

**CONTROL OF INHALABLE AND RESPIRABLE COAL
MINE DUST
REGULATORY IMPACT ASSESSMENT (PARTIAL)**

PURPOSE AND INTENDED EFFECT

Issue

1. Existing legislation, the Coal Mines (Respirable Dust) Regulations 1975 (RDR) has been extremely successful in reducing the prevalence of pneumoconiosis. However these regulations were drawn up based upon practices and assumptions made over 25 years ago, which do not reflect current working patterns, conditions and techniques.
2. Arguably, the main weakness in RDR is that the exposure limits it imposes are not time-weighted. While RDR directly regulates the concentration of respirable dust in the workplace there is no mechanism to take account of the other main factor that affects the risk - the time people spend at the workplace. Shift patterns worked by today's miners are more variable, and generally add up to longer hours being worked each year, than was the norm when RDR were introduced. Current thinking on occupational exposure limits is to specify them on a time-weighted basis so that if exposure time is longer than the reference period, the permitted concentration is reduced in proportion.
3. The recent rise in prevalence of pneumoconiosis shows that while compliance with RDR has protected the majority of individuals from high levels of exposure, it has not been successful in protecting individuals working long hours.
4. There is also a need to implement the European Directive on Chemical Agents (CAD) in so far as it relates to the control of coal mine dust as a health hazard.

Objectives

5. The ultimate objective of these proposals is to reduce the number and severity of cases of pneumoconiosis, chronic bronchitis and emphysema attributable to dust exposure to a level that would avoid significant disablement.
6. The proposals aim to achieve this by imposing time weighted exposure limits for respirable coal mine dust of $3\text{mg}/\text{m}^3$ and respirable crystalline silica of $0.3\text{mg}/\text{m}^3$ on coal mines, focusing dust sampling on personal

exposures and extending health surveillance cover to all employees below ground at risk of significant exposure to inhalable coal mine dust.

Risk assessment

Prevalence of pneumoconiosis

7. The prevalence of pneumoconiosis among the working miners x-rayed during the tenth four-yearly round, which ended in 2001, was 0.6%. This was a significant increase from the previous prevalence of pneumoconiosis in the mid 90s of 0.2%, all at the lowest category. Of the 40 miners this [the 0.6] represents, 10 were diagnosed with higher category pneumoconiosis, including two with PMF in 2000. Part of this deterioration may be due to the altered age structure of the industry with practically no recruitment and increased numbers of older miners remaining in the industry. Likewise some of the earlier improvements may be due to widespread redundancies among older mineworkers as collieries closed. However age is clearly not the only factor as the trends are the same for different age groups as the overall.
8. Investigations by HM Inspectors of Mines into the circumstances of the recent pneumoconiosis cases suggested that the mines were generally complying with RDR workplace limits but the individuals concerned had a history of working extended hours and so would have had particularly high exposures. In most cases, at least one four-yearly medical examination had been missed and there were a disproportionate number of contractors' employees among working miners being diagnosed with pneumoconiosis. This is supported by the results of the tenth four-yearly round where the overall prevalence is 1.8% amongst contractors' employees compared with 0.5% amongst directly employed miners.
9. The Health and Safety Laboratory (HSL) has calculated that, assuming a constant workforce of 4,500 units, under the current regulation there will be 225 cases of pneumoconiosis over the next 35 years¹. Previous studies give an approximate ratio of pneumoconiosis to chronic bronchitis of 1:5. HSL therefore estimates that, under the current regulation, 1125 individuals will contract chronic bronchitis over the next 35 years.

OPTIONS

10. Regulatory control already exists for controlling inhalable dust below ground in a coal mine. It is deemed appropriate to maintain a similar regulatory regime to maintain standards of health and safety that the industry wholeheartedly supports. The sanctions on operations at a mine, if exposure limits are exceeded, is fundamental to securing strict

¹ This estimate has been obtained by using HSL exposure data and the formula contained in the HSL document '*Impact of proposed changes to the respirable dust regulations on the risk of contracting pneumoconiosis*'.

adherence to the tight control that is demanded in order to protect the health of workers. This enforcement is only possible through a legislative regime. The requirements of CAD have also to be implemented at coal mines and this needs to be done via regulatory action to avoid infraction proceedings. Other non-regulatory methods of implementation have not been considered for these reasons.

