

Interim Findings
Review of Respiratory Component of the
Coal Mine Workers' Health Scheme

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Disclaimer

This document and the recommendations presented herein are interim only. The review is ongoing, and findings and recommendations will be revised as new information is received. A final report will be completed by June 30th 2016.

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Overview

Background

As of February 2016, six confirmed cases of coal workers' pneumoconiosis (CWP) had been identified among coal miners in Queensland. As these cases had not been directly detected within the existing coal mine workers' health scheme, a review of the design and operation of the respiratory component of the scheme was commissioned by the Queensland Department of Natural Resources and Mines (QDNRM). A team from Monash University and the University of Illinois at Chicago has been engaged to conduct the review.

The aims of the review are to:

- A Determine whether the respiratory component of the health assessment performed under the Queensland Coal Mine Workers' Health Scheme is adequately designed and implemented to most effectively detect the early stages of coal mine dust lung disease (CMDLD) among Queensland coal mine workers, estimating the extent and providing feedback and, if not,
- B Recommend necessary changes to correct deficiencies identified under Objective A, recommend measures to follow up cases that may have been missed as a result of these deficiencies and identify what additional capacity is needed in Queensland to improve this scheme.

The review team identified the following areas for review:

- 1. Purpose of the respiratory component of the scheme
- 2. Coal Mine Workers' Health Scheme Assessment Form
- 3. Nominated Medical Advisers (NMAs)
- 4. Chest X-ray (CXR) quality and reading
- 5. Spirometry quality and reading
- 6. Queensland medical capacity in respect of the scheme
- 7. Health assessment form data collection and storage

To date, QDNRM has provided the following to the review team for the review:

- 1. Health scheme data for the confirmed CWP cases
- 2. A spreadsheet of data from 91 completed health assessments extracted from the QDNRM database
- 3. A list of current nominated medical advisers
- 4. 398 Chest X-rays, radiologists' reports and related NMA reports
- 5. 252 Spirograms and related NMA reports

Main Findings

Purpose(s) of the Respiratory Component of the Current Coal Mine Workers' Health Scheme

The current focus of the health assessment scheme among stakeholders is to assess general fitness for work, e.g. pre-employment and periodic health assessments. Respiratory health is among the many aspects of health assessed, but there is no focus on medical screening for cases of early CMDLD or overall respiratory health surveillance for the industry. The review team considers that the respiratory component of the health scheme should provide systematic respiratory health monitoring in coal miners to:

1. Detect early changes indicative of coal mine dust lung disease (CMDLD) over time, with appropriate referral for follow-up, diagnosis, clinical management and reduction in ongoing coal dust exposure.
2. Collect and analyse data over time to provide ongoing surveillance of CMDLD and to help inform whether dust exposure should be reduced across the industry.
3. Inform the individual coal miners about the risk of CMDLD.
4. Assess respiratory fitness for work, including the assessment of the suitability of miners to wear personal protective equipment (PPE), in particular respiratory protective equipment (RPE).

The review team would like to emphasise medical surveillance of CMDLD is only useful for secondary prevention and identifying where there may have been excessive coal mine dust exposure. However, because of the long latency in the development of CMDLD, it is not a substitute for primary prevention, which should be in the form of coal mine dust monitoring and control.

Confirmed CWP cases

The main purpose of the review of the confirmed CWP cases was to identify deficiencies in the health assessment scheme which could have led to delayed detection in these cases. This was done by accessing and reviewing the respiratory component of the available health assessment forms performed under the scheme for these miners. For the six confirmed CWP cases the review team identified several notable deficiencies.

- There was poor documentation regarding follow-up or referral where abnormal spirometry or CXR results had been found during the health assessments.
- Where abnormalities were detected, suitable recommendations to mitigate further workplace exposure were not made.
- In some cases, the medical reviews for the health scheme were performed less frequently than required and with fewer than the required/necessary tests.
- There was misattribution of the cause of obstructive abnormalities on spirometry to tobacco smoking alone.
- CXR reports were not based on the International Labour Organisation (ILO) classification for pneumoconiosis. Where interstitial CXR changes were noted this was not adequately followed up.
- NMAs did not appear able to access previous health information collected under the scheme for these miners, so a clinically significant decline in lung function in serial spirometry was not detected.

Content of current health assessment form

The current form is lengthy (seven pages) and the respiratory component is dispersed throughout the form, which reduces the focus on the respiratory system. There is no specific reference to the absence/presence of CMDLD symptoms and/or signs, and no opportunity to identify changes in respiratory symptoms, signs, lung function or CXR findings over time. There are several ambiguously-phrased and duplicate questions.

The current form lacks:

- Sufficient questions about respiratory medical history
- A comprehensive respiratory questionnaire

- A dedicated section for type of respiratory protective equipment and frequency of use
- Adequate smoking history questions

Quality and completion of current health assessment forms

The employer's section of the form, especially the Similar Exposure Groups (SEGs), was poorly completed. Only four of 21 forms had the generic SEGs completed and none had the Company SEGs completed. The mine name was not completed in about one-third of forms.

There were inconsistent entries for duplicate/overlapping questions and responses did not correspond in about one-third of forms.

The criteria for "at risk of dust exposure" are unclear, so the NMAs have little guidance about which coal mine workers require a CXR. The form may be completed for an individual seeking employment, such as through a contractor or labour hire organisation, which means that "at risk of dust exposure" status may be unknown.

Criteria for being "at risk of dust exposure"

Only those miners who are determined "at risk of dust exposure" are required to undertake a CXR. SEGs are one of the means by which those "at risk of dust exposure" can be identified, but in addition to the problem highlighted above of missing SEG information in the completed health assessment forms, it is not clear which SEGs are deemed "at risk of dust exposure" and hence requiring a CXR. A simpler system and better guidance is needed for when a coal mine worker is considered "at risk of dust exposure".

NMA appointment and training

The large number of NMAs (237) means that it is difficult to maintain an up to date register, co-ordinate meetings and provide NMA training. A review of the current list of NMAs found that they have diverse qualifications (62% GPs, 12% Occupational Physicians, 26% others) and practise in a variety of medical settings, most of which are a considerable distance from the coal mines.

NMA appointment is the responsibility of employers and QDNRM has no involvement in the process. Currently no minimum qualifications and/or experience are required (apart from being a registered Medical Practitioner). In addition, no formal training is undertaken by new or current NMAs, and there is no auditing process in place.

The role and required qualifications of the Examining Medical Officer (EMO) is undefined in the scheme under the Regulations, and there is no appointment process and no qualification/training requirements.

The 18-page NMA information kit mainly outlines administrative procedures for conducting health assessments, rather than providing medical guidelines. There are no means of ascertaining NMAs' (or EMOs') understanding of the NMA information kit, its appropriate application, or whether they have a good knowledge of a coal mine worker's work environment for the purpose of adequately performing the respiratory component of the health assessment scheme.

Health assessment form data collection and storage

Currently, the Health Surveillance Unit (HSU) at the QDNRM receives hard copies of the health assessment forms by mail, and enters data into the QDNRM database manually. Not only is sending and receiving health assessments by ordinary mail out-dated, costly and has potential for health assessments being lost, manual data entry is time consuming and there is potential for data entry errors. Manual checking of documents for completeness and accuracy is slow, cumbersome and also prone to human error. The health records can be incomplete and NMAs do not always submit original CXR films or spiromograms.

The health records are currently stored at three different locations. After being checked they are meant to be scanned, key variables entered into an Access database and the data kept on an SQL server. Current status is that:

- Before the mid-1990s data from all forms were entered onto a database.
- Since the late 2000s (approx.) forms have been scanned and some data manually entered into the QDNRM database at Safety in Mines Testing and Research Station (SIMTARS).
- The hard copies and analogue CXRs are stored in cardboard boxes.

Resources to enter data into the database did not increase when the number of health assessments increased during the mining boom. Currently, there is a large backlog of around 100,000 health assessment forms awaiting entry into the database. A proportion of the forms have been scanned and logged into the database but the complete data have not been entered. Sequential health records for individual coal miners are not usually stored together, but can be manually identified from scanned data. Security procedures appear adequate.

The database is not currently being used for surveillance purposes. In order to utilise data from the respiratory component of the scheme for ongoing and industry-wide surveillance of trends, the necessary data fields should be identified and entered into the database, and the database interrogated regularly for overall reporting purposes.

Chest X-Ray film and spirogram reviews

Analogue films (n=268) have been provided by QDNRM and a protocol has been developed for their review to assess the CXR quality and its interpretation according to ILO criteria. The de-identification of digital images has proved problematic because of the variety of software used. However the review team at the University of Illinois at Chicago are developing a solution in coordination with the QDNRM. Five CXR reviewers have been identified in the USA, and one of two required CXR reviewers in Australia has been identified.

To date QDNRM has provided 252 spiromograms to the review team. A protocol has been developed to assess spirogram quality and review the reporting of lung function tests, and two reviewers have been identified. In addition, a short survey of the spirometry equipment, training and quality control procedures has been developed and is to be completed by NMAs.

Queensland medical capacity

Contact has been made with relevant specialist Medical Organisations. The Royal Australian and New Zealand College of Radiologists (RANZCR) and the Thoracic Society of Australia and New Zealand (TSANZ) have identified members in Queensland who are interested in

providing expertise in the field of CMDLD. Information on CMDLD among coal miners has been distributed to Queensland General Practitioners.

Interim Recommendations

Purpose of the Respiratory Component of the Coal Mine Workers' Health Scheme

- The scheme should be more focused on the early detection of CMDLD and ongoing surveillance across the industry, and these purposes should be clarified to employers, coal mine workers, NMAs and other stakeholders.
- An information pack for workers on the risks of exposure to coal mine dust should be developed.
- The revised scheme should be reviewed after two years to ensure that it continues to be fit for purpose and to identify possible improvements.

Content of health assessment form

- The respiratory component of the health assessment form should be consolidated to facilitate the identification of respiratory abnormalities.
- The following should be included in the form:
 1. A respiratory symptom questionnaire and past medical history that includes all relevant symptoms and respiratory conditions.
 2. A section on type and frequency of use of RPE required for the current job.
 3. In the occupational history, tick box options for job categories or industries where coal dust and/or mixed dust exposure is likely to occur.
 4. Revised and expanded questions about smoking history to better identify current/former/never smokers and cumulative smoking exposure (pack-years).
 5. In Section 4 (of the report), a specific reference to the absence or presence of symptoms/signs consistent with CMDLD, the follow-up required and frequency of subsequent health assessments.
 6. Determination of work capacity for individuals with CMDLD, including use of RPE.
- Ambiguous questions should be reworded and duplicate questions removed.
- The form should identify whether the worker is a sub-contractor.

Process of the Scheme

- NMAs should complete the respiratory component of the health assessments themselves, apart from spirometry, which should be undertaken by an appropriately trained technician, and CXRs, which should be reported by a trained radiologist using the ILO classification.
- EMOs should not complete the respiratory component of the health assessments.
- The occupational history should be checked by the NMA with the miner so that changes in mine site or jobs are updated and a CXR performed in situations where previous jobs were “at risk of dust exposure”.
- Spirometry printouts and CXR films should be submitted with all completed health assessment forms.

- A clinical pathway for referral and follow-up of suspected CMDLD cases should be incorporated into the scheme.
- Surveillance of coal mine workers should be continued for those who have been, but are no longer, “at risk of dust exposure” either because of changing jobs or because of retirement because symptoms may take time to develop.

Criteria for being “at risk of dust exposure”

- The criteria for “at risk of dust exposure” for both underground and open cut miners should be made more explicit within the scheme for the purpose of deciding which mine workers require a CXR.
- Section 1 (the employer’s section) of the form should be redesigned to provide a clearer determination of “at risk of dust exposure”, with a simpler classification than the current generic and company SEGs classification.

NMA appointment and training

- Appointment of NMAs to assess the respiratory health of those miners at risk of dust exposure should become a QDNRM function, but consideration will need to be given to the minimum numbers and geographical spread to ensure that miners, including those who are fly-in-fly-out, have easy access to an NMA.
- Minimum requirements to be met by NMAs in terms of medical training and experience to undertake the respiratory component of the coal mine health assessment should be established.
- A formal induction training and ongoing audit program for these NMAs should be developed. The training should be completed by NMAs prior to undertaking respiratory assessments in the coal mine workers’ health assessment scheme.
- This training program should include:
 1. Information about the primary purpose of the respiratory component of the health assessment scheme, in particular health protection, prevention and early detection of CMDLD.
 2. Information about the spectrum of diseases included in CMDLD.
 3. How to conduct and interpret quality spirometry.
 4. An introduction to the ILO CXR classification of pneumoconiosis.
 5. Information about coal dust and silica exposure associated with the coal mining industry in Queensland.
 6. A visit to a mine(s), with a focus on inspecting those jobs “at risk of dust exposure”.
 7. Training in how to complete each section of the respiratory component of the health assessment form and identify abnormalities.
 8. Training in the use of clinical guidelines for follow-up and appropriate referral in cases where respiratory abnormalities are found.
- An experienced Medical Officer should be responsible for the ongoing training and audit of those NMAs undertaking respiratory assessments.
- NMA training and auditing should utilise effective methods of modern communication, such as webinars, where geographical constraints make travel difficult.

Health assessment form data collection and storage

- An electronic system of data entry should be designed and implemented.
- Electronic data collection and data storage, with suitable security arrangements and the facility to link and access all records for individual mine workers, should be instituted.
- Existing health assessments that required a CXR should be prioritised, scanned and linked to electronic entries for future health assessments.
- CXR imaging and spirometry for the coal miners' health scheme should be digital, facilitating the transfer, storage and access of the images electronically.
- There should be regular medical review of the respiratory component of the health assessments to audit quality, examine trends and take action as appropriate.

Next Steps

These include:

- Visiting mine sites to better understand the process of NMA appointment, and the data and decision making underlying the development and application of SEGs.
- Finalising the review of the CXRs and spirograms.
- Identifying the local medical capacity for diagnosis, management and review of CMDLD cases.
- A review of comparable interstate and overseas coal miners' health schemes.
- An investigation of other sources of data to estimate the burden of CMDLD.
- Development of a proposal to better estimate the prevalence of CMDLD among Queensland coal miners.

1. Introduction

1.1 Background

Coal Mine Dust Lung Disease¹ (CMDLD) comprises a group of occupational lung diseases that result from the cumulative inhalation of respirable coal mine dust. Coal mine dust includes: carbon, quartz and silicates. It is thought that interactions between these dusts leads to a range of pathological changes.²

Coal miners are at risk of developing these diseases, which include the classic fibrotic lung diseases of coal workers' pneumoconiosis (CWP), mixed dust pneumoconiosis and silicosis, as well as chronic bronchitis, emphysema and diffuse dust related fibrosis. Progressive massive fibrosis (PMF) is the most severe form of CWP. Early detection of each of these diseases is based on different diagnostic criteria and testing. Spirometry can identify earlier declines in lung function than can chest X-rays (CXR), and is used to diagnose chronic bronchitis and emphysema.

All Queensland coal mine workers are required under the Coal Mining Safety and Health Act 1999 (Queensland) and Part 6 of Division 2 of the Coal Mining Safety and Health Regulation 2001 to undergo a Coal Mine Workers' Health Scheme (the scheme) medical assessment prior to the start of their employment at a coal mine, and then at least once every five years during their employment. The health scheme commenced in 1983 when all miners covered by the scheme were invited to participate in a one-off CXR survey, but from 1993 a CXR was required only for workers "at risk of dust exposure", and periodically every five years. The parts of the health assessment relevant to the early detection of CMDLD include a medical history, physical examination, spirometry to assess lung function and a posterior-anterior CXR. A CXR is only required when the employer has advised that the coal mine worker is "at risk from dust exposure". A CXR may show the early signs of CWP in the form of small opacities.

Health assessment under the scheme is the responsibility of Nominated Medical Advisers (NMAs) who are required to complete a "Report on Health Assessment" (the report) at the completion of the assessment. The actual health assessment may be performed by the NMA or an Examining Medical Officer (EMO), however only the NMA may complete and sign off on the report. The report is provided to the coal mine worker and the employer. The completed full health assessment form and CXR films are also forwarded to Health Surveillance Unit (HSU) of QDNRM.

A health assessment conducted under the current scheme covers respiratory health and a wide range of other health matters, including the musculoskeletal system, visual acuity, colour vision and audiometry. This review only relates to those aspects of the health assessment related to the respiratory system.

As of February 2016, six confirmed cases of CWP in coal miners had been identified in Queensland. As these cases had not been directly detected within the existing coal mine workers' health scheme, it is imperative that the design and operation of the respiratory component of the medical assessments performed under the Coal Mine Workers' Health Scheme be reviewed.

1.2 Types of Coal Mines and Numbers of Miners in Queensland

There were 54 coal mines in Queensland in 2013-2014 of which 41 were open cut and 13 underground.³ In addition there are 31 Coal Handling Production Plants (CHPPs), some of which serve multiple mines.

