

An Estimation Of The Exposure Of Queensland Underground Coal Longwall Workers To Respirable Dust



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INTRODUCTION

- Study by Kizil and Donoghue 2001
- NSW 33 Longwall mines 1985 – 1999
- No real change in 15 years.
- Average exposure 1.5 mg/m³ assuming 8 hour day 40 hour week.
- 6.9 % of samples > 3.0 mg/m³
- Exposure standard for an 8 hour shift, 40 hour week.

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The Queensland Coal Mining Safety and Health Regulations 2001 state:

Section 89 - the worker does not breathe an atmosphere at the mine containing respirable dust exceeding an average concentration calculated under AS 2985, equivalent to the following for an 8 hour period

- i. For coal dust – 3 mg/m³ air
- ii. For free silica – 0.1 mg/m³ air

If the worker works a shift more than 8 hours at the mine, the system must provide ways of ensuring the person's dosage of respirable dust is not more than the equivalent dosage for a person working an 8 hour shift.

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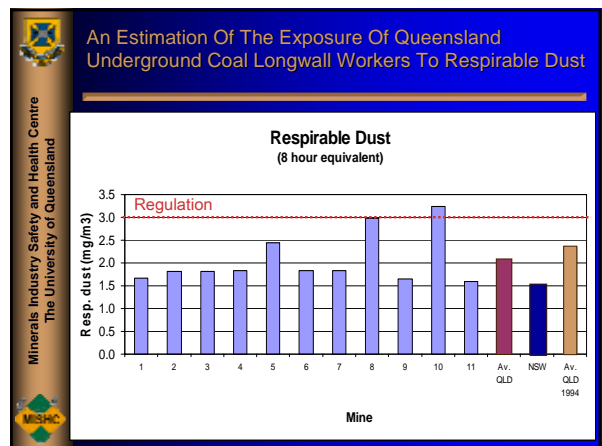
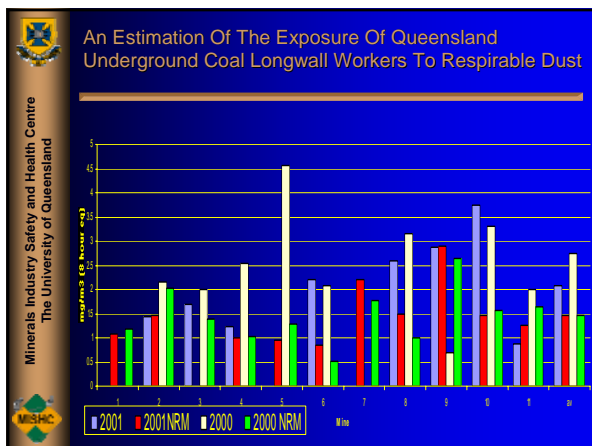
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METHODOLOGY

DATASET

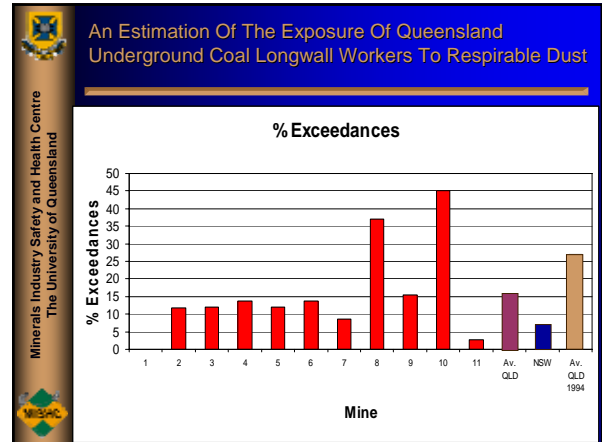
- DATA FROM EACH MINE
- NRM DUST SURVEY RESULTS
- 2000 – 2001 SELECTED
- ADJUSTED FOR SHIFT LENGTH – PHARMACOKINETIC MODEL
- OPERATOR FUNCTION
- PRODUCTION STATS