INFORMATION SOURCES AND BACKGROUND ASSUMPTIONS

11. Much of the information contained in this RIA that was supplied by the Mines Inspectorate is based on their industry knowledge, but information relating to the assessments was taken from detailed questionnaire responses obtained in 2000 from the managers of a representative sample of seven mines, all of who had taken part in the early HSL field trials. The Federation of Independent Mines was contacted to conduct the small firms impact test, and the information on wages was taken from the New Earnings Survey (NES 2002).
12. The costs and benefits have been discounted in line with Treasury guidance; the costs and non-health benefits at 3.5%, and the health benefits at 1.5%. The costs are presented in their annualised form unless it explicitly states otherwise, with a base year of 2002 and an appraisal period of 35-years. The costs are separated into policy (those costs that arise from prescribed changes to achieve policy goals) and implementation or “red tape” costs.

EQUITY AND FAIRNESS

13. The introduction of these regulations will result in an improvement in equity and fairness for the coal-mining workforce. Health surveillance under RDR is limited to mine owners’ employees, (although some voluntary arrangements do exist for some contractors’ employees). These regulations place duties on all coal mine owners and other employers who have people working below ground at a mine who are likely to be exposed to inhalable coal mine dust. I.e., contractors’ employees are now protected to the same extent as mines employees.

Atypical workers

14. These proposals could be considered to have a disproportionate effect on contractual workers, as they could be more likely to work longer hours. There are 3 mine contracting companies with 540 employees active in the industry.
15. The Coal Mining Contractors Association was contacted, and in their opinion, these proposals would not have a disproportionate effect on contractual workers. This is mainly because they have to follow the hours the mine operates, so even currently, will not work longer than a twelve-hour shift.

BENEFITS

Health and safety benefits

16. The health effect most clearly identifiable with coal mine dust is pneumoconiosis. However, chronic bronchitis and emphysema can also be attributed to dust exposure though that is not the only cause. In addition, exposure to respirable quartz dust (crystalline silica) is now known to be associated with rapid progression of pneumoconiosis.
17. Pneumoconiosis can be further classified into 'simple' pneumoconiosis, and 'complicated' pneumoconiosis or progressive massive fibrosis (PMF), with the distinguishing characteristic being the size of the associated lesions on the lung. Simple pneumoconiosis is not significantly disabling. In general terms, long-term cumulative exposure to coal mine dust has found to be associated with increasing severity and a progression from simple pneumoconiosis to PMF - however, PMF has occasionally been observed in miners without them first developing simple pneumoconiosis.
18. It has been estimated that under the new regulation 189 pneumoconiosis cases and 945 chronic bronchitis cases would be prevented over a period of 35 years. This corresponds to about 5 and 27 cases per year, respectively. We assume that most (ca. 96%) prevented cases of pneumoconiosis are of the 'simple' type. This implies that virtually all benefits arise from preventing chronic bronchitis².
19. The benefits of preventing a disease are equal to the costs associated with contracting the disease. In particular, we consider three types of costs arising from ill-health: lost output, medical treatment and subjective costs (an allowance for pain, grief and suffering).
20. The present value of lost output over the appraisal period of 35 years amounts to ca. £9.985 million. This corresponds to ca. £285,000 per annum³. This figure is derived by assuming that once a worker has been diagnosed with chronic bronchitis, they will be off work 5.4 days a year for the following 30 years. The value of lost output is set equal to the cost of labour. Taking into account an average working day of 8.5 hours and labour costs of £9.25⁴ per hour, this yields a value of around £250,000 per annum. The remaining £35,000 are due to pneumoconiosis. They account for time spent in unemployment looking for a new job (on average 103 working days).

² We also assumed that premature death occurs in 1% of the cases of chronic bronchitis and in 0.04% of the cases of pneumoconiosis.

³ All the monetary per annum (or annualised) values in this document have been calculated by dividing the present value by the length of the appraisal period (35 years).

⁴ £9.25 comprises of £6.95 wage costs (occupations in mining, NES 2002) plus non-wage labour costs of a third.

21. The present value of medical treatment costs amounts to ca. £3.769 million (ca. £108,000 per annum), nearly all attributable to chronic bronchitis. This corresponds to medical treatment costs for each affected worker of £185 per annum over a 35 years period.
22. The present value of pain, grief and suffering costs is equal to ca. £173.356 million (ca. £4.953 million per annum), again, nearly all of them due to chronic bronchitis. To calculate this amount we evaluated the subjective cost of chronic bronchitis at ca. £221,000 per affected worker⁵.