According to data from QDNRM there were approximately 5000 underground coal miners in Queensland at the end of 2015. Table 1 presents the number of miners in each Queensland mine as of November 2015, and whether or not the mine is regarded as “gassy”. Gassy mines are dewatered to expedite degassing for example of methane, leading to drier more friable coal and hence likely higher dust levels. (QDNRM personal communication)

In Queensland the vast majority of coal is coking and thermal coal which are classified as bituminous coals and typically contain between 76–90% fixed carbon, i.e. high rank coal types. All the underground mines in Queensland are bituminous coal mines.⁴

There are no anthracite coal mines in Queensland currently, but there are three semi-anthracite mines; Baralaba (currently on ‘care and maintenance’), Jellinbah East and Yarrabee, all of which are/were operated as open-cut mines. (QDNRM personal communication) There is an anthracite deposit in Nebo West, but there are no current plans to mine it.

All of these mines are known to contain less than 5% silica, provided the mining horizon is within the seam (this can vary). Eagle Downs is considered high silica because they are currently driving drifts in stone. (QDNRM personal communication)

Table 1: Estimated Number of Miners in Underground Mines in Queensland in 2015

Mine	Number of miners	Gassy Mine	Operational Status
Aquila	0	No	Non-operational (care and maintenance)
Broadmeadow	683	Yes	Operating Long Wall
Carborough	314	Yes	Operating Long Wall
Cook	362	No	Redevelopment - Long Wall not yet operating
Crinum	223	No	Non-operational (care and maintenance)
Eagle Downs	5	No	New development (care and maintenance)
Ensham	209	No	Operating Place Change
Grasstree	639	Yes	Operating Long Wall
Grosvenor	249	Yes	New development - Long Wall not yet operating
Kestrel	536	No	Operating Long Wall
Moranbah North	649	Yes	Operating Long Wall
Newlands	109	No	Operating Long Wall
North Goonyella	275	Yes	Operating Long Wall
Oaky No 1	248	Yes	Operating Long Wall
Oaky North	386	Yes	Operating Long Wall
Total	4887		

Most of the Queensland underground coal mines are operating longwall mining. Longwall mining is thought to give rise to four times as much dust as continuous mining,⁵ particularly when production rates (machine speeds) are high.^{5 6} In addition, bi-directional cutting can result in increased coal mine dust exposure for miners.⁵

Various dust control measures are available including improving the design and rate of ventilation, reduced shearer speeds, using sharp picks, enclosure and use of water sprays.⁵

1.3 Prevalence of Pneumoconiosis

The number and rate of fatalities and injuries among coal miners have diminished markedly in the USA¹ and UK⁷ since the 1970s, however workers in the coal mining industry are more likely to suffer chronic lung disease than comparable non-mining heavy industry.⁸

Using the USA as an example, data on occupational injuries and illnesses are substantially underreported in coal mining⁹ and other industries.¹⁰ Under-reporting of disease hinders a targeted public health and industrial hygiene response.

The USA has experienced a resurgence in pneumoconiosis since the late 1990s. There had been an expectation that after the institution of modern dust control regulations the prevalence of the disease would continue to decline. The USA National Institute for Occupational Safety and Health (NIOSH) reported a decline in prevalence from 6.5% in the 1970s to a low of 2.1% in the 1990s. Unfortunately, CWP prevalence subsequently increased to 3.2% in the first decade of the 21st century. The rate of PMF in certain coal mining states in the USA has also recently increased to levels observed prior to the institution of modern dust controls.¹¹ Recently, exposure to silica and silicates, e.g. from cutting rock beyond the coal seam and roof-bolting, have been implicated as a factor in rapidly progressive disease.¹²

Higher rates of CWP have been measured elsewhere. For example, coal miners in Chinese state-owned coal mines who commenced work in the 1970s had cumulative rates of CWP of between 4 to 17%.² The prevalence of CWP in Columbia was recently reported as 36%.²

The most recent report in 1984 of the prevalence of CMDLD in Queensland identified 75 cases of pneumoconiosis or suspect pneumoconiosis among 7,900 CXRs of 7,784 current and 123 retired employees.¹³

Australia has had very few reported cases of CWP in recent years, which has been attributed to be the result of strict dust exposure limits and controls¹⁴ (See Figure 1).

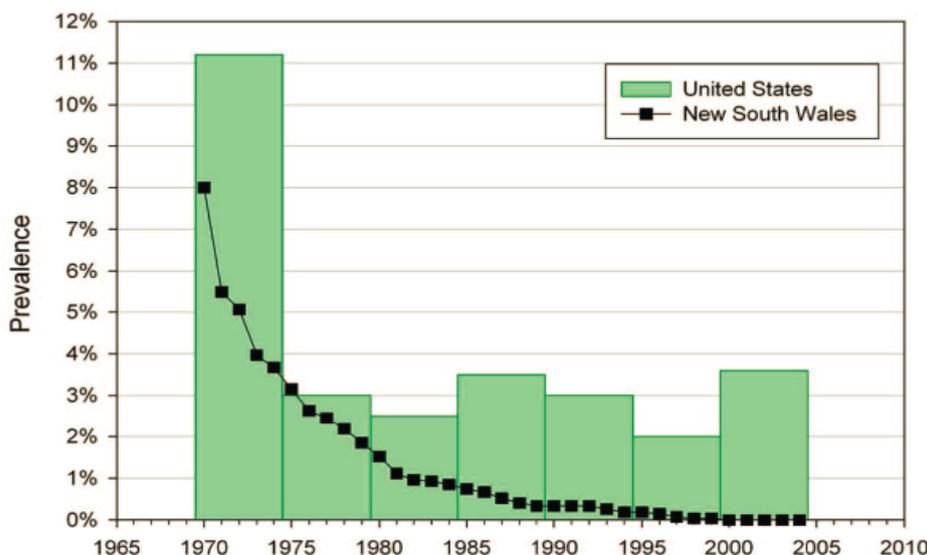


Figure 1: Prevalence of Pneumoconiosis, ILO Category 1/0 or Greater among US Underground Coal Miners and New South Wales Coal Industry Employees, by Year

A 24-year mortality surveillance study¹⁵ revealed that out of over 1,000 pneumoconiosis-related fatalities in Australia between 1979 and 2002, CWP accounted for fewer than 100 fatalities, with the largest decline occurring between 1988 and 1996. There were fewer than 5 workers' compensation claims per million employees for pneumoconioses (excluding asbestosis) from 2000-01 to 2007-08 and no claims from 2008-09 to 2010-11.¹⁶

A study performed by Joy et al¹⁷ for NIOSH compared the differences between USA and Australian mines and miners, although most of the data was from New South Wales (NSW), not Queensland. They concluded that Australian miners were exposed to less quartz, perhaps because they were mining higher seams, had larger numbers of employees implying bigger operations with more investment for environmental monitoring and dust control, and perhaps had more effective use of respiratory protection. This is despite occupational exposure limits for coal dust in Australia not keeping pace with reductions in such limits overseas.

The recent cases of CWP identified in Queensland suggest that more recent information on prevalence and/or incidence is required.

1.4 Similar Exposure Groups

Similar Exposure Groups (SEGs) are defined in the QDNRM fact sheet dated October 2014.¹⁸

“SEGs are groups of workers who have the same general exposure to risk, for example:

- the similarity and frequency of the tasks they perform
- the materials and processes with which they work
- the similarity of the way they perform those tasks.”

The fact sheet provides tables of generic SEGs in underground mines, open cut mines and in CHPPs.¹⁸ The table of SEGs for underground mines is presented below (Table 2).

In this context, SEGs are used to identify which workers should be considered “at risk of dust exposure” and hence should undertake CXRs during the 5-yearly medicals, although specific SEGs are not identified. These categories were devised by the Safety in Mines Testing and Research Station (SIMTARS), based on data of measured coal dust.

A report of a mine survey conducted by/on behalf of QDNRM⁴ stated that:

“Thirty-nine per cent (39%) of mines have implemented monitoring programs where exposures have been characterised and SEGs established.”

Since November 2010, coal companies have been required to identify the relevant SEG in the coal mine workers’ health assessment form. Companies may use the QDNRM generic SEGs or identify their own. The use of a variety of dust control technologies means that exposures vary from mine to mine or face to face within a mine.

Detailed guidance on the exposure data collection, including the number of samples required to establish SEGs, is provided in Appendix C of the Queensland Government report 2010.⁴

When a worker is sent for a health assessment under the scheme, the coal mine employer is required to include the SEG in Section 1 (the employer section) of the form, which subsequently is to be used to guide the decision about whether the worker requires a CXR. This also assumes that the NMA is familiar with the SEG classification. One difficulty with the use of this classification is where it relates to those mine workers who are subcontractors and so not working at one specified mine. A second difficulty is that miners may move between jobs within the mine, and thus may move between SEGs.

Table 2: Underground Coal Mines—Mines Inspectorate SEG Listing (from QDNRM information sheet) ⁴

SEG	Task descriptions	Code
Longwall production	<p>Employees and contractors:</p> <ul style="list-style-type: none"> • Operating shearer, maingate, chocks • Undertaking roof support, hanging/changing cables and hoses • Performing belt retraction, operating drifrunner and LHD 	QCU001
Development production	<p>Employees and contractors:</p> <ul style="list-style-type: none"> • Operating continuous miner, drifrunner, shuttle car, LHD, ramcar • Undertaking roof and rib bolting • Hanging hoses, handling cables, hanging vent tubes, performing belt extensions, hanging brattice 	QCU002
Underground maintenance	<p>Employees and contractors:</p> <ul style="list-style-type: none"> • Performing mechanical maintenance services underground • Performing electrical maintenance underground • Undertaking mechanical repairs and vehicleservicing underground 	QCU003
Outbye supplies	<ul style="list-style-type: none"> • Employees and contractors delivering supplies to underground locations on LHDs 	QCU004
Longwall moves	<ul style="list-style-type: none"> • Employees and contractors operating dozers, LHDs, drifrunners performing face retraction and installation. Any employees and contractors involved in the face retraction/ installation including fitters, electricians and mine technicians 	QCU005
Outbye construction/ infrastructure	<p>Employees and contractors:</p> <ul style="list-style-type: none"> • Operating grader, drifrunner, LHD • Changing hoses, cables, tyres, lights and pipe work • Hanging hoses, pipes and cables • Undertaking roof and rib bolting, shovelling, secondary support, concreting underground 	QCU006
VCD installers	<ul style="list-style-type: none"> • Employees and contractors spraying stoppings and using jackhammer 	QCU007
ERZ controllers	<ul style="list-style-type: none"> • Employees and contractors performing inspections and statutory duties 	QCU008
Surface maintenance	<ul style="list-style-type: none"> • Employees and contractors servicing/maintaining vehicles in surface workshop 	QCU009
Control room operator	<ul style="list-style-type: none"> • Employees and contractors involved in control room operations 	QCU010
Belt splicers	<ul style="list-style-type: none"> • Employees and contractors performing belt maintenance, splicing and commissioning 	QCU011
Boilermakers (surface)	<ul style="list-style-type: none"> • Employees and contractors involved in steel fabricating, welding, oxy cutting, air gouging—surface workshop and CHPP workshop 	QCU012
Administration	<ul style="list-style-type: none"> • Administration officers; stores; management 	QCU013
Resin Workers	<ul style="list-style-type: none"> • Employees and contractors undertaking resin injection and void filling activities throughout the underground workings. This includes the use of polyurethane resins (PUR) and phenolic resins. 	QCU014
Stone Driveage	<ul style="list-style-type: none"> • Employees and contractors involved in mining through stone, faults and intrusions. Generally this is for the purpose of mine expansion or drift construction. This does not include development or longwall workers who from time to time encounter small areas of faulted ground or stonebanding. 	QCU015

1.5 Exposure Limits and Risk of Pneumoconiosis

Dust exposure measurements are used to form SEGs so that workers with similar dust exposure are grouped together. The arithmetic mean exposure for the measurements within a SEG is compared to occupational exposure limits (OELs) to benchmark the extent of dust exposure in a given job. This will indicate whether further dust control measures are required and also whether a worker in a SEG is likely to be “at risk of dust exposure” and hence should undertake a CXR. This section provides background information on exposure limits and risk.

There are two types of OEL, those such as the American Conference of Governmental Industrial Hygienists (ACGIH) which are health-based, and those that are regulatory or pragmatic limits (usually higher) which take into account the feasibility and cost-effectiveness of control (and sometimes measurement feasibility) in relation to the risks.

Exposure limits for coal dust are measured as mean air concentrations over 8 hours (i.e. an 8-hour time weighted average (TWA)). If the shift is normally 12 hours for 5 days (i.e. longer than 40 hour per week) the mean exposure must be compared to a proportionally reduced limit (e.g. 8/12). This is because for coal dust and silica, increased risk is associated with cumulative exposure rather than exposure intensity. Consideration of extended shifts is discussed in Appendix C of a Queensland Government report 2010.⁴

The USA Mine Safety and Health Administration (MSHA) requires mine operators “to use the continuous personal dust monitor to monitor the exposures of underground coal miners in occupations exposed to the highest respirable coal mine dust concentrations”.¹⁹ Samples must be taken over the whole of a shift during normal production.

Number of samples is a critical issue to demonstrate compliance with exposure limits. This is also discussed in the above Appendix.⁴ Exposure measurements typically show lognormal distribution with a tail at the high end of the exposure distribution. This means that if few samples are taken, they are likely to fall at the lower end of the distribution.²⁰

Coal Dust Exposure Limits

The ACGIH set new Threshold Limit Values (TLVs) for coal dust in 1988, replacing the 2 mg/m³ that had been proposed in 1971. The TLVs are set to prevent the development of chronic obstructive pulmonary disease (COPD) and PMF. The TLV document states that a small risk of the latter disease will remain at this TLV, and that exposure should be reduced to those lowest achievable and that silica exposure should also be controlled.²¹

In 1986, a NIOSH-commissioned study carried out in the UK, showed that for coal with a carbon content of 86.2% and exposure at 2 mg/m³, the 40-year risks were 1.15% for PMF and 7.75% for CWP; for coal with a carbon content of 83% and exposure at 2 mg/m³, the risks were 0.71% for PMF and 6.49% for CWP; and for coal with a carbon content of 83% and exposure at 1 mg/m³ the risk was 3.4% for CWP.²² These risks were estimated based on CXRs taken during employment and are calculated for a 58 year-old miner. The study did not examine risks after retirement.

A CWP prevalence study of US bituminous coal miners estimated likely exposure based on measured data extrapolated to earlier years.²³ Prevalence of CWP category 1+ (small opacities) was related to cumulative dust exposure; for individuals with <30 mg-year/m³

prevalence was <5%, but prevalence was 30% for the group with exposure >110 mg-year/m³. On the basis of these data, miners of lignite and sub bituminous coal who work for 40 years at 2 mg/m³ were predicted to have a 1.4% risk of having PMF on retirement and 14% were predicted to get CWP ILO category 1+. Miners of harder bituminous coal were expected to have higher risks, with over 20% predicted to get CWP category 1+.

These data suggest that 30 years of exposure at the current Australian occupational exposure limit of 3 mg/m³ respirable dust would be likely to result in 15-25% prevalence of CWP depending on the hardness of the bituminous coal. Anthracite coal dust would appear to be more fibrogenic and the ACGIH recommends lower exposure limits for dust from anthracite than from bituminous coal based on modelling from Attfield and Moring²¹ (see Table 3).

Other countries have lower occupational exposure limits than Australia. Table 4 lists the occupational exposure limits by country, mainly sourced from the German government website GESTIS in 2016.²⁴

Table 3: Predicated Prevalence Rates of CWP and PMF among US Coal Miners aged 58 Following Exposure 1 mg/m³ Respirable Coal Mine Dust over a 40-year Working Life Time (after ACGIH²¹)

	% CWP Category 1 and greater	% CWP Category 2 and greater	% PMF
Anthracite	12.8	4.6	3.4
Bituminous	11.9	4.1	2.9

Table 4: Occupational Exposure Limits for Coal Dust^{6 19 24-26}

Country	Coal Dust 8 Hour TWA mg/m ³			
	Anthracite	Bituminous	Inhalable fraction	Respirable fraction
Australia				3
NSW				2.5
ACGIH TLV	0.4 ⁽¹⁾	0.9 ⁽¹⁾		
Belgium	0.4	0.9		0.4
Canada - Ontario	0.4 ⁽¹⁾	0.9 ⁽¹⁾		
Denmark				2
Ireland	0.4	0.9		1.6
Latvia	4	4		
New Zealand				3 ⁽³⁾
People's Republic of China			4 ⁽²⁾	2.5 ⁽²⁾
Singapore	2 ⁽¹⁾			
Spain	0.4	0.9		
South Korea				1
USA - OSHA PEL				2.4 ⁽⁴⁾
USA - MSHA				1.5 ⁽¹⁾⁽⁴⁾
USA - NIOSH REL				1 ⁽¹⁾
United Kingdom				2 ⁽⁵⁾

(1) Respirable fraction or aerosol

(2) Free SiO₂ < 10%

(3) 0.15 mg/m³ respirable quartz

(4) < 5% SiO₂ if >5% SiO₂, the standard is 10% quartz

(5) No longer included in published lists

The Australian and New Zealand limit of 3 mg/m³ is the highest value listed for respirable dust. The UK Advisory Committee on Toxic Substances has expressed concern that the UK value of 2 mg/m³ may not adequately protect health “because of doubts that the limit was not soundly-based”.²⁴ The OEL of 2 mg/m³ was included in the published UK 2002 list and its 2003 supplement, but was omitted from the published 2005 list.²⁴

The ACHIG TLV for bituminous coal dust is less than a third of the current Australian exposure limit. Some of the OELs listed for the anthracite dust (0.4 mg/m³) are almost an order of magnitude lower than the Australian limit (Belgium, Ireland and Spain), but the GESTIS source²⁴ did not identify whether they applied as inhalable or respirable dust. Ontario uses the ACGIH TLVs values as respirable dust limits.