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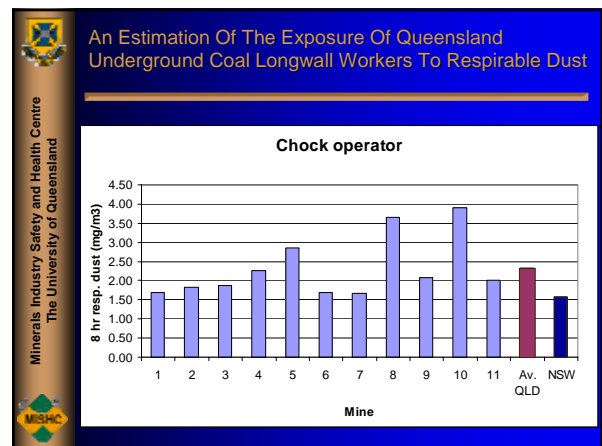
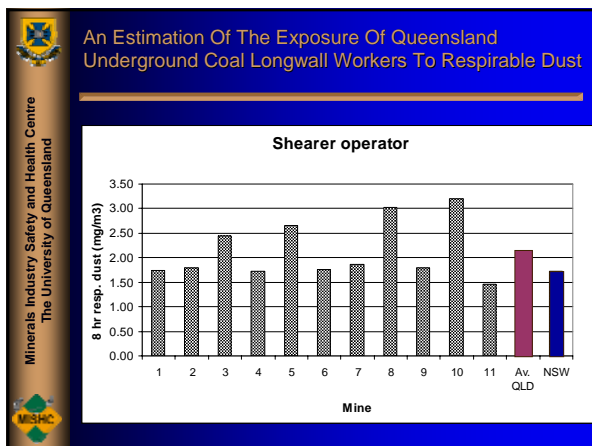
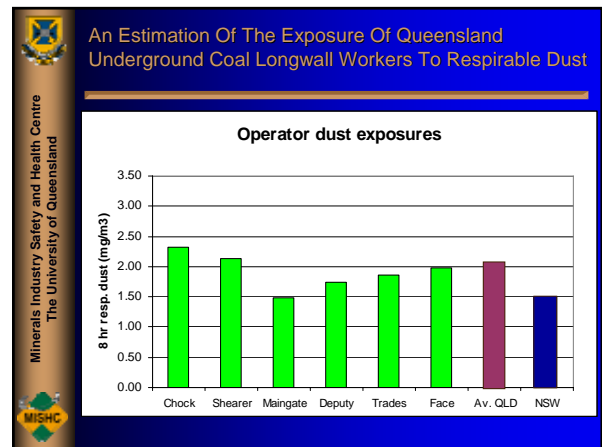
- Qld mines -1.55 to 3.25 mg/m³
- Qld 2.06 mg/m³ average (+/- 1.1)
- NSW 1.5 mg/m³ average (+/- 1.0)
- Qld statistically different to NSW only at 75 % confidence level.

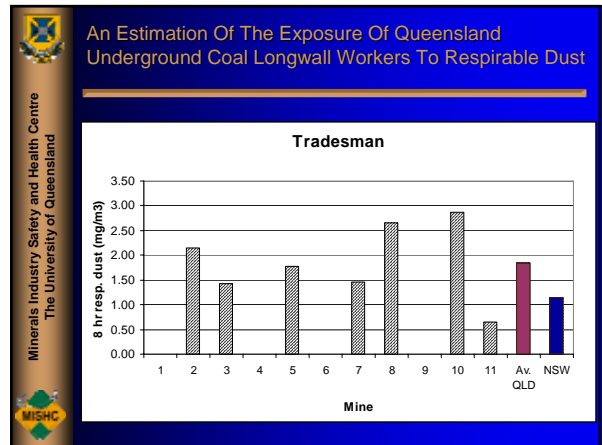
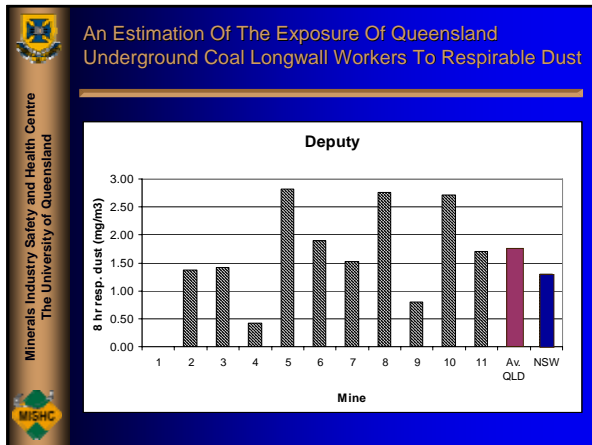
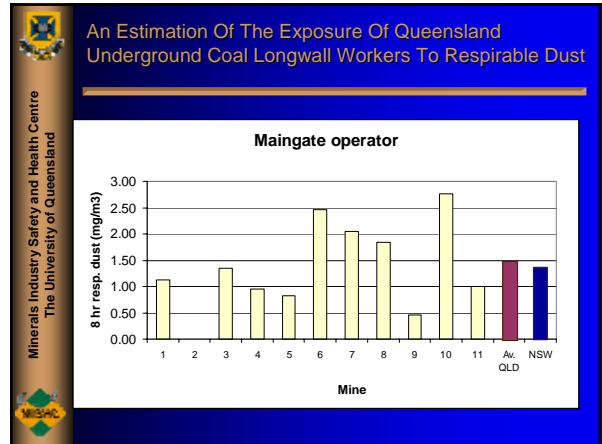
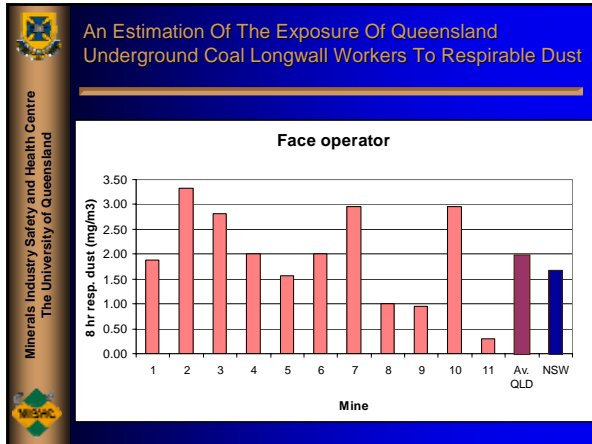