Other benefits

23. No non-health benefits have been identified

Total benefits

24. The sum of health and safety and other benefits yields a benefit from introducing the new regulation of ca. £187.111 million (£5.346 million per annum): £2.758 million (£79,000 per annum) are derived from preventing pneumoconiosis, while the remaining £184.353 million (£5.267 million per annum) are obtained from reducing the number of cases of chronic bronchitis.

COSTS

Business sectors affected

25. All coal mines are under scope of the proposals. There are at present some 27 mines which employ approximately 6,700 staff.
26. By the time the Regulations come into effect, it is expected that the number of mines operating in the industry will have declined significantly due to planned mine closures. When the Regulations come into effect, there are expected to be 10 small mines and 10 large mines, with an underground workforce (i.e. workers effected by the Regulations) of 4,500. We assume the underground workforce to remain constant over the entire appraisal period.

Compliance costs for a 'typical' business

27. It is obviously hard to identify a 'typical' mine, as they are likely to vary enormously in size, therefore this section shall be calculated on the basis of an 'average' small mine, and an 'average' large mine.

⁵ This value has been taken from HSE (1999), *The costs to Britain of workplace accidents and work-related ill health in 1995/96*, p. 77. The original estimate of £136,100 has been uprated to account for inflation and income growth. The corresponding figure for premature death is equal to ca. £1,246,000 (Department for Transport estimate).

28. For the purposes of this RIA, based on information from the Mines Inspectorate, it is assumed that there will be 20 mines, 10 large and 10 small, with an underground staff of 4,500 when the Regulations come into effect. It is assumed that the average number of employees in each of the 10 small mines is 25, and the average number of employees in large mines is 425.
29. As the costs are calculated on the basis of an 'average' mine, they are unlikely to reflect the position of any given mine, but are meant to be illustrative.

Familiarisation Costs

30. It is assumed that the senior management team, (perhaps 4 individuals at a large mine and 1 at a small mine), would need half a day training session, probably delivered by a team including an HSE Mines Inspector, a Laboratory service provider and a medical service provider. It can be assumed that the laboratory service provider and the medical service provider would have to be reimbursed for their time, whereas the Mines Inspector would consider it part of their inspection duties. Attendees would also need at least another half day to prepare (read the new legislation etc.)
31. Management time is valued at £22.90⁶, laboratory staff time is valued at £20.60⁷ and medical service staff time is valued at £32.70⁸. Therefore the costs of senior management training is approximately £400 at a small mine £900 at a large mine.
32. Two people (such as the mine safety engineer and dust control officer) for a large mine, one for a small mine (perhaps the manager again) would need more detailed training over about three days. This might incorporate the half day aimed at management with some external trainers. The rest of the training might be delivered by safety staff.
33. As mentioned earlier, management time is valued at £22.90, also safety engineers time is valued at £21.45⁹ and dust control officers time is valued at £9.25¹⁰. In addition, the value of time for the safety staff running the training is estimated at £18.60¹¹. Therefore the cost of

⁶ £22.90 comprises of £17.20 wage costs (production managers in mining, NES 2002) plus non-wage labour costs of a third.

⁷ £20.60 comprises of £15.50 wage costs (scientists, NES 2002) plus non-wage labour costs of a third.

⁸ £32.70 comprises of £24.60 wage costs (scientists, NES 2002) plus non-wage labour costs of a third.

⁹ £21.45 comprises of £16.12 wage costs (mechanical engineers, NES 2002) plus non-wage labour costs of a third.

¹⁰ £9.25 comprises of £6.95 wage costs (occupations in mining, NES 2002) plus non-wage labour costs of a third.

¹¹ £18.60 comprises of £14.00 wage costs (occupations in mining, NES 2002) plus non-wage labour costs of a third.

completing detailed training would be £1,000 for small mines and £1,200 for large mines.

34. The entire underground workforce would need about half a day of training to introduce the new regime. This would probably be delivered by previously trained mine management and specialist staff and be incorporated in a 'safety day' which run at most mines periodically anyway, so we assume no additional cost.
35. The total cost of training to familiarise the workforce with the Regulations has been estimated at £1,400 in a small mine £2,100 in a large mine. When annualised over the appraisal period, the cost for a small mine is £40, and the cost for a large mine is £60. This is an implementation cost.

