

MAXIMUM EXPOSURE LIMIT FOR FLOUR DUST

REGULATORY IMPACT ASSESSMENT

PURPOSE AND INTENDED EFFECT

Issue and Objective

1. Flour dust is taken to be the finely ground particles of cereals or pulses (including contaminants) which result from any grinding process and from any subsequent handling and use of that "flour". Any additives (e.g. flour improvers) are included in this definition only after they have been added to the final mix.

2. Through the Advisory Committee on Toxic Substances' Working Group for the Assessment of Toxic Chemicals (WATCH) programme, HSE has been studying the health issues of flour dust for several years, culminating in the WATCH review in January 1998. This review showed that 24,000 employees were exposed to flour dust as part of their employment. However, although this number represented the best estimate of those people employed in the baking and associated trades, it is believed that the total number of employees potentially exposed to flour in UK industry could be close to 70,000. The Surveillance of Work Related and Occupational Respiratory Disease (SWORD) database shows an average of 70 new cases of occupational asthma due to flour dust each year. WATCH felt that it was appropriate to make recommendations for the risk management of flour dust. WATCH concluded that the criteria for an OES could not be met, and this view was taken forward to the Advisory Committee on Toxic Substances (ACTS).

3. The objective of the proposals is to reduce occupational exposure to flour dust by the setting of a single Maximum Exposure Limit (MEL) - both an 8-hour and a 15-minute TWA. This document informed ACTS as to the financial consequences of this procedure. The costs quoted in the document are (unless otherwise stated) those that were current at the time this RIA was written (2000).

RISK ASSESSMENT

4. The available data indicate that flour dust, as defined, can induce a specific hypersensitive state in individuals, and provoke an asthmatic response, in individuals previously sensitised. The view of WATCH is that the main health effect of concern for flour dust is its ability to induce occupational asthma. Sections of the industry believe that it is exposure to bread improver itself that causes the major asthma problem. WATCH feels that alpha-amylase is probably the most potent asthmagen present in the flour industries' environment and supports the view that compositions of flour dust which are higher in alpha amylase content are of greater concern in terms of their predicted ability to cause asthma. However, WATCH was insufficiently reassured that the criteria for an OES are met for flour dust of any composition, within the definition of flour dust being used.

5. Non-specific respiratory irritation is also observed, particularly at higher concentrations of dust and this can result in non-allergic rhinitis, conjunctivitis and

bronchitis. This is particularly prevalent. In some surveys, 40-50% of the employees were affected.

Exposure to hazard and methods of control

6. Flour mills. The milling of grain is an enclosed process where, in normal operation, all production equipment is kept under negative pressure to minimise leakage of grain or flour dust. The negative pressure results from applied exhaust systems and/or the suction pneumatic conveying system used for transporting material within the milling process. Dust exposure for the operators can result from:

- spillages from choke conditions if the system becomes unbalanced;
- damaged sleeves interconnecting moving equipment;
- deliberate opening of inspection doors or hatches for monitoring or adjustment of equipment;
- tipping of bagged flour or improvers into receiving hoppers for blending purposes;
- leaks.

7. Following blending, most of the flour is loaded into tankers, where exposure is unlikely to be significant. But a proportion is weighed into bags from 1.5 kg up to 32 kg. At the bagging point, exhaust ventilation is used at the filling station but spillages, leakage around the rim and bag splitting are all potential causes of exposure to flour dust.

8. Baking industry. In general, dust control in the baking industry is variable, particularly in the small craft bakeries. However, changes in work practices could significantly reduce exposure to flour dust throughout the industry. A booklet, entitled "Guidance on Dust Control and Health Surveillance in Bakeries", produced by the members of the Health and Safety in Bakeries Liaison Committee, contains good advice on improving work practices. If this advice was fully taken up by the industry, exposures could be reduced dramatically in many circumstances.