Silica Exposure

In addition to coal dust, exposure to crystalline silica may also cause silicosis, another type of pulmonary fibrosis. The available international exposure limits are displayed in Appendix 1. The Australian workplace exposure limits for silica are similar to those of most countries, but higher than the TLV for respirable crystalline silica set by the ACGIH in 2006, and higher than the values set by many countries for cristobalite (the main form of crystalline silica). The ACGIH document states that the silica value was set to prevent lung cancer and the development of silicosis which had been identified in retirees.²⁷ Silica has been identified as a human carcinogen by the International Agency for Research on Cancer (IARC),²⁸ part of the World Health Organisation (WHO).

Steenland and Sanderson (2001) examined lung cancer mortality among 4,626 industrial sand workers. They estimated silica exposure by using a job-exposure matrix based on 4,269 air measurements collected between 1974 and 1995. The average length of employment was 8.8 years and estimated average daily silica exposure was 0.05 mg/m³. The standardized mortality ratio (SMR) for silicosis/pneumoconiosis was 18.2 (95% CI 10.6 - 29.1) based on 17 deaths. The lung cancer SMR was 1.60 (95% CI 1.31 - 1.93) based on 109 deaths. Smoking was thought to account for 10 to 20% of the lung cancer excess. Nested case-control analyses, excluding short-term workers, also showed a significant increased risk for lung cancer by quartile of average exposure.²⁹

In a follow up to a 1974 study, Graham et al examined CXRs of 350 retired granite workers hired between 1940 and 1954 when mean daily quartz exposures (probably respirable dust samples) were 0.05 to 0.06 mg/m³. There was a 5.7% prevalence of radiographic abnormalities defined as a profusion score of 1/0 or greater.³⁰ Graham et al commented that “...because silicosis may appear and progress after exposures to quartz dust have ended, the best group to study includes workers with a long tenure in the industry [including] radiographic follow-up after retirement.”³⁰

These data suggest that coal mines, particularly those cutting through stone (e.g. Eagle Downs) should measure the silica component of dust samples and ensure compliance with silica exposure limits as well as those for coal dust. Where coal seams vary in thickness and stone may be cut, samples also should be regularly checked for silica content.

2. Aims of the Review

A Determine whether the respiratory component of the medical assessment performed under the Queensland Coal Mine Workers' Health Scheme is adequately designed and implemented to most effectively detect the early stages of coal mine dust lung diseases in Queensland coal mine workers, estimating the extent and providing feedback and, if not,

B Recommend necessary changes to correct deficiencies identified under Objective A, recommend measures to follow up cases that may have been missed as a result of these deficiencies and identify what additional capacity is needed in Queensland to improve this scheme.

The full scope of the Review is included in Appendix 2.

3. Review Methods

3.1 Ethics Approval

The review team applied for and received ethics approval for the study from the Monash University Human Research Ethics Committee and the Institutional Review Board of the University of Illinois at Chicago.

3.2 Data from Queensland Department of Natural Resources and Mines

QDNRM have accessed and extracted most of the data for the review. They have de-identified, copied and provided data in electronic form, and also provided some analogue CXRs. De-identification included removal of the name, address, telephone number, day and month of birth (but not year of birth) for each record.

The de-identified data were sent to Monash University via a secure file transfer and are kept on a secure Monash server. Access is limited to Monash University's review team and requires a password login. CXR data will be sent to Professor Cohen by secure file transfer and/or secure courier from Monash University.

The data provided to date include:

1. Health scheme data for the confirmed CWP cases
2. A spreadsheet of data from 91 completed health assessments extracted from the QDNRM database
3. A list of current NMAs
4. 398 Chest X-rays, radiologists' reports and related NMA reports
5. 252 Spirograms and related NMA reports

3.3 Review of Confirmed CWP Cases

The review team received from QDNRM the de-identified data of six individuals with confirmed CWP, including completed health assessment forms and a majority of CXR reports. The spirometry printouts were not available for these cases, but lung function results were reported on the forms. These data were reviewed to detect where the scheme had failed to identify and/or report early respiratory abnormalities for these cases.

3.4 Health Assessment Form Review

We reviewed the content and design of the respiratory component of the current seven-page Health Assessment Form (Appendix 3), including information about the worker's medical history, symptoms, job history and information provided by the employer about risk of dust exposure. We also reviewed the completeness of a convenience sample of 91 forms, and investigated possible reasons for incompleteness and/or poor quality.

We have investigated the criteria for "at risk of dust exposure" by examining the 2010 report from QDNRM entitled "Similar Exposure Groups Coal Mine Workers' Health Scheme".⁴

We reviewed the current criteria used to evaluate risk of dust exposure for the purposes of selecting those requiring CXR screening, including when their job or job site changes.

3.5 Nominated Medical Advisers

We reviewed the list of Nominated Medical Advisers (NMA) currently registered with the HSU of the QDNRM. We examined their qualifications and their geographical coverage, and the information kit provided to NMAs by the HSU.

3.6 Chest X-ray Review

The review of CXRs is being co-ordinated by Professor Cohen.

We plan to examine the quality, accuracy and reporting of a sample of approximately 500 CXRs. CXRs will be read using the ILO Classification of Radiographs for Pneumoconiosis, which entails comparison of the CXR of interest to standard CXRs for identification of type of abnormality and its profusion. The CXRs will be reviewed by at least two B-readers in the USA (and up to five B-readers where there is not agreement), and two radiologists in Australia.

The two primary US B-readers are: Robert Cohen, MD Pulmonologist B-reader, NIOSH Project Officer American College of Radiology Pneumoconiosis Task Force, and Kathleen DePonte, Radiologist, B-Reader, Member of NIOSH Coal Worker's Health Surveillance Panel, Member of American College of Radiology Pneumoconiosis Task Force. Up to three other US B-readers will be included to resolve differences between the primary readers' findings according to the NIOSH protocol.

One of the two Australian X-ray reviewers is Dr Samantha Ellis, a Fellow of the Royal Australian and New Zealand College of Radiologists (RANZCR) and an experienced thoracic radiologist. The other Australian X-ray reviewer is yet to be appointed.

We have provided a CXR protocol (attached as Appendix 4) which sets out the aims, sample size calculations and processes to examine the quality, accuracy of reading and of reporting of:

1. Chest X-rays
2. Radiologists' reports
3. NMA reports based on the CXR data

This part of the review will assess quality by applying ILO criteria to the reviewing of approximately 500 CXRs sampled from across all mines, for coal miners workers with at least a 10-year work history.

We plan to identify the types of sites where the CXR were taken, where this information is identifiable from the CXR reports supplied.

3.7 Spirometry Review

The review team is developing a protocol to critically examine the current spirometry testing procedures. We aim to examine the quality and reporting of:

1. Spirometry data
2. NMA reports based on the spirometry data

We will examine the quality, accuracy, and reporting of a sample of approximately 300 spirogram. Quality of spirometry will be assessed by two reviewers, Professor Bruce Thompson and Dr Ryan Hoy, who are both experienced in interpreting lung function data according to the American Thoracic Society (ATS) criteria.

In addition, we plan to undertake a survey of the equipment, calibration, qualifications and training of the spirometry providers. A questionnaire to gauge quality control of spirometry testing has been developed and will be distributed by QDNRM to all currently listed NMAs.

3.8 Queensland Medical Capacity

For the final report we will identify the expertise and resources currently available in Queensland to perform high quality medical assessments, and to perform and interpret high quality CXR and spirometry. This will include:

1. The development of a framework for clinical standards for NMAs to guide assessment, management and specialist follow-up when respiratory abnormalities are detected,
2. A review of expertise and training of the specialist respiratory physicians available for referral and subsequent clinical management of coal miners suspected of having a CMDLD, and
3. The development of guidelines for radiologists to report CXRs undertaken under the scheme in line with the ILO classification.

3.9 Health Assessment Form Data Collection and Storage

We have reviewed the system for data collection and storage used by HSU, including accessibility by the NMA of previous health assessments, through discussions with the QDNRM Occupational Physician and other staff members of the HSU and a storage facility.

The dataset supplied to the review team included all fields except work history, respiratory medical history, quality of CXR film and EMO comments.

We visited the data storage centre at Stafford to discuss the data collection and storage processes, and to review the database and security arrangements.

4. Interim Findings

4.1 Purpose(s) of the Respiratory Component of the Current Coal Mine Workers' Health Scheme

Current situation

The 2010 report of a survey of coal mines⁴ stated that:

“The responses provided during this self-assessment process indicate there is some general confusion around the requirements for and the content of health surveillance for Queensland coal mine workers. For example only 83% of underground mines stipulate that chest X-Rays are conducted for some or all of the coal mine workers at the mine. In actual fact, at all underground coal mines, the majority of coal mine workers will receive a chest X-Ray as part of the five-yearly Coal Mine Workers Health Scheme. Similarly all coal mine workers receive a lung function test. This is not reflected by the responses received.”

The report states that only approximately 60% of mines indicated “that they reviewed the health surveillance data periodically” and that several mines indicated that they would like to access de-identified data gathered by the scheme but were unable to.

While historically there was a prime focus of the respiratory component of the health assessment scheme on the early detection of CWP and other CMDLD, this focus has been lost and the current focus is on fitness for work.

Limitations

The purposes of the respiratory component of the health assessment scheme should be more clearly stated as being to provide systematic respiratory health monitoring in coal miners to:

1. Detect early changes indicative of CMDLD over time, with appropriate referral for follow-up, diagnosis, clinical management and reduction in ongoing coal dust exposure.
2. Collect and analyse data over time to provide ongoing surveillance of CMDLD and to help inform whether dust exposure should be reduced across the industry.
3. Inform the individual coal miners about the risk of CMDLD.
4. Assess respiratory fitness for work, including the assessment of the suitability of miners to wear PPE, in particular RPE.

The scheme should have an important role in the detection of the early signs of CMDLD in individual miners, but this is not the prime focus at present. The scheme is mainly concerned with fitness for work, and the respiratory system questions are embedded with assessment of other body systems. The lack of consolidation, and thus focus on the respiratory component, means that early lung changes could easily be overlooked.

The scheme also excludes retired workers, in whom respiratory changes are more likely to be seen than in current workers, due to the latency of changes following exposure.⁷ This omission reduces the effectiveness of the scheme as a group surveillance program documenting trends in CMDLD over time.

The review team would like to emphasise medical surveillance of CMDLD is only useful for secondary prevention and identifying where there may have been excessive exposure. However, because of the long latency in the development of CMDLD, it is not a substitute for primary prevention, which should be in the form of coal mine dust monitoring and control.

4.2 Overall Process of the Current Coal Mine Workers' Health Scheme

Current situation

The flow chart in figure 2 shows the overall process of the current coal mine workers' health scheme. The respiratory questions and tests are administered alongside other tests for fitness to work, such as for hearing, vision and musculoskeletal fitness.

The information in this section is summarized from the Coal Mine Workers' Health Scheme – Information for Newly Appointed Nominated Medical Advisers (version 8, 24/02/15), which includes relevant sections of the Coal Mining Safety and Health Regulation (2001) (CMSHR).

The process and procedures of the Coal Mine Workers' Health Scheme begin when a potential, current or previous coal miner applies for work with an employer, who could be a coal mine operator or a contractor (step 1). It is not clear whether the hazards and risks associated with the coal mining industry are discussed at this initial stage or at a later stage during the course of the worker's employment, or not at all. Employers are required to explain the hazards and risks under general health and safety regulations but this may take place elsewhere, for example in pre-employment training, rather than as part of the health assessment.

As specified under section 46 of the CMSHR, employers must ensure prospective coal mine workers undergo health assessments with their NMA prior to employment, and periodically as decided by the NMA but at least every 5 years. Employers are expected to complete Section 1 of the Coal Mine Workers' Health Assessment Form before workers attend NMA appointments and employers are also required to pay for the assessments (step 2). Section 1 is meant to inform the NMA about the potential hazards of the coal miner's proposed job and importantly should specify whether the worker is "at risk of dust exposure" and therefore requires a CXR.

However, companies advertise for workers with a current fit for work health assessment, especially contractors and subcontractors. We understand that this is becoming more common in the industry. Not only does this mean that Section 1 about the relevant SEG cannot be completed as it will be unclear where the miner will be working, but often the burden of payment for the medical falls on the prospective mine employee. Further, it is likely that miners who are contractors will work across many different mines. This flaw in the process may partly explain the poor completion of the SEGs component in Section 1 (see Section 4.4.2 for further details). The importance of clearly defining SEGs was highlighted in a Departmental report,³¹ which revealed that although all coal mines conduct health surveillance and all underground and 93% of open cut mines conduct lung function testing, only 83% of underground and 36% of open cut mines include CXRs.

The coal mine worker completes Section 2 of the approved form, to provide details about work history, past and current medical history, prior to attending their NMA appointment (step 3). Section 3 of the form consists of the clinical findings, including the spirometry and CXR results if available and is completed by either the NMA or EMO after Sections 1 and 2 have been reviewed (step 4). Under section 46 of the CMSHR, health assessments can be carried out by an EMO other than the NMA, though assessments must be undertaken under the supervision of an NMA.

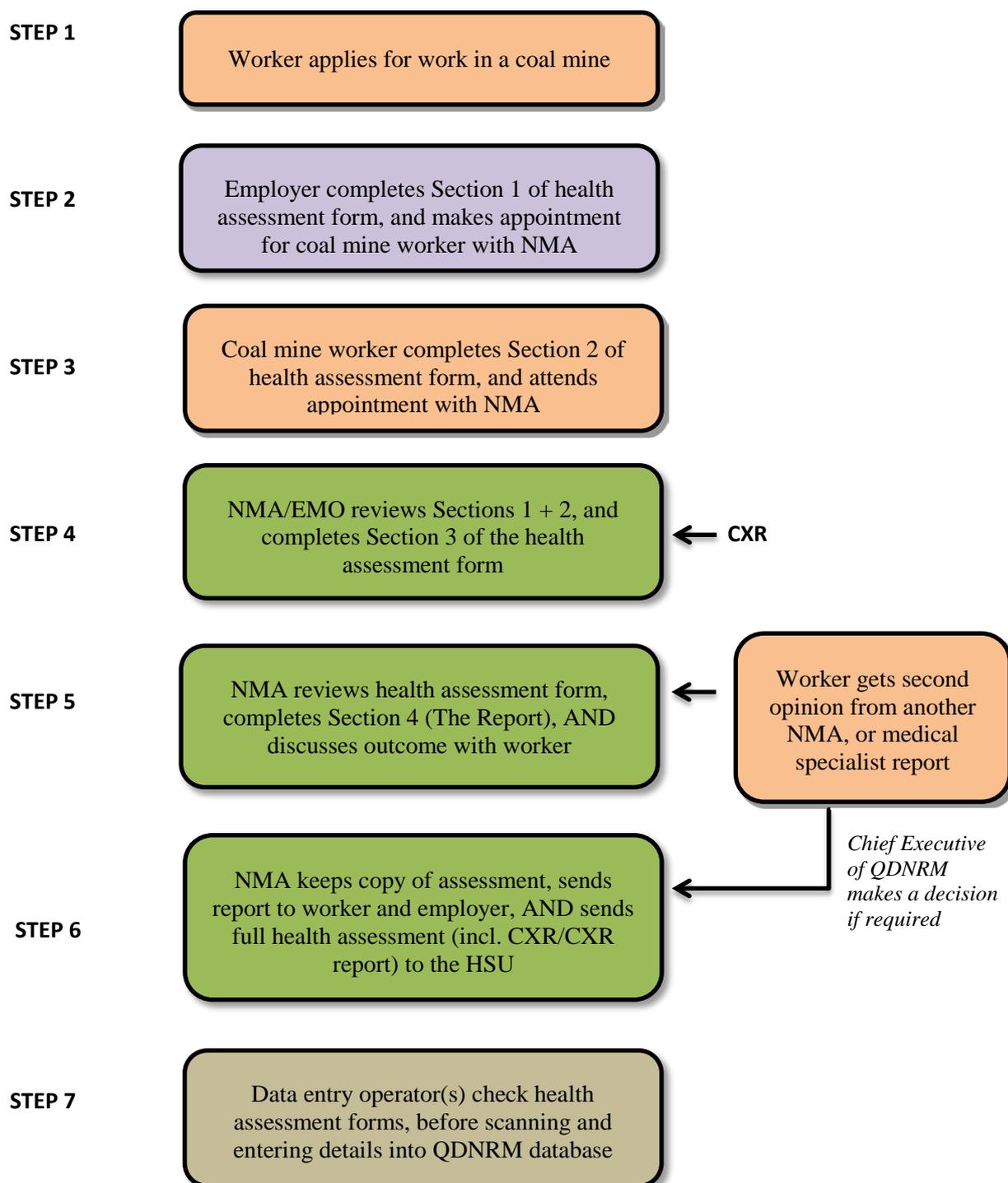


Figure 2: Flow chart of the current process of the Coal Mine Workers' Health Scheme (developed by the review team, based on QDNRM Coal Mine Workers' Health Scheme - Information for newly appointed NMAs)

EMOs are not authorized to complete Section 4 of the report. Instead, partially completed health assessments should be forwarded to the NMA, who is meant to review Sections 1 to 3 prior to issuing the report to the employer and coal mine worker (step 5). The report essentially summarizes the health assessment and outlines a worker's fitness for work, including any restrictions. NMAs are expected to provide an explanation of the outcome of the medical examination to the worker and "where practical" secure the worker's signature on the report. It is also the NMA's role to specify the nature and duration of restrictions imposed on a worker's fitness and any required review.