Initial Assessment

36. Three large mines were able to provide information on the time taken to do an initial assessment of the conditions at their mine, and to decide on an appropriate sampling strategy. All three mines reported that this would take three months in total (or 65 days of time). One mine that was able to give details said a number of specialist personnel would be involved. Based on this response, which appears typical, we assume a total of 32.5 days of management time, and 6.5 days each for mechanical and safety engineers, surveyors, ventilation officers, dust officers and samplers.
37. As mentioned earlier management time is valued at £22.90 and mechanical and safety engineers' time is valued at £21.45. In addition surveyors' time is valued at £19.70¹², with the ventilation officers, dust officers and samplers' time being valued at £9.25, as stated previously. This wage costs give an estimated cost of completing an initial assessment for the sample mine of £9,500.
38. Costs of assessment are likely to vary in line with the size of the mine. Taking into account the size of the workforce in the mine surveyed, it is estimated that the cost to a small mine of initial assessment will be £500, and a large mine £8,100. This is an initial cost occurring in the first year of appraisal only, and is a policy cost. When annualised over the 35-year appraisal period, this cost is approximately £10 for a small mine, and £230 for a large mine.

Recurring Assessment

39. We asked mines how often new developments would take place, and the average working life of typical developments at their mine. The responses indicated that conditions would change often enough at

¹² £19.70 comprises of £14.80 wage costs (surveyors, NES 2002) plus non-wage labour costs of a third.

each large mine so that over the course of one year, present working faces and drivages would be fully replaced. However, we would not expect mines to require the same amount of time in reassessing these new workings as they would have spent for the initial assessment, since a lot of information could be carried forward.

40. We therefore allow a recurring cost of half the initial amount, or £250 for small mines and £4,000 for large mines each year. This is a recurring cost that will occur in each year of the appraisal period. When annualised, this cost is approximately £100 for small mines and £2,300 for large mines and is a policy cost.

Managers Sampling Scheme

41. Information supplied by the Mines Inspectorate indicated that 1 static sample per month is currently needed for an average small mine, and 2 personal samples will be needed per month under the new regime. This suggests an additional 12 samples annually, and perhaps an additional 3 assessment validation samples might be needed in the first year.
42. The information also suggested that 9 static samples per month are currently needed for an average large mine, and 1 static and 28 personal samples per month would be needed under the new regime. This suggests an additional 216 samples annually, with a further 36 personal samples in the first year to validate initial assessments.
43. We expect the average unit cost to be approximately £30 per sample. This assumes no overhead to cover purchase and maintenance of the new sampler. This is because the current samplers are obsolescent and would have had to be replaced soon, even if the Regulations did not force the issue, and the maintenance overheads of the old samplers are likely to be significantly greater than the new samplers, effectively suggesting a cost saving by moving to the new sampling method.
44. When the costs are assessed over the 35-year appraisal period and annualised, the annualised cost to a small mine is £200, and a large mine is £3,900. This is a policy cost.

Control measures

45. The idea behind the time-weighted exposure limit is to refocus the control measure away from the workplace (i.e. dust suppression machinery etc) and on to the individual workers. That is, to comply, the mines are unlikely to have to alter the average dust levels; instead they will have to reorganise the work to move workers away from dust sources or prevent individuals from working excessively long hours that would cause that worker to exceed their limit.

46. What this will mean in practice for mines will vary enormously, and will be crucially dependent on the type of staffing arrangements that they have in place already. In an extreme case, where a mine relies on a limited number of individuals to work for extended periods of time, the mine may have to substantially alter its work patterns and as a result may have to increase its workforce. This will obviously have a significant cost, but this situation is expected to be unusual. It is expected that the majority of mines will find it relatively easy to comply with the new exposure limits by reorganising work patterns and 'tweaking' systems of working.

Health surveillance

47. Health surveillance will now be available for all underground workers as opposed to just mine employees. This means there will be an additional cost of providing Health surveillance to the 540 contractors' employees operating in the industry. This is difficult to quantify, but is expected to be minimal as it will simply involve the rolling out of existing systems to additional workers. Also, as most contractors currently encourage health surveillance, the additional element of the cost will be further lowered. This will be a policy cost.

Linking health records

48. The extra administration linking together the exposure data and health surveillance will be minimal, probably a small extension to existing systems in large mines. The small mines may be offered the software solutions by the large mine's service providers, otherwise they may need to set up a new hard copy record system to replace those for the current regime. Either way the costs will only consist of a small initial policy cost.