9. Within the largely automated plant bakeries, local exhaust ventilation (LEV) is common and personal protective equipment (PPE) is used when required. Flour dust exposure on the lines can be reduced by the use of liquid additives, weighing booths, bag disposal systems and totally enclosed mixers. At the weighing stage, when flour is blown through in-line sieves, to the weigh pan/mixer there is often a drop into the pan, which produces a transient cloud of dust. Exposure could be reduced by staff moving away from the source during this time. Better methods of reducing exposure would be by fully enclosing the weigh pan/mixer to reduce emissions or by adding a skirt of material and reducing the drop. In smaller bakeries where flour is often added, from bags, through sieves, handling procedures are crucial in reducing exposure. In one national company survey, exposure could be reduced by up to 10-fold by instruction and training staff in proper handling of flour. We also have anecdotal evidence that there are significant savings in flour usage following the instruction of staff in the correct procedures to be used.

10. Where flour is added to the dough piece, extraction and recycling of the flour will dramatically reduce exposure. One plant bakery was running two production lines, one with extraction and recycling at the flour dispensing point, another line without. The lines were running in parallel and exposure data was available from 1998. At the line without extraction at the dispensing point, flour dust exposure measured at the pinner and divider was 2.43 mg.m^{-3} and 10.84 mg.m^{-3} respectively. At the line with extraction, the corresponding values were 4.25 mg.m^{-3} and 2.33 mg.m^{-3} respectively, the latter value from a static sampler. Clearly, even with extraction on this line it is difficult to reduce exposures below 1 mg.m^{-3} . The problem of reducing exposure to very low levels is that increasing the suction could result in much of the flour being recirculated and insufficient flour being deposited on the product. However, if other work practices were implemented and background dust exposure was reduced, it should be possible to reduce exposure below 5 mg.m^{-3} .

11. The single most important source of airborne dust in craft bakeries or pastry rooms in large bakeries is from dusting down preparation tables. On stainless steel preparation tables in craft bakeries, flour is almost universally used as the anti-sticking agent. Spray canisters of vegetable oil are an alternative which are starting to be used and could be used more widely (but will not always be practical). When vegetable oil is used, the dough or pastry needs to be moulded immediately, but the use of flour creates exposure problems throughout the area and increases the need for cleaning. In 1999, HSE measured flour dust exposure in an in-store bakery where vegetable oil was used instead of flour for dusting down preparation tables (data presented in Table 2). Staff considered the oil to be a suitable substitute for flour and found that the surroundings had less dust. As a result, the need for cleaning was reduced. This substitution is still very much the exception rather than the rule as there is a reluctance to move towards oily or fatty substances which are thought to affect the make up of the finished product. The baking industry is a traditional industry with a reluctance to explore new ways of reducing flour dust exposure unless they are already well established elsewhere. It is not surprising that the newer areas of the sector, such as the in-store bakeries, are the first to seriously attempt these substitutions.

12. Where flour is thrown, by hand, onto dough to prevent sticking, the use of sprinklers or automatic dispensers can reduce exposure dramatically. Some products have flour sprinkled onto them following baking and again flour sprinklers can reduce exposure.

13. Flour is used in many bakeries as a universal anti-stick agent for dough or pastry and to decorate or enhance the product. Newer anti-stick surfaces are becoming available and are beginning to be used in some bakeries. The use of treated surfaces could reduce dramatically the use of dusting flour in these circumstances and needs to be explored further. Teflon surfaces are becoming more common and siliconised paper does reduce the need for flour as an anti-sticking agent in baking trays.

Current levels of risk

14. Data on the incidence of new cases of asthma was available from the bakery industries' trade associations. A survey was undertaken among member companies

by the Federation of Bakers (FoB), who got responses from 52 out of 61 production sites (accounting for 60% of UK bread production). These sites employ just over 17,000 people of which about 4,000 are involved in dusty processes. Fifteen cases of occupational asthma were reported over the five-year period, April 1993 to March 1998.

15. The National Association of Master Bakers (NAMB) also conducted a similar survey amongst its own members who include large and small craft bakers. 102 bakeries were surveyed and this represented 1158 bakers. Twelve cases of occupational asthma were reported but nine of them had been diagnosed prior to 1993. The results of a survey by the Scottish Association of Master Bakers showed 9 cases from 340 companies employing about 5,000 bakers.

16. The National Association of British and Irish Millers (NABIM) surveyed their members and received replies from 23 out of the 32 in membership representing 60 mills and most commercial flour production in the UK. 14 cases of occupational asthma, from seven mills, were reported over the last five years. Nine of these cases were initially reported to be due to flour.