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DIFFERENCES IN THE DATA SETS

- OVERALL AVERAGE = AVERAGE OF MINE AVERAGES
- NSW SAMPLING IS CRIBROOM TO CRIBROOM
- NSW DATA NOT ADJUSTED FOR SHIFT LENGTH
- QLD SAMPLING IS SURFACE TO SURFACE
- TO COMPARE REDUCE NSW VALUE BY APPROX 10 %



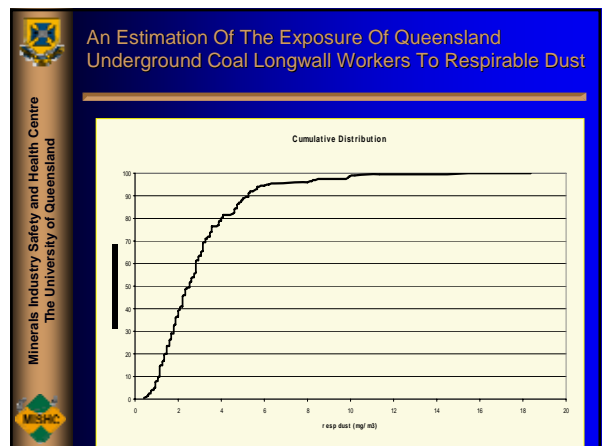


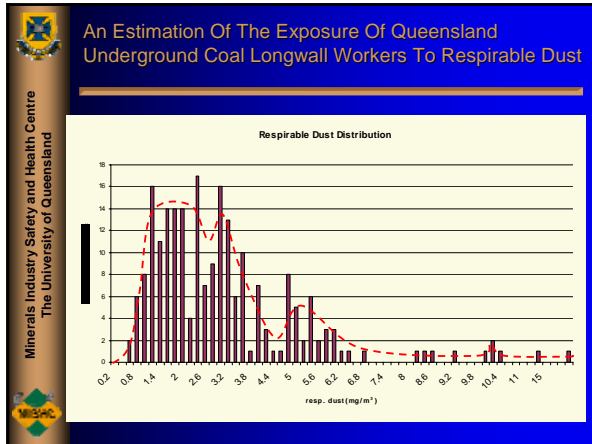
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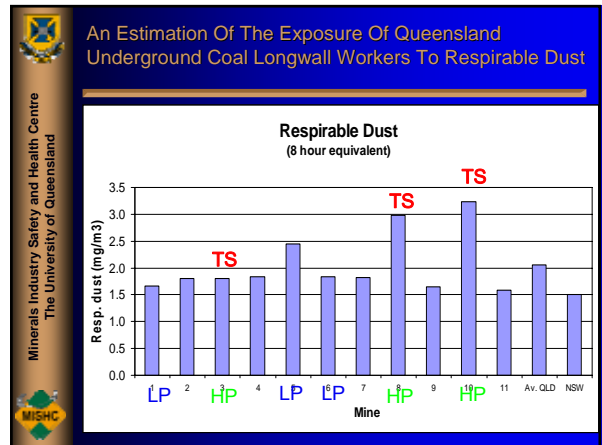
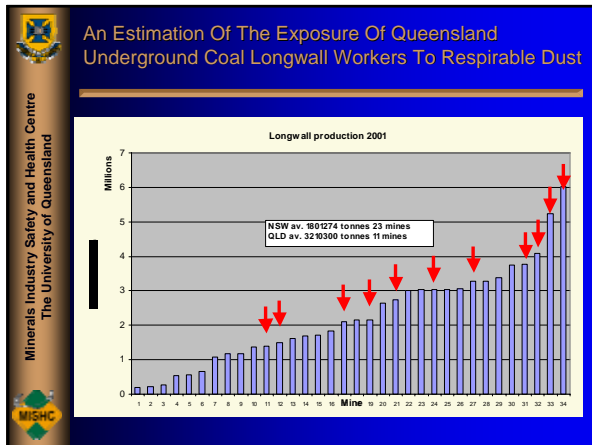
DATASET