The appendix of the NMA information kit illustrates examples of work restrictions relevant to nominated medical conditions, such as manual handling weight restrictions for musculoskeletal injury and diminished cardiovascular fitness. With respect to respiratory conditions, the information kit advises that individuals with COPD and pneumoconiosis are to avoid exposure to irritant airborne contaminants (including dusts) and should not work underground. However, there are no instructions or clinical standards to guide further evaluation and follow-up of abnormal clinical findings or newly diagnosed medical conditions. NMAs are advised not to disclose medical conditions on Section 4.

If a coal mine worker is declared unfit to undertake a certain position, or has restrictions imposed that an employer feels unable to accommodate and they intend to dismiss or demote the worker, the worker has a right under section 48 of the CSMHR to request an opportunity for a second opinion from another NMA or relevant specialist (step 5a) (at their own expense). The original NMA is then expected to review their initial report in light of the findings in the second doctor's report and issue another report. Where differences between the reports are unresolved, the worker or employer notifies the chief executive of the QDNRM, who will appoint a medical specialist to make a final decision based on a review of the conflicting reports and, if necessary, arrange a further assessment of the worker.

The health assessment records collected under the Health Scheme are the property of the QDNRM. NMAs are required to keep a copy of the health assessment data and completed forms and to send a copy of the full assessment, including original CXR films and reports (or copies of CD/DVD) and spirometry to the HSU of the QDNRM (step 6).

Data entry operators in the HSU check health assessments for completeness, before entering the data into the QDNRM database (step 7).

Limitations

The overall assessment, including the respiratory component, appears mainly aimed at current fitness for work, rather than the early detection and management of CMDLD.

There is no clear referral pathway for diagnosis, management and treatment of CMDLD implicit in the overall process in the event of finding an abnormality on the CXR, lung function or other respiratory abnormality. A clinical pathway for follow-up of abnormal spirometry, CXR results or other respiratory abnormalities, is needed; including further diagnostic tests, follow-up with a respiratory physician with expertise in occupational lung disease and pneumoconiosis, and management of suspected cases including appropriate workplace restrictions.

A diagnosis of CMDLD might be made by a specialist after referral from the NMA, however there is no established process by which such a diagnosis is formally notified to HSU.

The SEG approach in Section 1 of the form, which is necessary to determine whether a miner needs a CXR, does not account for the situation where the miner is working as a

subcontractor and is not working at a specified mine. CXRs are not being undertaken by all coal mine workers who work underground.⁴

Miners may have very small opacities and acceptable lung function at any one assessment and be viewed as fit for work, but comparison across serial medical assessments might show small, preclinical changes and declines in lung function. There is no mechanism for follow-up health assessments focusing on the respiratory health or additional CXRs of coal miners previously in a position “at risk of dust exposure” once they leave such a position.

The scheme does not explicitly include contract or labour hire workers. In addition, there is no mention of exit health assessments or on-going follow-up of coal mine workers who retire or leave the industry.

The current system does not prevent the submission of incomplete assessments. An electronic system of data entry to a centralised secure database would reduce workload for HSU by removing step 7. Lack of completion of steps e.g. Step 2 could be programmed to prevent the submission of incomplete forms. Such a system would also enable the findings from previous health assessments to be accessed by NMAs directly from the HSU and compared with recent assessments, including in instances where workers’ previous health assessments have been completed by different NMAs.

The review of the health assessments at HSU is purely administrative and involves no medical review or audit, and the QDNRM database is currently not being utilised for group surveillance.

There is also no explicit process by which the HSU can ensure that the scheme as implemented remains fit for purpose.

4.3 Confirmed CWP cases

The respiratory component of the health assessment forms for the six confirmed cases were examined and the overall deficiencies relevant to the early detection of CMDLD for the cases are summarised below.

The review team was not provided with additional medical information gathered outside the scheme, so it was not able to examine what prompted the (re-)assessments or investigations that led to the diagnosis of CWP in these cases. The review team will seek further information about this from the QDNRM. The review team will also request health assessment forms for any further confirmed cases which become known during the rest of the review.

The details of the individual cases are not included in this report, to preserve confidentiality.

Limitations

In general, there was a lack of documentation about follow-up or referral for any abnormal spirometry or CXR results, the majority of which were considered to be suggestive of chronic obstructive airway disease, rather than CMDLD.

CXRs were not reported according to the ILO classification for any case, though for one case the wording used by the radiologist was consistent with early pneumoconiosis changes.

In most instances where respiratory abnormalities were found during the health assessment, workers were considered fit for underground work with no recommendations for restrictions for respiratory conditions, e.g. avoiding exposure to dust.

The review periods were sometimes scheduled less frequently than desirable, even when there were indications in the health assessment that respiratory problems were present. In addition, follow up in such situations was not always relevant to the respiratory system.

Where obstructive ventilatory patterns were observed in the spirometry results, the abnormalities were attributed to tobacco smoking. However, coal mine dust exposure may cause obstructive lung disease, with or without the presence of the radiographic finding of CWP. Not recognising the contribution from coal dust has the potential for dust exposure not to be assessed and action not being taken to reduce dust exposure to reduce the potential for a future decline in lung function.

Where there was a decline in spirometry results over serial health assessments, this could only be identified by referring to the results of previous health assessments, which did not appear to be done, from the information supplied.

Where CWP was diagnosed after retirement, this highlighted the problem of no mechanism for respiratory follow up within the scheme for workers who have retired from coal mine work. Respiratory symptoms and radiographic findings may develop or worsen after cessation of coal mine dust exposure, but there is no provision for continuing the respiratory evaluation of retired coal miners in the current scheme.

Health assessments are required to be completed periodically at least every five years, although these may be undertaken more frequently at the NMA's discretion, in particular after being notified that the level of risk to the coal miner's health has increased appreciably

or where suggestive changes to the respiratory system have been identified at a health assessment. Health assessments for these cases often did not occur according to this required time interval. In some cases, health assessments were conducted more frequently, although the reasons for this were not always made clear on the health assessment forms. This may be explained, in part, by the worker changing employer and requiring a new health assessment, which can result in more frequent CXRs than desirable.

4.4 Content and design of the Respiratory Component of the Health Assessment Form

4.4.1 Content and design of the approved Health Assessment Form

Current situation

The current version (dated 27/06/11) of the scheme's Health Assessment Form is a seven page paper-based document. It is divided into four sections for completion by the employer, worker, EMO and NMA respectively.

The employer's section consists of free text boxes to record the employer and mine name, the coal worker's position (including generic and company SEG) and six "yes/no" questions about exposure to various hazards.

The coal mine worker's section consists of over 40 questions grouped under five separate headings, including "yes/no" tick box options for a range of medical conditions and free text entry for the work history.

The EMO's section consists of over 50 questions grouped under eighteen separate headings, including "yes/no", "abnormal/normal", "absent/present" tick box options for medical history and clinical findings for all the major body systems and space for additional comments.

The NMA's section, Section 4, of the Health Assessment Report, consists of similar fields as the employer's section, the EMO's examination details and five tick box options to record the coal mine worker's fitness for duty and restrictions.

This review is limited to the respiratory component of the form.

Limitations

The current structure of the health assessment form has the respiratory component scattered among the numerous questions and physical findings related to other body systems, which reduces the focus on the respiratory system.

The current health assessment form is lengthy and could be reduced by the use of tick boxes e.g. for previous occupational history provide a list of jobs such as that in Table 2, duration of employment and mine name. This would allow rapid identification of jobs associated with development of CMDLD.

There are insufficient questions about previous respiratory conditions such as asthma, bronchitis, emphysema, tuberculosis, pneumoconiosis, lung surgery, lung infections, allergies). The form does not have a complete respiratory symptom questionnaire, which is standard for health surveillance of hazardous substances that affect the lungs.

The 1995 National Occupational Health and Safety Commission (now Safe Work Australia) guidelines include a respiratory questionnaire and both the NSW and WA health assessment forms for mining employees include expanded respiratory sections compared with the

Queensland form. The six-page health assessment form used in WA Scheme focuses almost entirely on work history, current respiratory symptoms, spirometry and CXR results.

The form also does not include a section on types or frequency of use of RPE required for the job.

There are several ambiguously-phrased questions, e.g. Question 2.4e “Abnormal shortness of breath or wheezing?” asks about two symptoms in one question. The smoking history is also unclear, “Do you currently smoke, or have you ever smoked?” and doesn’t allow for the differentiation of current and former smokers.

There are several duplicate questions. Question 1a, “Dust exposure (x-ray needed?)” corresponds with questions 3.12 and question 1b, “underground work” corresponds with a question in the report (Section 4), “Is the assessment for underground work?”

There is no specific reference to the absence or presence of symptoms/signs consistent with CMDLD, the follow-up required and frequency of subsequent health surveillance in Section 4, such as:

1. Worker has no evidence of lung disease due to coal mine dust exposure, review in five years (or earlier if significant change in exposure, or change in health status).
2. Worker was noted to have significant exposure, but no evidence of disease due to coal dust exposure, review in five years (or earlier if significant change in exposure, or change in health status).
3. There are abnormal findings such as opacities on the CXR, respiratory symptoms or a decrease in lung function which require further assessment. (Include tick box option(s) for type of review required, specialist follow-up, current work status and date of respiratory review).
4. Worker unfit to undertake work that involves potential exposure to coal dust, (having defined what exposure to coal dust means).
5. Other findings not related to coal dust exposure, but which require follow-up with GP/other specialist, should be reported separately from the respiratory recommendations.

The lack of “N/A” tick box options also increase the likelihood of errors, as well as inconsistent interpretation and responses during form completion.

4.4.2 Completion of the Health Assessment Form

Current situation

Respiratory component of the health assessment form captured in the DNRM database

The aspects of the current health assessment form that were relevant to respiratory system were identified, and subsequently compared with the fields included in a dataset of 91 completed health assessments.

In general, the majority of the respiratory component of the form were captured in the DNRM's database. However, a number of important questions were omitted including:

- Section 2.2 - work history;
- Section 2.3 - health-related history, in particular whether a previous medical had been completed under the health scheme and date of the last examination;
- Section 2.4 – past medical history, in particular asthma, bronchitis or other lung diseases and abnormal shortness of breath or wheezing;
- Section 3.12 – quality of CXR film and whether it was attached to the report;
- Section 3.18 – fitness for duty in relation to working under various conditions such as underground, in dusty conditions and while wearing PPE such as respirators;
- Section 4 – NMA explained restriction or additional assessment for the worker.

In addition, other past medical history from Section 2, such as tightness of chest and allergic reaction or reaction to chemicals or dust are relevant to the respiratory system and therefore should be included in the DNRM database.

Completeness and quality of information in the DNRM dataset

The information contained in the DNRM dataset was assessed for completeness and quality from a convenience sample of 91 health assessment forms. Completeness was ascertained by the proportion of dataset fields that required an entry that were provided, for example worker's date of birth. Quality was determined by the proportion of fields that were internally consistent, for example the consistency of entries for duplicate questions.

Full quantitative results from this review of completeness and quality of the respiratory component of the 91 health assessments are presented in Appendix 5.

We found that the medical information was largely complete. However, some fields were consistently incomplete or poorly completed, as follows.

Limitations

The employer's section of the form was poorly completed. This may in part be due to workers being required to complete a health assessment prior to being employed. This is problematic in that the job may be unknown, particularly where contractors are involved, and so the appropriate decision about whether a CXR is needed cannot be made.

The SEG to which the coal worker's position was allocated was a required field from November 2010. The generic SEG was only provided in a minority (4/21) of medicals and company SEGs were not completed in any of the health assessments.

Other important fields that were poorly completed were questions about dust exposure and whether the assessment was for working underground.

Some of these questions were also duplicated or overlapped. Question 1a, “Dust exposure (x-ray needed?)” corresponded with questions 3.12 “CXR undertaken”. Although “y” was entered for question 3.12 in all 91 medicals, over one-third (38%) of entries for question 1a did not correspond, and had either “N” entered or were left blank. Question 1b, “underground work” corresponded with a question in the report (Section 4), “Is the assessment for underground work?” Almost one-third (27%) of the responses in Section 4 did not correspond with the responses for question 1b.

Another field from Section 1 that was poorly completed was the name of the mine. Although all 91 medicals had this field completed, approximately one-third (36%) had quality limitations, with either “Unknown” or “Various mines” entered for this field. It is possible that the term “Unknown” is because these were workers seeking employment and “Various” was used where the worker is a contractor or labour hire employee.

The remaining notable quality issues related to the EMO’s details in Section 4, for which surnames alone were entered for fifty-seven out of fifty-nine medicals, and details of restrictions in Section 4, from which it was unclear whether they related to respiratory conditions.

In some cases the free text boxes have been completed in illegible handwriting.

Targeted auditing, which could be conducted in several ways, would reduce the poor completion of the forms. For example, an audit of the first batch of health assessment forms completed by new NMAs and a random sample of assessment forms completed by more experienced NMAs. In the WA-based system, approvals to undertake mining employees health surveillance is revoked if an unacceptable number of poor quality forms are submitted.

4.5 Criteria for “At Risk of Dust Exposure”

Current situation

Whether the coal mine worker is “at risk of dust exposure” is required to be specified by the employer in Section 1 of the health assessment form by the inclusion of SEGs. It triggers the need for a CXR when the worker attends an NMA appointment so it is important that it accurately reflects the dust exposure of the individual. Otherwise those who require a CXR may not receive one and those who do not require a CXR may have one unnecessarily.

In the convenience sample of 91 completed medical forms examined by the review team, 21 were completed post-2010 when the SEGs were introduced. In respect of the 21, we found that:

1. Generic SEGs were poorly completed, this section was completed in only four forms.
2. Company SEGs were not completed in any of the forms, hence the review team was unable to identify any company SEGs.

There were also inconsistent entries for duplicate questions on the form relating to “at risk of dust exposure” jobs, e.g. dust exposure/CXR needed and working underground.

The Queensland Government Dust Self-Assessment Feedback Report (2010)⁴ stated that 76% of coal mines identified that respirable silica was a hazardous dust at their site and 29% identified that respirable coal dust might be a problem, but it not clear how this is reflected in the SEGs.

Further review of the approach to company SEGs will be undertaken by discussion with the employers identified through the Coal mine operators’ representatives in the Reference Group. Although a minority (13/54) of mines in Queensland is underground, about half of the CXRs are performed for underground miners. QDNRM recently examined a convenience sample of 5,997 records, 56% of which were health assessments for underground workers (n=3,369) and 44% for open cut workers (n=2,628). For CXRs that related to a first assessment (n=2,792) 53% were underground and 47% were open cut. For CXRs that related to a periodic medical (n=3,205) 59% were underground and 41% were open cut.

Limitations

The criteria for “at risk of dust exposure” are not well specified. All underground workers are likely to be “at risk of dust exposure” but some above ground miners at underground sites, some open-cut miners and some workers at CHPPs are also likely to be “at risk of dust exposure”.

NMAs rely on employers’ completion of Section 1 (including SEGs) to guide their decision about whether a coal miner requires a CXR, however there is no guidance for NMAs about the development or application of SEGs, let alone the criteria for “at risk of dust exposure”.

The use of SEGs to categorise exposure has some merit, but is complex to operationalise. Workers may change SEGs and SEGs may change due to changes in dust levels when production or control measures change. It should be clearer which SEGs should be regarded as “at risk of dust exposure”. The decision could be based on mean data from the most recent SIMTARS survey for the QDNRM SEGs, and on company data for the company SEGs.

The SEGs should take into account silica as well as coal dust. An example of such a definition might be:

Any job where the arithmetic mean exposure to coal dust and/or arithmetic mean exposure to silica is more than a half of the relevant exposure limit should be regarded as a job which is “at risk of dust exposure”. For Queensland in 2016, these limits are 3 mg/m³ 8 hour TWA for coal dust and 0.1 mg/m³ 8 hour TWA for silica.