17. The baking industries believe that, in flour milling, grain dust and not flour is the principal sensitiser. In bread making, they believe that fungal amylase and not flour is the principal sensitiser. In large scale cake baking, the industry view is that the risk of developing symptomatic sensitisation approaches zero. Across all sectors, their view is that there is a high prevalence of transient non-specific symptoms, which seem to relate to short term, high dust levels.

18. HSE ruled out RIDDOR data on occupational asthma, which could be linked with flour dust because it severely underestimates all disease and the information, supplied often does not establish the agent. Hence HSE uses more reliable data from the SWORD database. From SWORD, the total estimated annual incidence of new cases of asthma, due to occupational exposure to flour dust, in the past five years (after grossing up to allow for the fact that many of the physicians report on an annual basis, one month out of twelve) has ranged from 60 to 90, with an average of around 70 cases per year. These cases occur in a range of industries where flour is used but a large majority occur in the bakery industry. A proportion of the incidence of occupational asthma may be caused by exposure to fungal alpha amylase in bread conditioner (or bread improver) itself, which is not strictly flour dust. WATCH was fully aware of this position.

19. In the five years between 1993 and 1997, there was an estimated total of 298 new cases of asthma in the bakery industry. In this same period there were 55 cases in the related industries, such as pizza making and other food processing. However this area has shown a steadily rising trend. In unrelated industries, such as among laboratory technicians, there were only three cases in this period.

20. It is worth noting that the SWORD scheme is thought to underestimate the incidence of occupational asthma diagnosed by consultant physicians. Recent reviews of the data suggest that the overall level of occupational asthma may be underestimated by between a third and a half (HSC Health & Safety Statistics 1997/98 ISBN 0 7176 1636 3).

21. The available data is tabulated below.

Table 1: Rates of asthma associated with flour dust in bakery, related and unrelated industries over years 1993 - 1997

Group collecting data	Number of flour-exposed employees surveyed	New cases of asthma 1993 - 1997	Annual incidence per 1,000 employees exposed
NABIM	3,000	14	0.9
FoB	4,000	15	0.8
SAMB	5,000	9	0.4
NAMB	1,000	3	0.6
SWORD*	Bakery population of about 34,000	298	1.8
SWORD	Related and unrelated to bakery population of about 34,000	58	0.3

* The combined annual incidence rate per 1,000 employees according to SWORD is 0.9.

Table 2: Summary of data on 8-hour TWA exposure to flour dust in UK industry

Study	Activity	Number of samples	Range	% of samples above 5mg.m ⁻³	% of samples above 10 mg.m ⁻³
HSE survey of Scottish craft bakers	All activities	217	<0.1 - 118	43	20
UK industry data Plant bakeries 1993-1997	High dust activities in 7 large bakeries	124	0.3 - 93	46	25
Craft Bakery HSE data (1999)	All activities	11	1.0 - 12.8	36	9
Published data, Plant bakeries (Wastell 1997)	Sieving, weighing and mixing in 22 large bakeries	141	0.1 - 770	60	22
1998 NABIM survey of flour mills	All activities	> 700	-	-	20
In-store bakeries - industry data (1998)	All activities	64	0.1 - 31.3	72	31*
In-store bakeries HSE data (1999)**	All activities	3	0.7 - 1.7	0	0
Pizza making - Combined HSE & Industry data (1997-1999)	Weighing, mixing and dough handling	5	0.6 - 14.0	40	20

* cleaning activities accounted for many of the values over 10 mg.m⁻³. The use of sweeping brushes rather than vacuum cleaners was usual.

** In-store bakery using vegetable oil instead of flour for dusting down preparation tables.

Options considered

22. At its meeting in July 1998, ACTS asked HSE to build a case for a single MEL alongside current work on amylase (present in flour and often added as part of an improver). As part of this case for a single MEL, HSE has undertaken a Regulatory Impact Assessment for a MEL at various levels of exposure.

23. The following levels were chosen for comparison;

(i) A level of 10 mg.m^{-3} is currently used as a MEL for grain dust. The industry has agreed a level for flour dust of “reduce below 10 mg.m^{-3} so far as is reasonably practicable” in guidance for several years.