- NOT NORMAL DISTRIBUTION
- SKEWED
- TOP 10 % CONTRIBUTE 25 % OF AVERAGE





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- QLD > NSW**
WHY?
- HIGHER PRODUCTION RATES
 - THICKER SEAMS
 - MINING METHOD – VENTILATION
 - ALL MINES UNI DI
 - GAS DRAINAGE
 - DUST CONTROLS



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PREDICTION OF LUNG FUNCTION

COALWORKER'S PNEUMOCONIOSIS

- HSL 2000 FORMULAE
- ALLOWS FOR COAL RANK
- BASED ON 35 YEARS DATA UK
- INCLUDES BORD AND PILLAR DATA IN MODEL

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$$P_{CAT1} = -\frac{104}{R} + \frac{0.0517 * C_{AV} * R * Y * H}{1631 * 40}$$

$$P_{CAT2} = -\frac{53}{R} + \frac{0.01667 * C_{AV} * R * Y * H}{1631 * 40}$$

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$P_{cat1} = 8.85\%$ after 40 years
For NSW the value is 6.26 %

$P_{cat2} = 2.63\%$ after 40 years
For NSW the value is 0.98 %

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If 10 % of CAT 2 will contract Progressive Massive Fibrosis and eventually die from the disease

- 0.26 % will contract PMF = 1 in 400.
- Fatality rate from Rockfalls = 1 in 300.
- Overall fatality rate from accidents 2000/2001 = 1 in 200.

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- ☐ NO NEW CASES OF PMF HAVE BEEN REPORTED IN AUSTRALIA IN THE PAST 5 YEARS.
- ☐ WORKERS LEAVE INDUSTRY AND MAY NOT REPORT ILLNESS
- ☐ UNDERGROUND WORK LIFE << 40 YEARS
- ☐ UK AND USA CONTINUE TO DETECT PMF.

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MODEL OVERPREDICTS

- ☐ UK MODEL BASED ON EXPOSURE TO ALL TYPES OF COAL MINING
- ☐ ESTIMATION OF LENGTH OF WORKING LIFE
 - FEW WORKERS WORK UNDERGROUND FOR 40 YEARS
- ☐ ESTIMATION OF ANNUAL DUST EXPOSURE
 - NO ALLOWANCE FOR LOST PRODUCTION SHIFTS
 - NO ALLOWANCE FOR PPE

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The expected loss in lung function (FEV_1) can be predicted from the formula:

$1.22 \times \text{mean dust exposure} \times 40 \text{ years} = 100.5 \text{ ml} < 10\% \text{ OF LUNG FUNCTION}$

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CONCLUSIONS

- ☐ THERE IS A DUST PROBLEM
- ☐ NEED TO IMPROVE CONTROLS
 - ☐ IMPROVED DUST SUPPRESSION ?
 - ☐ EFFECTIVE USE OF PPE
 - ☐ JOB ROTATION
 - ☐ SEPARATION OF SOURCES FROM PERSONNEL – POSITIONING
- ☐ MORE MONITORING
 - ☐ IMPROVE RELIABILITY OF ESTIMATES
 - ☐ USE REAL TIME MONITORING TO OPTIMISE ENGINEERING CONTROLS



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