Guidance on data gathering for SEGs is provided in Appendix C of the 2010 report⁴ for when a SEG is to be considered “at risk of dust exposure” and thus triggering a CXR. The 2010 report⁴ indicated that 11% of mines did not carry out monitoring, a further 26% monitored annually or less frequently, and 31% only monitored on the day shift.⁴ These data include open-cut and underground mines but there are likely to be some open-cut jobs that should be regarded as “at risk of dust exposure” for the purposes of a CXR. However, the respiratory component of the current scheme imply that it is only underground miners who require a CXR.

The SEGs should also take into account extended shifts and adjust the relevant exposure limit in proportion. The 2010 report suggested that only 25% of mines did this.⁴

Lastly, if SEGs are used to define “at risk of dust exposure” they should be revisited and updated regularly if there are changes in the mine which would be reasonably anticipated to change the dust exposure of jobs in the SEGs, e.g. to the strata, to production methods, production rates, or dust control measures.

4.6 NMA Appointment, Training and Qualifications

Current situation

Nominated Medical Advisers – Total number, clinic type and qualifications

The NMAs were grouped according to qualifications and clinic type, as displayed in Table 5 and Figure 3. More details are provided in Appendix 6.

In total, there are 237 NMAs registered to conduct the coal workers' health assessments under the scheme. The NMAs practise in over 140 clinics and are based in five different States. Some NMAs practice in more than one clinic. The number of NMAs expanded greatly during the mining boom (after 2005), but prior to this there were approximately 40 NMAs.

General Practitioners (GPs) accounted for 62% of NMAs, while specialist Occupational Physicians constituted the smallest proportion at 12%. Non-specialists or medical practitioners with general registration accounted for the remaining 26% of NMAs.

There were two main types of clinic in which the coal mine workers' health assessments were conducted, GP clinics and Occupational Health Service clinics. However, there were more than twice as many GP clinics as Occupational Health Service clinics, (97 vs. 43).

The majority (about 90%) of NMAs and clinics are in Queensland. Although the coal workers' health assessments are undertaken in 28 different Queensland regions, these activities were concentrated in five main regions: Brisbane/Brisbane City, Mackay, Sunshine Coast, Rockhampton and the Gold Coast. The majority of these sites are a considerable distance from the mines.

Table 5: Number of NMAs and their Qualifications in Queensland 2015, by Main Region

Region	Occupational Physicians	General Practitioners
Mackay	2	28
Rockhampton	2	14
Sunshine Coast	0	14
Brisbane/Brisbane City	10	33
Gold Coast	1	8
Total	15	97

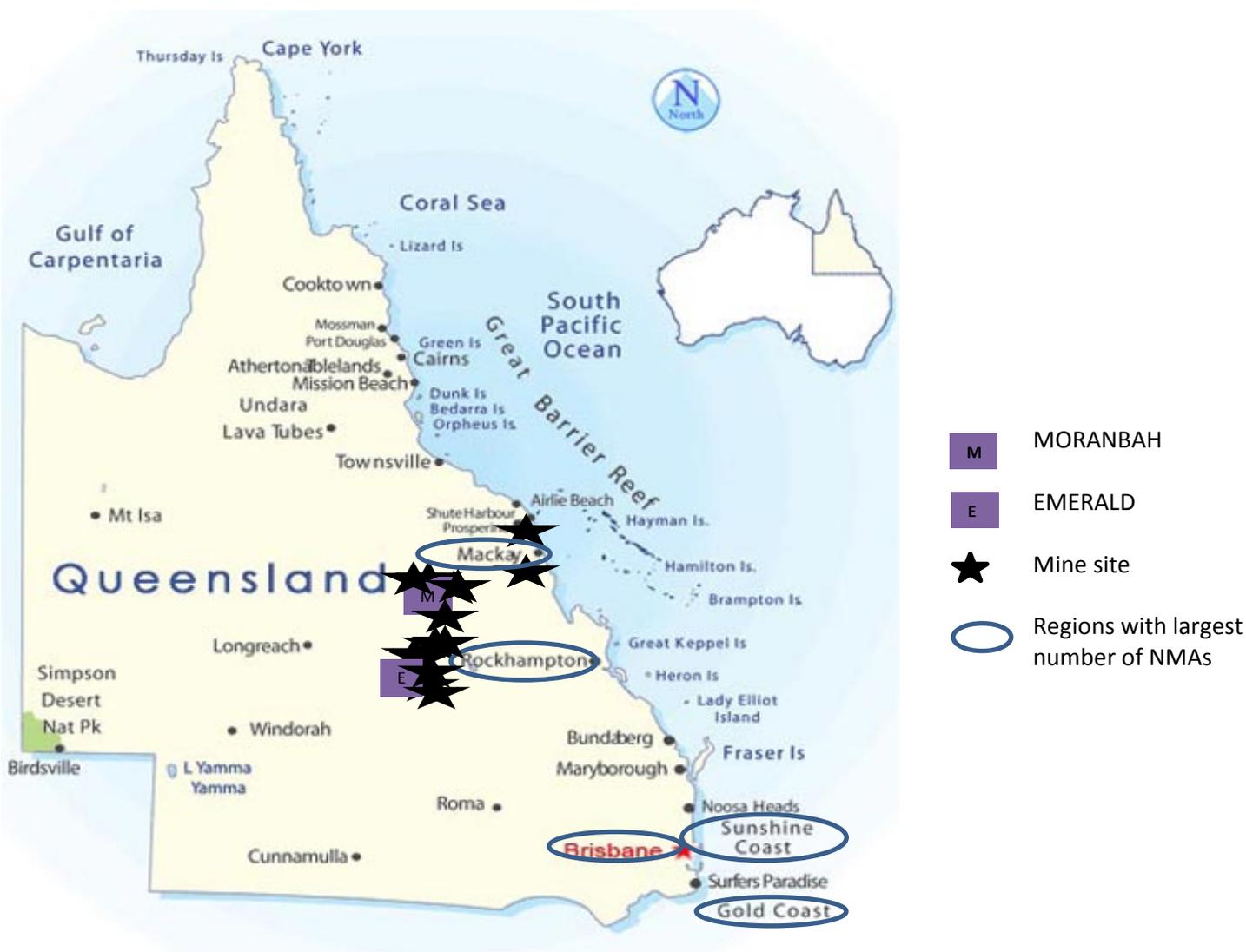


Figure 3: Underground Mine and NMA Main Locations in Queensland

Nominated Medical Advisers - Appointment and training

There is no formal system for appointing NMAs by QDNRM, and selection of NMAs is at the discretion of the mine companies, contractors and labour hire firms.

There is currently no formal training of NMAs prior to being appointed to undertake health assessments of coal mine workers, although regular meetings with NMAs were conducted by HSU prior to the expansion of the number of NMAs during the mining boom. In addition, NMAs are not required to hold any specific qualifications apart from being a registered Medical Practitioner. Instead, the QDNRM furnishes newly appointed NMAs with an information kit. The current version (dated 24/2/15) is an 18-page document which outlines the process of the coal mine workers’ health scheme but does not clearly outline the purpose of the scheme related to the early detection of CMDLD or medical guidelines for this purpose. The kit includes an Appendix which summarises the relevant sections of the 2001 Coal Mining Safety and Health Regulation and contains a list of suggested work restrictions for workers with nominated medical conditions, including asthma, COPD and pneumoconiosis.

Limitations

There are currently too many NMAs conducting the respiratory component of the coal mine workers' health assessments. EMOs also undertake health assessments, so the pool of medical providers is even larger. This current situation has created challenges for the HSU in maintaining an accurate and up-to-date register of NMAs and co-ordinating (previously held) NMA meetings and training. Furthermore, a large group of medical providers with diverse qualifications and practising in a variety of clinic settings is likely to impact negatively on quality assurance.

NMAs are “strongly advised” to visit the mine sites for which they will be providing services, however this is not mandated. Experienced medical providers or those with specialist training in occupational medicine are likely to be familiar with hazards and risks specific to the coal mining industry. However, without a good knowledge of a coal mine worker's particular work environment, there are likely to be limitations in the conduct and quality of respiratory health assessments and this is a major weakness in the integrity of the health assessment scheme.

The lack of formal training for NMAs is particularly concerning. There is currently no means of ascertaining understanding of the content of the NMA information kit or its appropriate application, and no ongoing audit of NMAs' performance. The main purpose of the information kit is to outline administrative procedures for conducting health assessments, rather than to provide medical guidelines; there is no information about the primary purpose of the coal mine workers' health scheme and no explicit instructions about procedures for clinical management/referral for suspected CMDLD cases.

The role and qualifications of the EMOs are undefined in the scheme under the Regulations. Given that more training and selection is suggested for NMAs, allowing comparatively less trained EMOs to carry out the respiratory examination is a further weakness.

The 2010 WA guide to health surveillance system for mining employees and the corresponding 2011 Coal Services (CS) Health Order 41 document for NSW contain detailed information about the purpose, objectives and process of their health surveillance systems. In addition, CS Health has developed an information pack for workers.

4.7 Chest X-ray Review

Current situation

Review of the confirmed cases has demonstrated that:

- The purpose of the CXR is usually not adequately conveyed on the CXR request form, e.g. terms such as “pre-employment medical” are used
- It is not specified that the CXR is for screening, not diagnostic purposes
- CXR reports have not been based on the ILO criteria

To date, we have received a convenience sample of 268 analogue CXR films for review. The majority were performed at two sites, Moranbah Hospital and CQMI Emerald. Due to difficulties with de-identification the review team have not yet reviewed the digital films and hence do not know where they were performed. The distribution of CXRs according to sites where the analogue CXRs were performed is presented in Table 6. The CXRs provided by QDNRM will be reviewed according to the protocol outlined in Appendix 4.

Table 6: Analogue Chest X-Ray Film Sites

Site	Number of CXRs	Percentage
Bundaberg Medical Imaging	1	-
Bundaberg Radiology	1	-
Collinsville Hospital	2	1
CQMI Emerald	101	38
CQMI Radiology Rockhampton	1	-
CQMI Rockhampton Mater	6	2
CQMI Rockhampton Mackay	1	-
CQMI Rockhampton North	6	2
CQMI Yeppoon	4	2
IRG Wollongong	1	-
Mackay Radiology	16	6
Medical Imaging Lithgow	1	-
Middlemount Medical Centre	1	-
Moranbah Hospital	103	38
Mater Womens Diagnostic	2	1
North Queensland X-ray Services	1	-
Queensland X-ray 4 ways Mackay	4	2
Queensland X-ray Mater Mackay	9	3
Queensland X-ray St. Andrews Hosp.	1	-
Rockhampton R Radiology	1	-
SCR Tweed heads	1	1
Southern Cross X-ray Clayfield	1	-
Southern X-radiology Ipswich	1	-
Southern X-ray Clinics Clayfield	1	-
Sunshine Coast Radiology Nambour	1	-
Total	268	94

Table 6 shows that three sites performed a majority (82%) of the CXRs. A number of sites performed very few CXRs. All but one of the sites were hospitals or specialist imaging facilities, while only one site appeared to be a general medical centre. This information only relates to recent CXRs and the types of sites undertaking imaging may have differed in the past.

Limitations

Of the 313 CXRs that have been identified by QDNRM, about one third are digital on CDs and the remainder analogue films. Table 7 shows the required number of CXRs for each Queensland mine and the number accessed so far. This table demonstrates that 68 CXRs cannot be attributed to a specific mine. These may be for mine workers from contractors and labour hire organisations. As shown in the Table, a large proportion of CXRs from the following mines are still to be accessed: Broadmeadow, Cook, Crinum, Ensham, Grasstree, Grosvenor, Kestrel, Moranbah North, Newlands, Oaky Creek No 1 and Oaky Creek North.

The digital films use a variety of software and de-identification is proving difficult for a number of these CXRs. Software from the USA has been provided by UIC team members. Reading digital films collected on different software may also be a problem, but steps are in place to start the CXR review soon.

Table 7: Chest X-ray Type by Mine

Mine	Provided			Requested
	CD	Film	Total	
Aquila	2	1	3	-
Broadmeadow	5	37	42	63
Carborough Downs	11	16	27	27
Cook Colliery	2	30	32	32
Copabella (Open cut)	1	-	1	-
Crinum (closed)	0	15	15	25
Curragh (Open cut)	-	1	1	-
Eagle Downs	1	4	5	-
Ensham	-	10	10	25
Goonyella Riverside (Open Cut)	-	1	1	-
Grasstree	4	4	8	59
Grosvenor	0	2	2	25
Kestrel	2	36	38	50
Moranbah North	2	47	49	59
Newlands	5	14	19	25
No specific mine listed - Various	30	38	68	-
North Goonyella	6	17	23	27
Oaky Creek - Various sites/unspecified	8	0	8	-
Oaky Creek No 1	6	2	8	25
Oaky Creek North	24	5	29	36
Saraji (open cut)	1	-	1	-
Total	125	268	398	478

4.8 Spirometry Review

Current situation

Table 8 shows the number of spirograms received from the QDNRM, and the corresponding mines at which the coal miners worked.

Table 8: Number of Spirograms by Mine

Mine	Number of Spirograms	Proportion by current mine population
Aquila	3	75
Broadmeadow	5	0
Carborough Downs	11	4
Cook Colliery	12	3
Copabella (Open cut)	-	-
Crinum (closed)	6	3
Curragh (Open cut)	-	-
Eagle Downs	5	5
Ensham	1	0
Goonyella Riverside (Open Cut)	-	-
Grasstree	37	6
Grosvenor	4	2
Kestrel	11	2
Moranbah North	9	1
Newlands	5	4
No specific mine listed - Various	56	-
North Goonyella	10	4
Oaky Creek - Various sites/unspecified	4	-
Oaky Creek No 1	26	10
Oaky Creek North	47	1
Saraji (open cut)	-	-
Total	252	

4.9 Queensland Medical Capacity

Contact has been made with all three relevant specialist medical organisations [RANZCR, TSANZ and Australasian Faculty of Occupational and Environmental Medicine (AFOEM)] and all three are willing to assist in the current review and in building improved capability in Queensland. The RANZCR and TSANZ have identified members in Queensland who are interested in providing relevant expertise to the scheme.

The review team has developed a CMDLD Fact Sheet for GPs, which was provided to the QDNRM for distribution through Queensland Health (see Appendix 7).

4.10 Health Assessment Form Data Collection and Storage

Current situation

Data collection

The HSU of the QDNRM receive full health assessments, including CXR reports and films from the NMAs by ordinary mail. The forms are initially checked by the data entry operators for completeness, for example individual health assessments consist of all seven pages, workers' dates of birth entered consistently, spirometry results transcribed onto the appropriate section of the forms and the EMO examination date in Section 3 corresponds with the EMO date in Section 4. Incomplete and inaccurately completed health assessment forms are returned to the relevant NMAs for amendments. Although CXR films (or CDs) are supposed to be sent with their corresponding health assessments to the HSU, NMAs do not always comply with this requirement.

Health assessment forms that have been checked for completeness are subsequently sorted alphabetically. The records are then scanned and manually entered into the QDNRM database, either at SIMTARS or at a QDNRM storage facility in Stafford after they have been transferred in cardboard boxes. According to the 2015 Queensland Mines & Quarries annual report, of 16,463 total health assessments received from NMAs in 2014/15 just under 3,000 assessments (<18%) had been entered into the database and of 150,040 total health assessments awaiting database entry (as of 2014-15), less than 10% of the assessments had been scanned.

Data storage

The review team visited the storage facility at Stafford and discussed data collection, including quality controls applied, and storage systems and the ease of search and retrieval of health records.

Prior to the mid-1990s all data from all health assessment forms were entered into a database. Since the late 2000s (approx.) the forms have been scanned, and some data manually entered into the database at SIMTARS. The health assessments that are scanned are saved into the data entry operators' files on the SIMTARS hard drive, which is password protected. Individual health assessments are renamed with the worker's surname and date of birth to aid search and retrieval upon request.

Hard copies of health assessments and chest x-ray films are currently stored in boxes and shelves in storage facilities at three locations: Stafford, Geebung and Eagle Farm.

The storage facility at Stafford was acquired at the end of 2015. Health assessment files are segregated according to the first alphabet of surnames and each box also has a numerical ID and is stored in "pigeon holes". The health assessment files are a mixture of records that have been entered but not scanned, scanned but not entered and entered and scanned. The warehouse is secured by a gate which requires a security code, and a door which requires an access swipe card.

The storage facility at Geebung is based in a Government department in a privately-owned company, and has been in use from approximately 2011. All health assessment files at this facility have been scanned and entered into the QDNRM database. The storage boxes have a

barcode and an HSU registration number and contain up to fifty files (a list of which is enclosed within the box). The health assessments can only be accessed by staff based at the facility.

The facility at Eagle Farm is used to store archived files, that is, health assessments that were completed between 1983 to the early 1990s. All health assessments apart from “historical” records have been entered, but no health assessments have been scanned. The files can only be accessed by Eagle Farm staff members.