(ii) A level of 1 mg.m^{-3} is the level to which, the baking industry trade associations consider, flour dust containing a substantial concentration of amylase, should be controlled.

(iii) A level of 5 mg.m^{-3} is close to the midway point of these values and is considered for comparison purposes.

Information sources

24. Information for this RIA was collected via a survey of the industries affected, in addition to previous work on MELs undertaken by HSE. Questionnaires, asking for information on processes, exposure patterns and potential costings were sent to the following industry Associations :

the Federation of Bakers

the National Association of Master Bakers

the Incorporated National Association of British and Irish Millers

members of the Supermarket Safety Group

the Bakers, Food and Allied Workers Union

the Scottish Association of Master Bakers

the Biscuit, Cake Chocolate and Confectionery Alliance

the Association of British Ingredients Manufacturers

the Food & Drink Federation

the British Retail Consortium

the Pizza, Pasta & Italian Food Association

In addition, Rank Hovis McDougall Ltd, the British Frozen Foods Federation, The British Meat Manufacturers Association and the UK Association of Frozen Food Producers were contacted, informed of the RIA and its implications and asked for information.

25. Visits were made to a small selection of mills, plant bakeries, craft bakeries, in-store bakeries, biscuit manufacturers, food processing factories and pizza manufacturers to see the processes. Measurements of flour exposure were made by

HSE at a craft bakery, an in-store bakery and a pizza manufacturer in order to check the current exposure pattern in these industries.

26. At the craft bakery, video recordings were made of the processes involving flour handling and these were viewed to see which particular actions elicited the highest flour dust exposures. A plant bakery was also visited to compare two production lines. Although both lines had fully enclosed weighing and mixing, one line had LEV installed to reduce exposure to and recycle the flour dust during the addition of flour to the dough pieces. The other line did not and served as a control to study the effects of the LEV. Values are given in paragraph 9. Other plant bakeries were visited to see high production lines in operation.

27. One major manufacturer of milling and baking equipment was contacted and a trade association for the equipment producers visited and the potential engineering controls and their associated costs discussed. An independent consultant with a lot of recent experience in monitoring for flour dust in bakeries accepted an invitation to visit HSE to discuss their conclusions.

Technical assumptions

Discounting

28. We discount costs at a rate of 6% per-annum following HM Treasury guidelines. Discounting allows for individuals' observed preferences towards current spending, and rising real income over time. We uprate labour costs by 2% per year in line with medium term real earnings growth. Finally, benefits are discounted at 2%, again following HM Treasury guidelines. Costs and benefits are shown in year 2000 present values.

Appraisal period

29. We estimate the costs and benefits of adopting the MEL over a ten-year period from 1 January 2000.

HEALTH AND SAFETY BENEFITS

Costs of work-related respiratory illness

30. The costs of work-related respiratory illness have been examined previously by HSE, most notably for a future consultation over an Approved Code of Practice on Asthma. Work-related respiratory illness causes costs to the individual, employer and society as a whole. The most significant direct costs fall to individuals (and equivalently society) in loss of actual or potential income (equivalent to productivity), and in the suffering of those individuals involved. These are estimated below. Direct costs are also incurred by firms in employee absence, administration and recruitment and retraining, although costs of absence are subsumed in the societal costs above. Finally, costs are incurred by society in medical treatment and recuperation.

31. Quantified costs are as follows:

- (i) loss of income through absence from work or through having to change jobs or take early retirement;
- (ii) expenditure on medical treatment; and
- (iii) pain and suffering of those affected.

32. We do not estimate administrative costs to firms in dealing with absence recruitment or retraining. It should also be noted that any work-related illness has wider effects on those concerned and their families, which remain unquantified.

Loss of income

33. A high proportion of asthma sufferers have to change their jobs. Depending on circumstances, this may mean a change of employer or a change of jobs within the same firm. A follow-up sample study of workers with confirmed occupational asthma¹, found about half had to change jobs and as a result lost income. The median reported income loss was £3,888 per-year. We assume this group is typical of occupational asthma sufferers.