Table 2: Summary of annualised costs to an 'average' small and large mines

Cost area	Small mine	Large mine
Familiarisation	£40	£60
Initial assessment	£10	£230
Recurring assessment	£100	£2,300
Sampling	£200	£3,900
Control	Un-quantifiable	Un-quantifiable
Health surveillance	Un-quantifiable - Minimal	Un-quantifiable - Minimal
Linking health records	Un-quantifiable - Minimal	Un-quantifiable - Minimal
Total	£400	£6,000

N.B the figures may not add due to rounding

Total compliance costs to business

49. The costs outlined above detail the approximate cost to an average mine, therefore, to calculate the total compliance costs to business, the average cost should be multiplied by the number of mines, i.e. the

small mines cost by 10, and the large firms cost by 10. A breakdown of the total compliance costs to business is given in the “costs to society” section.

Costs to HSE

50. It is expected that there will be no additional costs to HSE over and above the costs of developing the policy. This is because the tasks undertaken by inspectors to help familiarise mines with the Regulations, are expected be done as part of their existing duties.

Other costs

51. No other costs have been identified.

Environmental impacts

52. There are no environmental impacts of these proposals.

Total costs to society

Table 3: Total annualised compliance costs to society

Area of cost	Annualised costs
Familiarisation	£1,000
Initial Assessment	£2,400
Recurring Assessment	£24,000
Sampling	£41,000
Control	Un-quantifiable
Health surveillance	Un-quantifiable – Minimal
Linking health records	Un-quantifiable – Minimal
Total	£70,000

N.B the figures may not add due to rounding

53. The annualised cost to society is £70,000. Only £1,000 of this total is implementation costs, the remaining £69,000 are policy costs.

SMALL FIRMS’ IMPACT TEST

54. The Federation of Independent mines were contacted. They said that while small mines were on the whole very diverse making it difficult to generalise, in their opinion, the proposals would not impose a significant cost on small mines.
55. They said that small mines should not have a problem complying with the proposals for Quartz, but the new time weighted exposure limit for coal mine dust could pose a problem, but that this would depend on the limit set. They said that the cost of the proposals per tonne of coal produced might be slightly higher than for the larger mines. This is

because while small mines generally have lower dust levels, it could be harder for them to conduct the sampling.

56. They emphasised that the proposals should not pose a significant problem for small mines, and they recognised the need to address the potential danger of high exposure.

COMPETITION ASSESSMENT

57. These proposals will impact on a number of markets, namely, the coal and energy markets, as well as the market for the provision of personal samplers and analysis of the results. Both the market for coal and the energy market are international markets, with over half of the supply of coal coming in as imports and over a third of all energy being supplied in the form of imports. Given these large, international markets, it is unlikely that any one firm will hold a dominant position with a large market share.
58. The market for the provision of the personal samplers and analysis of the results consists of the 20 mines under the scope of the proposals. Despite the fact that, theoretically, any suitable laboratory could provide this service, the current sampling service is provided by just one laboratory, and this situation is expected to continue. The monopolistic nature of the market is more likely to be due to the declining nature of the mining industry meaning that the market is unable to support more than one provider, rather than high barriers to entry.
59. These Regulations are not expected to have a negative impact on the structure of any of the markets they affect. The costs of the Regulations, start-up and ongoing, will not impact differently on different firms in the market, or on firms wanting to enter the markets.

BALANCE OF COSTS AND BENEFITS

60. The annualised benefits of the new regulation amount to £5.346 million and are far larger than the total annualised compliance costs to society, which are equal to £70,000. Even if the new regulation were to prevent only one case a year of chronic bronchitis instead of the expected 27, the benefits, which would amount to ca. £274,000 per annum, would still comfortably exceed the costs.

Uncertainties

61. The 'average' number of employees in large and small mines is uncertain, and based on an arbitrary assumption. However, this will only impact on the illustrative costs to a 'typical' business, and will have no effect on the overall costs to society.

62. The costs of control are uncertain, as it is unclear what lengths mines will have to go to in order to comply with the time weighted exposure limit. It is expected that most mines will find it easy to comply by reorganising work patterns and 'tweaking' systems of working.
63. The costs of health surveillance and the linking of health records are difficult to quantify. However, they are considered to be minimal in comparison to the other costs.

ENFORCEMENT AND SANCTIONS

64. The proposals will be enforced by the existing enforcement authority, the Mines Inspectorate, and will have usual powers under HSWA to serve notices for non-compliance.

ARRANGEMENTS FOR MONITORING AND EVALUATION

65. The evidence to gauge success of the new proposals is gathered very slowly over time as the development of respiratory health problems occurs over a working life. Evidence will be gathered from continuation of the 4 yearly periodic x-ray (PXR) programme, along with information from individual health records. No statistical meaning can be made on the success of meeting the objectives of the proposals until several rounds of the PXR programme have been conducted. This will be 12 to 16 years on from the introduction of the regulations.