obtain worker consent to provide RSHQ with a copy of the respiratory health surveillance medical examination form and health surveillance report for confirmed MDLD cases, to support industry-wide health surveillance.

[18] Mine dust lung diseases and workers compensation in Queensland Factsheet: https://www.rshq.qld.gov.au/miners-health-matters/media/documents/Mine-dust-lung-diseases-and-workers-compensation-in-Qld-Factsheet-22.pdf/.

[19] ResHealth: https://www.rshq.qld.gov.au/reshealth.

Appendix B – Guide on estimating occupational contribution to workers with smoking history diagnosed with COPD

DISCLAIMER

The following guide highlights the need to consider the contribution of occupational exposure when reporting cases of COPD to RSHQ when the worker has a smoking history as mine dust is almost as significant a contributor to COPD as tobacco smoke.

This guide can be used to estimate relative contribution to COPD from mine dust exposure and tobacco smoke. This is a guide only, recognising the challenges with accurately quantifying exposures, hence physicians should exercise their clinical judgement in consideration of the specific circumstances of each worker.

It will be appropriate to consider other factors such as likelihood of dust exposure in relation to a worker's job role, potential exposure levels, other respiratory hazards such as occupational exposures (e.g. other dusts, fumes, vapours) or lifestyle exposures (e.g. e-cigarettes, vaping, other drugs etc.) and the efficacy of hazard controls over time.

This guide is intended to provide RSHQ with more consistent reporting of occupational exposure contribution to workers with a smoking history diagnosed with COPD. It has not been developed for use in legal proceedings or workers' compensation considerations, where a more detailed review of individual circumstances may be required, including further analysis of individual exposure data, where available.

Chronic bronchitis, emphysema, and lung function impairment

Chronic cough and sputum production due to chronic bronchitis is commonly encountered among miners.[20,21,22] The prevalence of chronic bronchitis increases with increased cumulative dust exposure. Symptoms of chronic bronchitis are also associated with significant declines in the *forced expiratory volume in one second* (FEV1).[23]

[20] Murray & Nadel's Textbook of Respiratory Medicine, 2-Volume Set - 7th Edition. Accessed August 16, 2021.
[21] Rae S, Walker DD, Attfield MD. Chronic bronchitis and dust exposure in British coalminers. *Inhaled Part*. 1970; 2:883-896.
[22] Leigh J. 15-year longitudinal studies of FEV1 loss and mucus hypersecretion development in coal workers in New South Wales, Australia. In: *Proceedings of the VIIth: International Pneumoconioses Conference Part II*. Vol 2. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, DHHS (NIOSH); :112-121. Accessed December 4, 2011. http://www.cdc.gov/niosh/docs/90-108/.
[23] Wang X, Yu IT, Wong TW, Yano E. Respiratory symptoms and pulmonary function in coal miners: looking into the effects of simple pneumoconiosis. *Am J Ind Med*. 1999;35(2):124-131.

Mine dust is also an important cause of emphysema.[24,25,26] Emphysema severity scores are strongly associated with increased lung dust content.[27,28] Centrilobular emphysema is the most common type of emphysema associated with dust exposure and can develop in non-smoking as well as smoking miners.[29] The effect of cigarette smoking on emphysema is additive to that of dust exposure.[30] All pathologic types of emphysema, including centriacinar, panacinar, and bullous emphysema, are associated with both dust exposure and cigarette smoking.[31]

Mine dust exposure is associated with impairment in lung function as measured by spirometry, even in the absence of radiographic evidence of fibrosis from mine dust lung diseases like coal workers' pneumoconiosis.[32] Examination of multiple cohorts of miners is notable for evidence of an excess lifetime risk of significant loss of lung function attributable to dust exposure.[33, 34] After adjusting for age and smoking status, the magnitude of decline in lung function is proportional to estimated cumulative mine dust exposure.[35, 36, 37, 38,39] The correlation between the rate of decline in FEV1 and cumulative mine dust exposure is greater in nonsmokers,[40] and is the same order of magnitude as that caused by exposure to tobacco smoke.[41] In addition to being a

[24] Kuempel ED, Wheeler MW, Smith RJ, Vallyathan V, Green FHY. Contributions of dust exposure and cigarette smoking to emphysema severity in coal miners in the United States. *Am J Respir Crit Care Med*. 2009;180(3):257-264. doi:10.1164/rccm.200806-840OC.

[25] Ruckley VA, Fernie JM, Chapman JS, et al. Comparison of radiographic appearances with associated pathology and lung dust content in a group of coal workers. *Br J Ind Med*. 1984;41(4):459.

[26] Ryder R, Lyons JP, Campbell H, Gough J. Emphysema in coal workers' pneumoconiosis. *Br Med J*. 1970;3(5721):481.

[27] Leigh J, Driscoll TR, Cole BD, Beck RW, Hull BP, Yang J. Quantitative relation between emphysema and lung mineral content in coal workers. *Occup Environ Med*. 1994;51(6):400-407.

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marker for respiratory symptoms, the magnitude of FEV1 decline is associated with increased risk of death from cardiovascular and nonmalignant respiratory disease.[42]

Asthma may be caused or exacerbated because of exposure to the mine atmosphere. Mines contain contaminants that may contribute to asthma, including isocyanates[43, 44] and diesel exhaust particulate.

Guide for estimating contribution to COPD from mine dust exposure and tobacco smoke

This calculation guide below can be used to consider and estimate the contribution of occupational exposure when reporting cases of COPD to RSHQ when the worker has a history to both smoking and mine dust exposure.

Step 1: calculate total 'pack years' of tobacco smoke.

1 pack year = 20 cigarettes a day for 1 year

Number of cigarettes smoked per day (a)

Number of years a smoker (b)

Number of pack years (c) = a / 20 x b

Example: If worker has smoked 40 cigarettes a day for 30 years

Number of pack years

= 40/20 x 30

= 60 pack years

Step 2: determine total years of mine or quarry dust exposure (d)

Roles that increase the likelihood of dust exposure:

- Work underground, particularly at the face
- Work at the surface drilling, blasting or drag lines.

Step 3: calculate approximate percentage contribution from dust exposure compared to smoking contribution.

= d / (d + c) x 100

Generally, a contribution from dust exposure to COPD > 10% indicates that dust exposure has been a contributing factor in addition to smoking.[45]

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Example 1: If worker has a 25-year history of dust exposure and 25 pack years smoking history

Approximate contribution from dust exposure = 25 / (25 + 25) x 100 = 50%

Example 2: If worker has a 10-year history of dust exposure and 90 pack years smoking history

Approximate contribution from dust exposure = 10 / (10 + 90) x 100 = 10%