CXR films are arranged alphabetically and some are stored separately from their corresponding health assessment files. X-ray wallets with unique registration numbers were previously used to store health assessment records for each worker, however this system ceased when scanning was introduced in the late 2000s. In other words, the sequential health assessment records for workers may be stored separately.

The QDNRM database is only accessible by authorised HSU staff members.

Limitations

The process of sending and receiving health assessments by ordinary mail is not consistent with contemporary methods of transfer and receipt of medical records, which are predominantly electronic. NMAs are required to send the entire assessments but do not always submit CXR films or spiograms, so reliance on this means of communication is ineffective. Manual checking of documents for completeness and accuracy and manual database entry is slow, cumbersome and prone to quality issues as a result of human error. The QDNRM review is purely administrative and involves no medical review or audit.

Scanning capability was introduced by the QDNRM in part to assist data storage, as well as searching and retrieval of files. However, with over ninety per cent of health assessments still awaiting scanning this process has not been maximally utilised. A mixture of scanned and/or entered health records is currently stored at three different locations and, although the files have been sorted alphabetically and numerically, access is hampered by storage in cardboard boxes. The sequential health assessments for individual workers have not been consistently linked and this contributes to inefficiencies of the data collection and storage system.

Resources to enter data into the database did not increase when the number of health assessments increased during the mining boom resulting in a large backlog of forms awaiting entry into the QDNRM database.

Electronic data entry would reduce workload for the HSU, facilitate completeness of data entry, facilitate data checking and review, and allow review of previous medicals. Importantly it would facilitate collation and analyses of group surveillance data to assess trends.

The health assessments that required a CXR should be prioritised for scanning and entry into the database.

In order to utilise data from the respiratory component of the scheme for evaluation and monitoring of industry-wide trends, the necessary data fields should be identified and the database interrogated regularly for overall reporting purposes. If cases of CMDLD are identified, the QDNRM Medical Officer should contact employers to discuss and implement preventive action.

4.11 Next Steps

Site visits / contact with employers

We plan to visit at least two underground mines of varying sizes in Queensland to further investigate steps taken to determine jobs that are deemed ‘risk of dust exposure’. We also plan to visit an open cut mine and a coal handling and preparation plant, and to inspect those jobs likely to involve dust exposure.

We plan to discuss how NMAs are appointed and individual miners referred to the NMA, with mine operators and labour hire contractors.

We intend to discuss how SEGs are developed and review the monitoring data on which these are based.

Continue chest X-ray and spirometry reviews

The CXR and spirometry reviews are ongoing. A second Australian radiologist to take part in the review is yet to be identified, but several possible candidates have been identified by the review team. The protocol for the spirometry review is being completed.

Queensland Medical Capacity

We will:

- Identify the expertise and resources to perform high quality medical assessments in Queensland among the following groups:
 1. NMAs – Occupational Physicians/GPs
 2. Respiratory physicians
 3. Radiologists
- Determine training requirements for the above-mentioned professional groups.
- Make recommendations to build capacity in Queensland to ensure that there are sufficient numbers of suitably qualified practitioners to be NMAs, respiratory physicians trained to recognise CMDLD, and trained personnel to carry out and interpret high quality CXR and spirometry, where the current level of expertise and/or resources are found to be inadequate.

What is done interstate/overseas?

We will review health surveillance systems for coal mine workers in other Australian States e.g. WA, NSW Coal Services; and overseas, e.g. US, UK, South Africa, Japan, Canada and possibly other countries.

We will identify what can be learned from these examples and which components may be suitable for use in Queensland.

Other sources of data

We will identify routinely collected health data to help estimate the presence of CMDLD among Queensland coal miners from Queensland hospital records, workers' National and State-based compensation data, and the National Death Index (NDI). All of these data sources have their limitations and these will be discussed.

Prevalence survey plan

We will develop a research plan to better estimate the current prevalence of CMDLD in Queensland coal mine workers including those cases undetected by the health assessment scheme.

Final Report

The final report will be prepared by 30th June 2016.

5. Recommendations

A list of interim recommendations is included in the overview of this interim report. A list of final recommendations will be developed at the completion of the review and included in the final report. As several aspects of the review are still ongoing, there may be some modifications to some of the interim recommendations.

Glossary

ACGIH	American Conference of Governmental Industrial Hygienists
CHPP	Coal Handling Production Plants
CMDLD	Coal Mine Dust Lung Disease
CMSHR	Coal Mining Safety and Health Regulation (2001)
COPD	Chronic Obstructive Pulmonary Disease
CS	Coal Services
CWP	Coal Workers' Pneumoconiosis
CXR	Chest X-ray
EMO	Examining Medical Officer
HSU	Health Surveillance Unit
IARC	International Agency for Research on Cancer
ILO	International Labour Organisation
MSHA	Mine Safety and Health Administration
NIOSH	National Institute for Occupational Safety and Health
NMA	Nominated Medical Adviser
OEL	Occupational Exposure Limits
PMF	Progressive Massive Fibrosis
PPE	Personal Protective Equipment
QDNRM	Queensland Department of Natural Resources and Mines
RANZCR	Royal Australian and New Zealand College of Radiologists
RPE	Respiratory Protective Equipment
SEG	Similar Exposure Groups
SIMTARS	Safety in Mines Testing and Research Station
SMR	Standardized Mortality Ratio
TLV	Threshold Limit Values
TSANZ	Thoracic Society of Australia and New Zealand
STEL	Short Term Exposure Limit
TWA	Time Weighted Average
U/G	Underground
WHO	World Health Organisation

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Appendices

Appendix 1: 8 Hour TWA Occupational Exposure Limits and Short Term Exposure Limits (STEL) listed for Silica ^{24 25,32}

Country	Silica 8 Hour TWA mg/m ³				
	Quartz Cas 14808-60-7	Mineral Dust with Respirable Quartz	Respirable Crystalline Silica	Cristobalite, total Cas 14464-46-1	Tridymite Cas 15468-32-3
ACGIH			0.025	0.025	
Australia	0.1 ⁽¹⁾		0.1	0.1 ⁽¹⁾	0.1 ⁽¹⁾
Austria	0.15 ⁽¹⁾		0.15		0.15 ⁽¹⁾
Belgium	0.1		0.1	0.05	0.05
Canada - Ontario	0.1 ⁽¹⁾			0.05 ⁽¹⁾	
Canada - Québec	0.1		0.05		0.05
Denmark	0.3 (0.6 STEL) ⁽²⁾ 0.1 (0.2 STEL) ⁽¹⁾	0.5	0.05 (0.1 STEL)	0.15 (0.3 STEL)	0.15 ⁽²⁾
Japan		E=3.0/(1.19 Q+1) ⁽⁷⁾			0.05 ⁽¹⁾
Finland	0.05 ⁽¹⁾		0.05		0.05 ⁽¹⁾
France	0.1 ⁽¹⁾⁽³⁾			0.05 ⁽¹⁾⁽³⁾	0.05 ⁽¹⁾⁽³⁾
Hungary	0.15 ⁽¹⁾			0.15 ⁽¹⁾	0.15 ⁽¹⁾
Ireland	0.1 ⁽¹⁾		0.1	0.1 ⁽¹⁾	0.1 ⁽¹⁾
New Zealand	0.2 ⁽¹⁾			0.1 ⁽¹⁾	0.1 ⁽¹⁾
People's Republic of China	1 ⁽¹⁾⁽⁴⁾ 0.7 ⁽¹⁾⁽⁵⁾ 0.5 ⁽¹⁾⁽⁶⁾		0.7 ⁽³⁾ 0.3 ⁽⁴⁾ 0.2 ⁽⁵⁾		
Singapore	0.1 ⁽¹⁾		⁽⁸⁾	0.05 ⁽¹⁾	0.05 ⁽¹⁾
South Korea	0.05			0.05 ⁽¹⁾	0.05
Spain	0.1 ⁽¹⁾			0.05 ⁽¹⁾	
Sweden	0.1 ⁽¹⁾			0.05 ⁽¹⁾	0.05 ⁽¹⁾
Switzerland	0.15 ⁽¹⁾		0.15	0.15 ⁽¹⁾	0.15 ⁽¹⁾
The Netherlands	0.075 ⁽¹⁾		0.0758	0.075 ⁽¹⁾	0.075 ⁽¹⁾
USA - NIOSH REL	0.05		0.05	0.05	0.05
USA - OSHA PEL				0.05 ⁽¹⁾	0.05 ⁽¹⁾
United Kingdom			0.1		

Interim Findings – Review of Respiratory Component of Current Health Scheme

- (1) Respirable dust, fraction or aerosol;
- (2) Inhalable or total dust
- (3) Restrictive statutory limit values
- (4) $10\% \leq \text{free SiO}_2 \leq 50\%$
- (5) $50\% < \text{free SiO}_2 \leq 80\%$
- (6) $\text{free SiO}_2 < 80\%$
- (7) E = administrative control level; Q = content of free silica (percent) Dust of sand and stones, rocks, ores (minerals), metallic or carbon.
- (8) See cristobalite, quartz, tridymite, tripoli

Appendix 2: Scope of the Review

- A. The adequacy of the scope, processes, quality and reporting of the respiratory component of the existing medical assessment program, including information provided by the employer on risk of dust exposure, medical history, physical examination, chest radiography and spirometry, in detecting the early stages of coal mine dust lung disease.
- B. The expertise and resources required, firstly to undertake high quality medical assessments (respiratory component) under the scheme, secondly to have effective referral pathways for suspected of a CMDLD, thirdly to use the gathered data to effectively implement a high quality medical surveillance program for the early detection of coal mine dust lung disease in Queensland coal miners and fourthly to make the information available to relevant stakeholders for necessary action.
- C. The expertise and resources currently available in Queensland to perform medical assessments, perform and interpret high quality CXR and perform and interpret high quality spirometry. This will include a review of expertise and training of the current list of Nominated Medical Advisers, the use of EMOs and the specialist respiratory physicians available for referral and subsequent patient care.
- D. Where deficiencies are found, make recommendations to improve the current program for the medical assessment of coal mine dust lung disease to achieve a state of the art program for the reliable detection of early disease.
- E. Recommendations to build capacity in Queensland to ensure that a list is available of sufficient numbers of suitably qualified practitioners to be NMAs, respiratory physicians, trained personnel to carry out and interpret chest x-rays (CXR) and spirometry, where the current level of expertise and/or resources are found to be inadequate.
- F. Depending upon findings from A, B and C, make recommendations for an interim strategy to handle undetected cases and ensure that the current cohort of mine workers is effectively screened for coal mine dust lung disease until longer term recommendations can be implemented.
- G. Develop a methodology for the review of past x-rays and spirometry to estimate the extent of coal mine dust lung disease that may have been undetected by the medical assessment scheme.
- H. Develop a research plan to measure the current prevalence of CMDLD in Queensland coal mine workers.

Appendix 3: Coal Mine Workers' Health Scheme Health Assessment Form

Coal Mine Workers' Health Scheme - Health Assessment Form

Section 46 Coal Mining Safety and Health Regulation 2001 Form Number CMSHR 1
(Form approved by Chief Inspector under section 281 of the Coal Mining Safety and Health Act 1999)

Name (Full Given Name(s) and Family Name)

Date of Birth

Privacy Obligations

Health surveillance information is collected by the Department of Employment, Economic Development and Innovation for the purpose of identifying medical conditions or impacts on health resulting from exposure to chemical and physical agents in the coal mining industry. It is collected under the authority of Part 6 – Division 2 of the *Coal Mining Safety and Health Regulation 2001*.

The Department will not disclose this information to any person except in accordance with the Regulation. The Regulation requires that the identity of a coal mine worker is protected when information is disclosed for research purposes.

Guidance Notes for completion of Health Assessment

Employer

- Must arrange for the Health Assessment of Coal Mine Worker.
- Must complete Section 1 on page 2 which includes informing the Examining Medical Officer or Nominated Medical Adviser if: a colour vision test is required; the worker is, or may be, exposed to dust (and therefore a chest x-ray is required); and the SEG (similar exposure group) of the worker.
- Must meet the cost of the Health Assessment.

Coal Mine Worker

- Must bring photo identification to have identity checked by the Examining Medical Officer.
- Must complete Section 2 on pages 2 to 3.
- In relation to Section 2 - Work History:
 - **if the coal mine worker is commencing work** – full work history must be provided; or
 - **if the coal mine worker is already employed in the industry** – only work history since last Health Assessment is required.
- Should request the Nominated Medical Adviser provide a copy of the Health Assessment Report and an explanation.

Examining Medical Officer/ Nominated Medical Adviser

- Must check photo identification provided by the Employee.
- Must review Section 1 and Section 2 (pages 2 to 3 with the coal mine worker and comment on any abnormality).
- Must complete Section 3 on pages 4 to 6
- Must attach a separate statement if space on Form is insufficient.
- Must take advice from the employer on the requirements for a colour vision test and/or chest x-ray.
- Must **not** complete the "Section 4 Health Assessment Report" if not a Nominated Medical Adviser.
- Must, where appropriate, forward the completed Health Assessment Form (intact) to Nominated Medical Adviser.

Nominated Medical Adviser

- Must review Sections 1, 2 and 3.
- Must assess whether the Health Assessment provides adequate information to make a report on the fitness for duty of the coal mine worker.
- If the coal mine worker has an abnormal colour vision and/or hearing result affecting fitness for duty, a practical test should be arranged.
- Must complete "Section 4 Health Assessment Report".
- Must provide an explanation of "Section 4 Health Assessment Report" to the Coal Mine Worker and, where practical, secure the signature of the Coal Mine Worker on the Health Assessment Report:
- Must provide a copy of "Section 4 Health Assessment Report" to:
 - the Coal Mine Worker at the address shown on page 2; and
 - the employer.
- Must forward a copy of the complete "Health Assessment Form" (all 7 pages) to the Health Surveillance Unit of the Department of Employment, Economic Development and Innovation.
- Must maintain secure records of the Health Assessment and associated documentation.

Section 1 – Employer to complete

Name of Nominated Medical Adviser

Employer

Coal Worker's Position

Description:

Generic SEG*:	Company SEG**:
---------------	----------------

Mine (e.g. Southern Colliery)

SEGs are groups of workers with similar exposure

* Generic SEG is sourced from the list provided by Safety & Health

** Company SEG is the employer SEG

- (a) Is the coal mine worker at risk from dust exposure (X-ray needed)? Yes No
- (b) Will the coal mine worker be working underground? Yes No
- (c) Does the coal mine worker require colour discrimination? Yes No
- (d) Is the worker at risk from occupational noise? Yes No
- (e) Is the worker at risk from hazardous chemicals? (comment) Yes No
- (f) Are there hazardous duties requiring a specific fitness assessment? (comment) Yes No

Comment

Section 2 – Coal Mine Worker to complete

2.1 Coal Mine Worker

(a) Family Name Given Name (s)

(b) Date of Birth (d) Male Female (e) Telephone:

(c) Address:

2.2 Work History (coal mine worker to refer to Guidance Notes on the coversheet)

Year		Job Title or Description	Employer
From	To		

2.3 Health-related History

- (a) Have you previously had a medical examination under this scheme? Yes No
- (b) If Yes, when was the last examination?
- (c) Have you been admitted to a hospital or undergone surgery or an operation? Yes No
- (d) Have you ever had an illness or operation that has prevented you from undertaking your normal duties for more than two weeks? Yes No
- (e) Have you ever had an injury that has prevented you from undertaking your normal duties for more than two weeks? Yes No
- (f) Are you taking any medication? Yes No
- (g) Do you use hearing protection whilst in noisy areas? Yes No
- (h) Do you currently smoke, or have you ever smoked? Yes No

(Supply details) START..... STOP TYPE QUANTITY/DAY

Examining Medical Officer's comments on Questions 2.1 to 2.3

2.4 Have you ever suffered from, or do you now suffer from, any of the following?

	Yes	No		Yes	No
(a) Heart disease or heart surgery	<input type="checkbox"/>	<input type="checkbox"/>	(n) Diabetes	<input type="checkbox"/>	<input type="checkbox"/>
(b) Chest pain, angina or tightness in chest	<input type="checkbox"/>	<input type="checkbox"/>	(o) Sciatica, lumbago, slipped disc	<input type="checkbox"/>	<input type="checkbox"/>
(c) High blood pressure	<input type="checkbox"/>	<input type="checkbox"/>	(p) Neck injury or whiplash	<input type="checkbox"/>	<input type="checkbox"/>
(d) Asthma, bronchitis or other lung diseases	<input type="checkbox"/>	<input type="checkbox"/>	(q) Back or neck pain which has prevented you from undertaking full duties	<input type="checkbox"/>	<input type="checkbox"/>
(e) Abnormal shortness of breath or wheezing	<input type="checkbox"/>	<input type="checkbox"/>	(r) Knee problems, cartilage injury	<input type="checkbox"/>	<input type="checkbox"/>
(f) Deafness, loss of hearing or ear problems	<input type="checkbox"/>	<input type="checkbox"/>	(s) Fractures or dislocations	<input type="checkbox"/>	<input type="checkbox"/>
(g) Ringing noises in your ears	<input type="checkbox"/>	<input type="checkbox"/>	(t) Shoulder, knee or any other joint injury	<input type="checkbox"/>	<input type="checkbox"/>
(h) Other hearing difficulties	<input type="checkbox"/>	<input type="checkbox"/>	(u) Hernia	<input type="checkbox"/>	<input type="checkbox"/>
(i) Disease or disorder of the nervous system	<input type="checkbox"/>	<input type="checkbox"/>	(v) Arthritis or rheumatism	<input type="checkbox"/>	<input type="checkbox"/>
(j) Episodes of numbness or weakness	<input type="checkbox"/>	<input type="checkbox"/>	(w) Dermatitis, eczema, or skin problems	<input type="checkbox"/>	<input type="checkbox"/>
(k) Psychiatric illness	<input type="checkbox"/>	<input type="checkbox"/>	(x) Allergies	<input type="checkbox"/>	<input type="checkbox"/>
(l) Blackouts, fits or epilepsy	<input type="checkbox"/>	<input type="checkbox"/>	(y) Allergic reaction or reaction to chemicals or dust	<input type="checkbox"/>	<input type="checkbox"/>
(m) RSI, tenosynovitis, over-use syndrome or wrist strain	<input type="checkbox"/>	<input type="checkbox"/>			

2.5 Previous vaccinations and blood tests

- (a) When were you last immunised against Tetanus? Year
- (b) When were you last immunised against Hepatitis A? Year
- (c) When were you last immunised against Hepatitis B? Year
- (d) When was your last cholesterol test? Year

Examining Medical Officer's comments on Questions 2.4, and 2.5 _____

Coal Mine Worker's Declaration (to be witnessed by Examining Medical Officer)

I certify to the best of my knowledge that the above information supplied by me is true and correct.
 I understand that if any of the information given is knowingly false, my employment may be terminated.