34. The value of lost output can be proxied by the wages paid to the worker by the employer. This will be their gross earnings plus non-wage labour costs (employers national insurance, superannuation, etc.). We are not clear whether the survey bases the loss of income data on individuals' gross, or net earnings. If it is net earnings, then a scaling factor would be necessary to derive gross earnings, and the income loss would increase. We make an allowance for non-wage labour costs, at around 30% of gross earnings. We also increase the loss of earnings figure to 1997 prices, in line with earnings' growth. Overall, this gives an estimated loss of output figure around £6,100.²

35. Some asthma sufferers will not have to change their jobs, but will take some time off work during the year as a result of their illness. While this is likely to result only in a partial income loss to individuals (because of sick payments, etc.) there will be costs to employers and society through loss of output and extra administration.

36. The Central Statistical Offices Labour Force Survey (LFS) revealed that, of those who had to take time off work, the average number of days' absence per-year was 17. We assume that half of the occupational asthma sufferers who do not change jobs take, on average, 17 days off each year, because of their illness. Based upon average earnings plus an allowance for non-wage labour costs, 17 days' absence costs society about £1,600³ in lost productivity.

¹"Health, Employment and Financial Outcomes in Workers with Occupational Asthma", Gannon, Weir et al, British Journal of Industrial Medicine 1993.

²It is assumed the £3,888 applies to 1992. This is uprated by 20.2% to £4,670 in line with overall earnings growth 1992-97. £4,670 is increased by 30% for non-wage costs to give £6,100.

³Figure computed is £1,554. If those affected by occupationally-related asthma are typically in jobs below average earnings then this will be an overestimate.

37. For the remaining 25% of occupational asthma sufferers we assume they do not take time off work and therefore do not experience any loss of income. Therefore the average annual loss of output associated with each income, to an individual with occupationally-related asthma, we estimate as follows:

$$(0.5 \times \text{£}6,100) + (0.25 \times \text{£}1,554) + (0.25 \times \text{£}0) = \text{£} 3,400 \text{ (approx.) per-year}$$

Medical treatment

38. The Office of Health Economics estimates the average annual cost of medical treatment for asthma sufferers in 1987/88 was around £115 per-case - just over half of this is accounted for by hospital services and is free to the individual. Prescription charges account for part of the balance. In 1997 prices, this total cost to society would be around £195 per-year, however diagnosed occupational asthma involves treatment by specialist medical practitioners. We believe a more reasonable estimate relating to occupational asthma would be around £500 per case each year.

Pain and suffering

39. This section uses estimates published by HSE⁴, based upon research undertaken at the University of East Anglia, into the relative severity of different illnesses and injuries ranked by their severity. Using Department of Transport values attached to risk of injury reduction we translate these welfare losses into monetary values.

40. We estimate a non-permanently-incapacitating-illness involving outpatient, or GP, treatment involves a welfare loss of around £1,600 in 1997 prices (around £1,000 in 1990 prices). Since this related to cases where there were over 7 days off work, we assume, for those absent because of respiratory illness (at an average of 17 days), their welfare loss is around double (say £3,200 in 1997 prices).

41. We estimate a permanently incapacitating illness involves a welfare loss of around £111,000 in 1990 prices. For those having to change jobs, we expect the welfare loss to lie between this figure and the welfare cost for an individual needing to take some time off work, but probably much closer to the latter. We assume this cost may lie between £5,000 and £10,000.

42. Finally, there are those who experience occupational asthma but do not take time off work. Although there is no loss of income, there will still be an element of pain and suffering. We make a notional allowance of £80 for the pain and suffering from minor cases of ill health (a figure from Davies and Teasdale of £50 updated).

43. Therefore, we estimate the loss in terms of pain and suffering of occupational asthma, on average, is as follows:

$$(0.5 \times \text{£}5,000 \text{ to } \text{£}10,000) + (0.25 \times \text{£}3,200) + (0.25 \times \text{£}80) = \text{£}3,320 \text{ to } \text{£}5,820$$

⁴"The Costs to the British Economy of Work Accidents and Work-Related Ill-Health", N.V.Davies and P.Teasdale, 1994.