Signature Date / /

Witness Date / /

Section 3 – Clinical Findings – Examining Medical Officer to complete

3.0	ID Check	Type
3.1	Height	cm
3.2	Weight	kg

Comment

3.3 Vision Visual acuity

		Uncorrected				Corrected	
		Right	Left			Right	Left
(a)-(b)	Distant	6/	6/	(e)-(f)	6/	6/	
(c)-(d)	Near	N	N	(g)-(h)	N	N	

3.4 Visual fields (by confrontation)

Abnormal Normal

Abnormal Normal

3.5
3.6 Work-related colour vision practical test (if Ishihara test abnormal) Unsatisfactory Satisfactory

3.7 Hearing

Audiogram		500 Hz	1000 Hz	1500 Hz	2000 Hz	3000 Hz	4000 Hz	6000 Hz	8000 Hz
(a)-(h)	Left								
(i)-(p)	Right								

(q) Time since last high noise exposure? hours

(r) Audiogram result Abnormal Normal

(s) Were hearing aids used Yes No

(t) Auditory canals Abnormal Normal

(u) Tympanic membranes Abnormal Normal

The result is normal if hearing threshold is 40dB or less in the better ear at 500, 1000, 1500 and 2000 Hz. If an abnormal result impacts on a coal mine worker's "fitness for duty", the NMA should consider a practical test.

Examining Medical Officer's comments on Questions 3.1 to 3.7 (Note any abnormality, including past noise exposure, workers' compensation claims and tinnitus)

3.8 Cardiovascular System

		Systolic	Diastolic
(a)	Blood Pressure		
(b)	(Repeated if necessary)		
(c)	Pulse rate	/min	
(d)	Peripheral pulses	Absent <input type="checkbox"/>	Present <input type="checkbox"/>
(e)	Heart sounds	Abnormal <input type="checkbox"/>	Normal <input type="checkbox"/>
(f)	Evidence of cardiac failure or oedema	Yes <input type="checkbox"/>	No <input type="checkbox"/>
(g)	Varicose veins	Yes <input type="checkbox"/>	No <input type="checkbox"/>
(h)	E.C.G. (if indicated by some abnormality)	Abnormal <input type="checkbox"/>	Normal <input type="checkbox"/>

Examining Medical Officer's comments on Questions 3.8

3.9 Respiratory system

Litres	Observed		Predicted		Observed/Predicted %	
Forced exp. Vol. 1 sec- FEV ₁	(b)		(e)		(h)	
Forced vital capacity - FVC	(c)		(f)		(i)	
FEV ₁ /FVC%	(d)		(g)			

- 3.10** Spirometry (*abnormal includes FEV1/FVC<70%*) Abnormal Normal
- 3.11** Auscultation of chest Abnormal Normal
- 3.12** (a) Was chest x-ray undertaken (as advised by employer) Yes No
- (b) Date x-ray was taken / /
- (c) Quality of film? Unsatisfactory Satisfactory
- (d) What was the result? (Also attach x-ray film to this Report) Abnormal Normal

3.13 Musculo-skeletal system

- | | Abnormal | Normal |
|--|--------------------------|--------------------------|
| (a) <u>Lower back</u> | | |
| (i) Range of movement | <input type="checkbox"/> | <input type="checkbox"/> |
| (ii) Posture and gait | <input type="checkbox"/> | <input type="checkbox"/> |
| (iii) Straight leg raising | <input type="checkbox"/> | <input type="checkbox"/> |
| (b) <u>Neck</u> – range of movement | <input type="checkbox"/> | <input type="checkbox"/> |
| (c) <u>Joint movements</u> | | |
| (i) Upper Limbs | <input type="checkbox"/> | <input type="checkbox"/> |
| (ii) Lower Limbs | <input type="checkbox"/> | <input type="checkbox"/> |
| (iii) Reflexes | <input type="checkbox"/> | <input type="checkbox"/> |

3.14 Urinalysis and Blood Sugar

- | | Present | Absent |
|-------------------------------------|--------------------------|--------------------------|
| (a) Sugar | <input type="checkbox"/> | <input type="checkbox"/> |
| (b) Protein/albumin | <input type="checkbox"/> | <input type="checkbox"/> |
| (c) Blood | <input type="checkbox"/> | <input type="checkbox"/> |
| (d) Blood sugar analysis (optional) | <input type="checkbox"/> | <input type="checkbox"/> |

3.15 Abdomen

- | | Present | Absent |
|---------------------|--------------------------|--------------------------|
| (a) Abdominal scars | <input type="checkbox"/> | <input type="checkbox"/> |
| (b) Abdominal mass | <input type="checkbox"/> | <input type="checkbox"/> |
| (c) Hernia | <input type="checkbox"/> | <input type="checkbox"/> |

3.16 Skin

- | | Present | Absent |
|--------------------------------------|--------------------------|--------------------------|
| (a) Eczema, dermatitis or allergy | <input type="checkbox"/> | <input type="checkbox"/> |
| (b) Skin cancer or other abnormality | <input type="checkbox"/> | <input type="checkbox"/> |

Examining Medical Officer's comments on Questions 3.9 to 3.16

3.17 Is the coal mine worker's fitness for duty is likely to be affected by any of the following?

- | | Yes | No |
|--|--------------------------|--------------------------|
| (a) Dietary Habits | <input type="checkbox"/> | <input type="checkbox"/> |
| (b) Exercise routine | <input type="checkbox"/> | <input type="checkbox"/> |
| (c) Stress Level | <input type="checkbox"/> | <input type="checkbox"/> |
| (d) Alcohol Consumption | <input type="checkbox"/> | <input type="checkbox"/> |
| (e) Drugs or medication not prescribed by a doctor | <input type="checkbox"/> | <input type="checkbox"/> |

3.18 Is there any reason why the coal mine worker may be not fit for duty in relation to work:

- | | Yes | No |
|---|--------------------------|--------------------------|
| (a) As an operator of (or working around) around heavy vehicles | <input type="checkbox"/> | <input type="checkbox"/> |
| (b) Underground (including use of self-rescue breathing devices and escape) | <input type="checkbox"/> | <input type="checkbox"/> |
| (c) Shift work | <input type="checkbox"/> | <input type="checkbox"/> |
| (d) Performing heavy manual handling | <input type="checkbox"/> | <input type="checkbox"/> |
| (e) In wet or muddy conditions | <input type="checkbox"/> | <input type="checkbox"/> |
| (f) In dusty conditions | <input type="checkbox"/> | <input type="checkbox"/> |
| (g) At height or on ladders | <input type="checkbox"/> | <input type="checkbox"/> |
| (h) In confined spaces | <input type="checkbox"/> | <input type="checkbox"/> |
| (i) While wearing safety footwear or other personal protective equipment such as ear plugs, glasses and respirators | <input type="checkbox"/> | <input type="checkbox"/> |
| (j) Another capacity – define | <input type="checkbox"/> | <input type="checkbox"/> |

.....

Examining Medical Officer's comments on Questions 3.17 and 3.18 _____

<p>Examining Medical Officer's name and address</p> <p>Please print or stamp</p>	<p>Signature</p> <p>Date / /</p>
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Approved Form - Section 4 – Health Assessment Report

Coal Mine Worker's Details

Family Name	Given Name(s)	Date of birth/...../.....
-------------	---------------	------------------------------------

Employer	Mine(s) (if applicable)
----------	-------------------------

Examination Details

Date of Examination by EMO/...../.....	Position (e.g. job title (generic))	Is the assessment for underground work? Yes <input type="checkbox"/> No <input type="checkbox"/>
---	-------------------------------------	---

As at the date of this examination, the coal mine worker:

- Is fit to undertake any position
 - Is fit to undertake the proposed / current position
 - Is fit to undertake the proposed / current position subject to the following restriction(s) (if necessary, outline a management program)
- Is suitable for and has no condition which precludes participation in mines rescue - See Mines Rescue Medical Guidelines
For Queensland Mines Rescue Service personnel / applicants only.

Is not fit to undertake the proposed / current position because of the following restriction(s):

The duration of the restriction is:
Is a further review necessary? Yes Date / / No

Specify full or type of review required:
Was a chest x-ray taken? Yes Date / / No

As Nominated Medical Adviser I have explained the restriction / additional assessment to the worker Yes No

As Nominated Medical Adviser I have provided a copy of Section 4 to the worker (refer Note a): Yes

I have been advised of the outcome of this assessment. (Practical constraints prevent this from being a compulsory item)	Coal Mine Worker's Signature	Date / /
Nominated Medical Adviser's name and address: Practice stamp	NMA's Signature:	Date / /

- Distribution:**
- (a) copy of Section 4 to coal mine worker at address shown on page 2; and
 - (b) copy of Section 4 to employer; or in the case of Mines Rescue membership a copy also to Queensland Mines Rescue Service, GPO Box 156, Dysart, Qld 4745; and
 - (c) copy of complete Health Assessment Form to Health Surveillance Unit, Simtars, Department of Natural Resources and Mines, PO Box 467, Goodna Qld 4300.

Appendix 4: Chest X-Ray review protocol

Aims

The aims of the review of CXRs previously taken for mine worker health assessments as part of the overall review of the respiratory component of the Mine Worker Health Assessment Scheme are to:

1. Identify deficiencies in the CXR component of the health assessment scheme which may have contributed to failure to identify early changes of CWP and other CMDLDs in coal mine workers
2. Determine the quality of a sample of these previous CXRs according to the ILO quality classification
3. Compare the agreed quality assessment for each CXR with that on the NMA report
4. Report the CXRs according to the ILO classification to identify CXRs with opacities of Category 1 or more
5. Compare the agreed review report for each CXR with the original radiologist's report
6. Compare the agreed review report with the NMA report, including planned follow up
7. Feed the relevant information back to QDNRM for notification to the relevant NMA and worker where a major finding is found during the CXR review which was not detected by the original radiology report

Sample size

The sample size of the number of coal miner chest x-rays required for the x-ray review was calculated based on an estimated 3% prevalence of x-ray changes consistent with coal workers' pneumoconiosis ($\geq 1/0$ category by the ILO system), among Queensland coal mine workers with more than 10 years of employment. This is comparable to the prevalence reported in a recent study by Blackley and colleagues¹ among large underground coal miners in Kentucky, Virginia and West Virginia, who participated in a health surveillance program between September 2005 and December 2012. A related study² found a 2.7% prevalence of at least ILO category 1 small opacities among coal workers who participated in the NIOSH surveillance program between 2000 and 2008, although the main focus was on silicosis.

Based on these US findings, a sample size of x-rays from 452 Queensland coal mine workers is estimated to be able to detect a 3% prevalence of x-ray changes (ILO category of at least 1) consistent with coal workers' pneumoconiosis. The review team considers it important to include x-rays from all mines as part of this review. The formula used for this calculation and the number of coal miners required from each mine are both outlined below.

$$n = (Z^2 \times P(1 - P))/e^2$$

Z = value from standard normal distribution corresponding to desired CI (Z=1.96 for 95% CI)

P is expected true proportion

e is desired precision (half desired CI width).

Estimated true proportion	0.03
Confidence Interval	95%
Desired precision	± 0.015
Population size	4887
Sample size	452

Mine	Employee numbers Nov 2015	Percentage of total	Sample size	Number received	Number missing
Aquila – N/A	0	-	-	3	
Broadmeadow	683	14	63	34	29
Carborough	314	6	27	21	6
Cook	362	7	32	15	17
Crinum - closed	223	5	25 (25)	0	25
Eagle Downs	5	-	-	5	
Ensham	209	4	18 (25)	6	19
Grasstree	639	13	59	6	53
Grosvenor**	249	5	23 (25)	3	22
Kestrel	536	11	50	34	16
Moranbah Nth	649	13	59	39	20
Newlands	109	2	9 (25)	7	18
Nth Goonyella	275	6	27	16	11
Oaky No 1	248	5	23 (25)	6	19
Oaky Nth	386	8	36	24	12
Total	4887	99	449 (478)	219	267

As some of the mines are small, the calculated number of x-rays needed is correspondingly small and may not give an adequate representation of the quality and content of the CXRs, so we propose that a minimum of 25 CXRs be reviewed from each mine. This would mean an additional 27 CXRs will be reviewed, spread over 5 mines, making a grand total of 476. The revised numbers are in red brackets in the above table. This will be dependent on the estimated numbers of CXRs for eligible miners being accessible for each of the mines. For example, as Grosvenor is new it may not have sufficient miners with 10 years' experience.

In addition, there are mine workers who work for contractors and therefore are not associated with a particular mine, but work across different mines. It is planned that the review will include a sample of CXRs from this group as well. If this is set at the minimum of 25, as for the individual mines, this makes a grand total of 503 CXRs to be included in the CXR review.

CXR review process

The selected CXRs will involve a mix of analogue and digital films. The review of the CXRs will involve reviewers in both the US and Australia. Each reviewer will:

1. Assess quality of the x-rays by applying the ILO criteria of quality one through three or unreadable and identify which films might be copies.
2. All chest radiographs will be reviewed by at least two reviewers in each country.
3. In the US, an additional three B-readers will be available if agreement is not achieved by the first two readings. The images will be categorized according to ILO criteria using the following procedure developed for the US Coal Workers' Health Surveillance Program. (Note: NIOSH data shows agreement between two B-readers as defined in the protocol 92% of the time, the third B-reader allows a determination for an additional 6% of x-rays and the remaining 2% require the full panel of 5 B-readers).

a) If there is agreement between the two classifications, as described below, the result will be considered final and reported.

b) When agreement is lacking, a third classification will be obtained. If any two of the three classifications demonstrate agreement, the result will be considered the final determination.

c) If agreement is lacking among the three classifications, we will obtain independent classifications from two additional B Readers and the final determination will be the median category derived from the total of five classifications.

4. Definition of Agreement:

a) Two classifications will be considered to be in agreement when both find either stage A, B, or C complicated pneumoconiosis, or, for simple pneumoconiosis, are both in the same major category or (with one exception noted below) are within one minor category (ILO Classification 12-point scale) of each other.

b) In the last situation, the higher of the two classifications will be reported.

c) The only exception to the one minor category principle is a reading sequence of 0/1, 1/0, or 1/0, 0/1, which will not be considered agreement.

5. In Australia:

a) If there is agreement of the major category between the two classifications, the result will be considered final and reported.

b) When agreement is lacking, an attempt will be made to reach agreement by consensus, but if agreement is not reached, then the higher category will be considered the final determination.

6. Compare the final determination by the US and Australian reviews. Where there is discrepancy between major categories, attempts will be made to reach agreement by consensus, but if consensus can't be reached then the higher category will be the final determination.

7. Compare the final determination with the original reports on the x-rays to determine if there is a qualitative agreement as described below:

a) Reports to be reviewed by at least one qualified occupational pulmonologist and categorized as:

- (1) Normal
- (2) Abnormal consistent with simple pneumoconiosis
- (3) Abnormal consistent with complicated pneumoconiosis
- (4) Other abnormality not pneumoconiosis

b) The Coal Miners' Health Scheme radiology report will be considered to agree in general with the ILO final reading as follows:

- (1) Normal = ILO categories 0/-, 0/0, or 0/1
- (2) Simple pneumoconiosis = ILO categories 1/0 through 3/+
- (3) Complicated pneumoconiosis – ILO category A,B, or C
- (4) Other abnormality – not pneumoconiosis

c) A further check of what the NMA has reported to check consistency with the radiology report will be undertaken.

d) Notify QDNRM to contact participants about results of the re-evaluation of their CXR results according where important abnormalities are identified that were not previously identified within the Coal Mine Workers' Health Scheme.

8. The findings will be collated to quantify the proportion of CXRs where an opacity category of at least 1 was found during the CXR review and which was not reported on the radiologist reports and vice versa. A calculation of the proportion of workers where the NMA did not adequately report the CXR finding and appropriate follow up on the form 4 will also be undertaken.

9. US Reviewers – Note: 5 B-readers are required to execute the protocol.

a) Robert Cohen, MD – Pulmonologist B-Reader, NIOSH Project Officer American College of Radiology Pneumoconiosis Task Force

b) Kathleen DePonte – Radiologist – B-Reader, Member of NIOSH Coal Worker’s Health Surveillance Panel, Member of American College of Radiology Pneumoconiosis Task Force

c) David Lynch, M.D. Radiologist – B-Reader, Professor of Radiology, National Jewish Health, University of Colorado School of Medicine, Denver Colorado. Member of NIOSH Coal Worker’s Health Surveillance Panel, Member of American College of Radiology Pneumoconiosis Task Force

d) Jack Parker, MD – Pulmonologist, B-reader. Chairman Division of Pulmonary and Critical Care Medicine, West Virginia University. Member of NIOSH Coal Worker’s Health Surveillance Panel

e) Edward Lee Petsonk, MD – Pulmonologist B-reader. Professor of Medicine, West Virginia University, Member of NIOSH Coal Worker’s Health Surveillance Panel, NIOSH Project Officer for American College of Radiology Pneumoconiosis Task Force

10. Australian reviewers:

a) Dr Samantha Ellis, thoracic radiologist and consultant radiologist to the Australian interstitial fibrosis registry

b) To be confirmed

References

1. Blackley DJ, Halldin CN, Wang ML, et al. Small mine size is associated with lung function abnormality and pneumoconiosis among underground coal miners in Kentucky, Virginia and West Virginia. *Occup Environ Med* 2014;71:690-694.
2. Laney AS, Petsonk EL, Attfield MD. Pneumoconiosis among underground bituminous coal miners in the United States: is silicosis becoming more frequent. *Occup Environ Med* 2010;67:652-656.

Appendix 5: Completeness and Quality Assessment of a Sample of completed Health Assessment Forms

	Section/Questions	Included in DNRM dataset	If Y, degree of completeness	
			Num.	Qual.
Section 1	Employer to complete			
	Name of NMA	Yes	91/91	91/91
	Employer	Yes	82/91	79/82
	Coal workers' position - description	Yes	90/91	89/90
	Coal workers' position - generic SEG	Yes	4/91	-
	Coal workers' position – company SEG	Yes	0/91	0/0
	Mine	Yes	91/91	58/91
	(a) Dust exposure (X-ray needed?) - Y/N (Duplicate Q – see section 3/3.12)	Yes	60/91	56/91
	(b) Underground work - Y/N	Yes	66/91	66/66
Section 2	Coal Mine Worker to complete			
2.1	(a) Family Name, Given Names	N/A – De-identified data		
	(b) Date of Birth	Yes	91/91	91/91
	(c) Address	N/A – De-identified data		
	(d) Gender	Yes	91/91	91/91
	(e) Telephone	N/A – De-identified data		
2.2	Work history	No		
2.3	Health-related history			
	(a) Previous med./examination under scheme – Y/N	No		
	(b) If yes, date of last examination	No		
	(c) Current smoker, or ever smoked – Y/N	Yes	89/91	89/89
	Supply details – Start, Stop, Type, Quantity/day	No		
2.4	Ever suffered from, or currently suffer from any of the following:	No		
	(b) Chest pain, angina or <u>tightness of chest</u> – Y/N (?)	No		
	(d) Asthma, bronchitis or other lung diseases – Y/N	No		
	(e) Abnormal shortness of breath or wheezing – Y/N	No		
	(y) Allergic reaction or reaction to chemicals or dust – Y/N (?) – <i>irritant</i>	No		
	NO DETAILED Questions about RESPIRATORY SYMPTOMS			
Section 3	Clinical Findings			
3.1	Height	Yes	91/91	90/91
3.2	Weight	Yes	91/91	90/91
3.8	Cardiovascular system			
	(h) ECG - AbN/N (R-sided heart changes)	Yes	68	5/68
3.9	Respiratory system			
	(b) FEV ₁ – observed	Yes	88/91	-
	(e) FEV ₁ – predicted	Yes	88/91	-

Interim Findings – Review of Respiratory Component of Current Health Scheme

	Section/Questions	Included in DNRM dataset	If Y, degree of completeness	
	(h) FEV ₁ – observed/predicted %	Yes	87/91	86/87
	(c) FVC – observed	Yes	88/91	-
	(f) FVC – predicted	Yes	88/91	-
	(i) FVC – observed/predicted %	Yes	87/91	84/87
	(d) FEV ₁ /FVC% - observed	Yes	88/91	85/88
	(g) FEV ₁ /FVC% - predicted	Yes	88/91	86/88
3.10	Spirometry – abnormal/normal	Yes	90/91	90/90
3.11	Auscultation of chest – abnormal/normal	Yes	90/91	90/90
3.12	CXR undertaken – Y/N	Yes	91/91	91/91
	Date CXR taken	Yes	85/91	83/85
	Quality of film – unsatisfactory/satisfactory	No		
	What was the result – AbN/N	Yes	70/91	70/70
	Attach film to report	No		
3.17	Is coal mine worker’s fitness for duty likely to be affected by any of the following	No		
	No lifestyle question relating to respiratory system, e.g. smoking			
3.18	Is there any reason why the coal mine worker may not be fit for duty in relation to work:	No		
	(b) Underground (including use of self-rescue breathing devices & escape) – Y/N	No		
	(d) Performing heavy manual handling – Y/N	No		
	(f) In dusty conditions – Y/N	No		
	(h) In confined spaces – Y/N (?)			
	(i) While wearing safety footwear or other PPE such as ear plugs, glasses and respirators – Y/N	No		
Section 4	Health Assessment Report			
	Examination Details			
	Date of examination by EMO	Yes	91/91	0
	(Name of EMO – not on assessment form)	Yes	59	2/59
	Is assessment for underground work – Y/N (Duplicate Q – see Section 1)	Yes	85	62/85
	Detail of restrictions	Yes		?4
	NMA explained restriction/additional assessment	No		
	1. Fit for duty – 5 options to select from with a tick 2. None of the options are specific for the respiratory system	Entered as “true” or “false”		
	NMA provided copy of Section 4 to worker - Y	No		
	Coal mine workers’ signature/date	No		
	NMA’s stamp & signature	Yes	91/91	91/91
	NMA date		91/91	91/91

Detailed explanation of the Quality Issues of completed Health Assessment Forms

	Section/Questions	No. of entries	Details
Section 1	Employer to complete		
	Employer	3	“H”, “Self”, “Services”
	Coal workers’ position - description	1	“U/G”
	Coal workers’ position - generic SEG	-	
	Mine	33	12 “Unknown” BUT 11 with employer named; remainder no employer named 21 “Various mines” BUT 20 with employer named; remainder no employer named
	(a) Dust exposure (X-ray needed?) - Y/N (Duplicate Q – see Section 3)	35	4 “N”, but CXR “Y” 31 blanks, but CXR “Y”
Section 3	Clinical Findings		
3.1	Height	1	“0” entered
3.2	Weight	1	“0” entered
3.8	Cardiovascular system		
	(h)ECG - AbN/N (R-sided heart changes)	63	“X” entered instead of “A” or “N”
3.9	Respiratory system		
3.9	FEV ₁ – observed	-	
	FEV ₁ – predicted	-	
	FEV ₁ – observed/predicted %	1	FEV ₁ observed & FEV ₁ predicted but no %
	FVC – observed	-	
	FVC – predicted	-	
	FVC – observed/predicted %	3	FVC observed & FVC predicted but no % FVC observed > predicted but =100% FVC observed > predicted but <100%
	FEV ₁ /FVC% - observed	3	FEV ₁ > FVC but <100%
	FEV ₁ /FVC% - predicted	2	FEV ₁ > FVC but <100%
3.12	(b) Date CXR taken	2	Incomplete “11/10”, “06/2001”

Interim Findings – Review of Respiratory Component of Current Health Scheme

	Section/Questions	No. of entries	Details
Section 4	Health Assessment Report Examination Details		
	Date of examination by EMO (Name of EMO – not on assessment form, but in DNRM database)	0 57	55 with surnames only 2 with the names of the surgery
	59 medicals completed by an EMO (35 doctors in total, including 14 NMAs) 28 medicals completed by EMOs who are also NMAs		
	Is assessment for underground work – Y/N (Duplicate Q – see Section 1)	23	Work U/G cf. U/G work Blank cf. “Y” (18) Blank cf. “N” (1) “N” cf. “Y” (3) “Y” cf. “N” (1)
	Detail of restrictions	?4	Not clear from the details if these relate to a respiratory condition

Appendix 6: List of NMAs, by practice type and qualifications

In total, there were 237 Nominated Medical Advisers (NMAs) conducting the coal workers' health assessments, in over 140 surgeries and in five different States. The majority (146) of NMAs were General Practitioners who were mainly based in General Practice clinics, followed by Medical Practitioners (57) with General registration practising in both Occupational Health Service and General Practice clinics. There were only twenty-eight specialist Occupational Physicians participating in the coal workers' health scheme. The different surgeries included ninety-seven General Practice clinics and forty-three Occupational Health Service clinics.

Queensland

The majority (approximately 90%) of NMAs and surgeries where the coal workers' health assessments were conducted were in Queensland. The coal workers' health assessments were undertaken in twenty-eight Queensland regions and these activities were concentrated in six regions: Brisbane, Mackay, Sunshine Coast, Rockhampton, Gold Coast and Brisbane City.

In Brisbane there were forty-eight NMAs based in twenty-nine different surgeries, including nine Occupational Health Service clinics and sixteen General Practice clinics. Three specialist Occupational Physicians, three General Practitioners and seven non-specialists conducted the assessments in the Occupational Health Service clinics. There were an additional two specialist Occupational Physicians practising from private clinics. The General Practice clinics were comprised of twenty-six General Practitioners and five non-specialists.

In Mackay there were forty NMAs based in twenty different surgeries, including three Occupational Health Service clinics and seventeen General Practice clinics. Medical Practitioners in the Occupational Health Service clinics included one specialist Occupational Physician, five General Practitioners and one non-specialist. There were one specialist Occupational Physician, twenty-three General Practitioners and nine non-specialists in the General Practice clinics.

On the Sunshine Coast the coal workers' health assessments were conducted by nineteen NMAs, all of whom were based in General Practice clinics. The NMAs included fourteen General Practitioners, four non-specialists and no specialist Occupational Physicians.

In Rockhampton, the distribution of NMAs was similar to the Sunshine Coast, but there were two Occupational Health Service clinics.

On the Gold Coast there were 12 NMAs in eleven different surgeries, including two Occupational Health Service clinics and nine General Practices. Eight General Practitioners and two non-specialists were based in the General Practice clinics.

In Brisbane City there was a similar number of NMAs as the Gold Coast, but there were more Occupational Health Service clinics (5) than General Practice clinics (1). There were five Specialist Occupational Physicians, four General Practitioners and three non-specialists.

Other States

The coal workers' health assessment was conducted in four other States: New South Wales, Victoria, Western Australia and South Australia. There were twenty-seven NMAs, based in eleven different Occupational Health Centres and three General Practices. The Medical Practitioners included nine specialist Occupational Physicians, nine General Practitioners and nine non-specialists.

Appendix 7: Coal Miners Dust Lung Disease – Fact sheet for GPs

Coal Mine Dust Lung Disease – Fact sheet for GPs

Since May 2015, there have been six confirmed cases of coal workers' pneumoconiosis (CWP), one form of coal mine dust lung disease (CMDLD), reported among former and current Queensland coal mine workers, and the outcome of at least one suspected case is still pending. The Queensland Department of Natural Resources and Mines (QDNRM) has commissioned an independent review of the respiratory component of the coal mine workers' health scheme, including an interim strategy to detect and manage further CMDLD cases. This fact sheet contains information for General Practitioners about CMDLD, to assist in the assessment and management of such cases. Due to the high media interest in this issue, many coal miners in Queensland are likely to be worried about their respiratory health and seek advice from their GP.

Summary

- Coal miners occupationally-exposed to respirable coal mine dust over several years are at risk of developing coal mine dust lung disease, which includes CWP, emphysema, chronic bronchitis, and lung function impairment.
- CMDLD should also be considered in former coal miners, such as retirees and ex-industry employees, who present with significant respiratory symptoms. These diseases develop gradually, usually after at least 10 years of exposure, however in sensitive miners or in cases of intense exposure symptoms may occur sooner.
- Typical symptoms of CMDLD include cough, sputum production, and shortness of breath, however individuals with early disease may be asymptomatic but may have detectable chest x-ray or spirometry findings.
- Early detection of coal mine dust lung disease is based on chest imaging and lung function testing, usually with plain chest radiography and spirometry, along with careful evaluation of respiratory symptoms.
- Individuals who are or have been coal mine workers and are suspected of having CWP should be referred to a Respiratory and/or Occupational physician for further assessment. Links to lists of such physicians can be found at <https://www.business.qld.gov.au/industry/mining/safety-health/mining-safety-health/medical/coal-board-medical/pneumoconiosis-screening>

About Coal Mine Dust Lung Disease

Coal mine dust lung disease (CMDLD) is the broad term for diseases caused by coal mine dust exposure, and comprises a group of occupational lung diseases that result from the cumulative inhalation of respirable coal mine dust over several years. Coal miners are at risk of developing these diseases, which include pneumoconioses (coal workers' pneumoconiosis, silicosis, and mixed dust pneumoconiosis). Pneumoconiosis is a disease of the lung parenchyma caused by deposition of dust particles, and the reaction of lung tissue to the dust.

Emphysema, chronic bronchitis, lung function impairment, and diffuse dust-related fibrosis are other manifestations of the disease.

Coal workers' pneumoconiosis, the form of disease identified by chest imaging, can be further classified by severity: simple CWP which may be category 1, 2, or 3 reflecting increasing profusion of scars seen on chest imaging. The more severe stage of the disease known as complicated CWP or progressive massive fibrosis (PMF) is diagnosed when a scar is greater than one cm in diameter. The likelihood of CWP development is directly related to the intensity and duration of exposure to coal mine dust. The disease typically occurs after at least 10 years of exposure, and the risk of disease persists after exposure has ceased.

Under the current Queensland Coal Mine Workers' Health Scheme, all coal mine workers are required to undergo a medical assessment prior to the start of their employment at a coal mine, and then at least once every five years during their employment. Employees identified as at risk from dust exposure, in particular underground coal miners are also required to undertake chest x-rays as part of their health assessments. Given the long latency between exposure and disease occurrence, the population at risk extends to previous employees including retired coal miners and coal miners who have transferred to other industries. Coal workers' pneumoconiosis was thought to have been eradicated from Australia, with no new cases having been reported for many years. In light of the recent CWP cases increased vigilance is required among treating doctors, in particular GPs, to identify individuals with early stages of CWP.

Symptoms

Individuals with early-stage coal workers' pneumoconiosis are often asymptomatic, however typical symptoms of CWP (and other CMDLD) include cough, sputum production, wheezing, and shortness of breath. Progressive massive fibrosis is a debilitating and life-threatening condition, and individuals may present with more severe symptoms. Emphysema, chronic bronchitis and lung function impairment are well described adverse health outcomes of coal mine dust exposure and have the same presentation seen when caused by tobacco smoke exposure. The toxicity of tobacco smoke and coal mine dust are roughly equal in potency, and result in an additive effect.

Investigations

Detection of coal mine dust lung disease requires identification of relevant occupational exposure history and evaluation of respiratory symptoms, as well as chest imaging and lung function testing, which usually includes plain chest radiograph and spirometry. Chest imaging is interpreted using International Labour Office (ILO) criteria. Coal workers' pneumoconiosis is a more complex disease to diagnose, and suspected cases should be referred to specialist Respiratory or Occupational physicians for assessment and management. All confirmed cases of CWP should be reported to the Queensland Department of Natural Resources and Mines by treating specialists.

There is currently no effective treatment for coal workers' pneumoconiosis, and emphasis is therefore on early detection of asymptomatic or early-stage disease, and advice to avoid further exposure to coal mine dust and other respiratory hazards including smoking cessation.

Further information

The Queensland Department of Natural Resources and Mines has compiled a list of Respiratory physicians who can be contacted for further assessment of potential cases of CWP. A list of radiology clinics reporting chest x-rays to the ILO classification has also been compiled. These lists can be accessed on the Department's webpage, and will be regularly updated. See <https://www.business.qld.gov.au/industry/mining/safety-health/mining-safety-health/medical/coal-board-medical/pneumoconiosis-screening>

Reference

Petsonk EL, Rose C, Cohen R. Coal Mine Dust Lung Disease – New Lessons from an Old Exposure. *Am J Respir Crit Care Med* 2013;187(11):1178-85.