This is not an estimate of the value of pain and suffering each year. It is an estimate for pain and suffering, in present value terms, expressed by how much individuals are willing-to-pay today to avoid having occupational asthma, the effects of which might last for many years.

Overall costs of work-related respiratory illness

44. The estimates relating to loss of income and medical treatment are annual costs. Therefore, undiscounted over ten years, loss of income and costs of medical treatment would be £30,750 and £5,000 respectively. Discounting gives a present value of around £29,000 for loss of income and £3,900 for medical treatment.

45. Adding these costs to those estimated for pain and suffering in paragraph 43, yields an average cost-per-case of between £36,000 and £38,000. Given the fairly narrow range, we take £37,000 as a point-estimate. This figure represents the average benefit for society, over a ten-year-period, of preventing an individual from contracting occupational asthma in 1999.

Total realisable health benefits of control measures

46. The SWORD data presented in the risk assessment suggests an annual incidence of about 70 cases of flour-induced asthma. As previously indicated, an unknown proportion of these may relate to bread improver itself, but SWORD cannot differentiate. Industry figures for the incidence of flour-induced asthma are much lower, although they do note that, on average, for every case of asthma there are 1-2 cases of allergic rhinitis. Since the effects and severity of the illnesses are similar, we also apply the cost-per-case figure developed for asthma to cases of allergenic rhinitis.

47. There is some evidence for a dose response relationship between the concentration of flour in air and the occurrence of occupational asthma. This being the case, the incidence of asthma will be reduced with a lower exposure to flour dust. However, the dose response data is not sufficiently robust for this relationship to be quantified. We cannot therefore quantify any expected reduction in incidences of ill-health associated with the control methods outlined below. However, we can estimate the current scale of the problem in monetary terms. The Regulatory Impact Assessment for a draft Approved Code of Practice on asthma examined the incidence of occupational asthma in detail and found that the true incidence may be up to double that indicated by SWORD, through the inclusion of undiagnosed cases (the total number of new cases was estimated to be between 1,500 and 3,000 each year). This would indicate that, recognising that a proportion may relate to bread improver itself, there are around 70 to 140 new cases of occupational asthma caused by flour dust each year, and (based on the industry estimate) there would be around 70 to 280 cases of allergic rhinitis. This incidence of occupational asthma represents 5% of the total incidence. Given the number of new cases, and the estimated cost of each case (taken as a point estimate), this suggests that the total costs to society of the new cases of occupational asthma caused by flour dust that we would expect to appear over the next ten years lies between £47.5 million and £142.4 million. In addition, the proposals can be expected to mitigate existing cases. We make no explicit allowance for this further potential benefit.

48. As explained earlier, in paragraph 4, the industry believes that it is the bread improver that is the main causative agent of asthma. Thus, industry contends that the real benefit from setting a MEL for flour as defined would be much lower.

Other illnesses

49. A reduction in exposure to flour dust will also lead to a reduction in the incidence of non-allergic irritant effects to the respiratory system. The benefits of this reduction have not been included in the benefits total costed but, in view of the high prevalence of symptoms, could be significant. Although some surveys show that 40-50% of exposed employees may be affected by non-specific respiratory irritation this figure is based on research in developing countries, and would not be applicable to the UK.

50. We can illustrate the likely scale of these benefits as follows. For every case of asthma or allergic rhinitis, we assume that there may be around five cases of non-allergic irritancy. This would suggest around 1,500 new cases each year. The prevalence of such minor illnesses would therefore be around five cases per thousand workers, or 0.5%. This is far lower than the evidence above, and if anything, we believe that we may be underestimating the extent of minor illnesses in the industry.

51. We value any reduction in these illnesses at around £2,000 for each case in total, following Davies and Teasdale's estimate of the costs of 'other illnesses'. The vast majority of this saving is the willingness to pay to avoid the condition, since these minor illnesses are unlikely to lead to significant time away from work. This would suggest yearly costs of around £3 million, or £25 million over the appraisal period.

52. We do not include this amount in our quantified estimates of benefits, since we have no epidemiological evidence to base the figures on. However, we do conclude that prevention of the more minor illnesses could lead to significant additional benefits. This would accord with our work on other substances used in the workplace that have attracted maximum exposure limits.

Other benefits

53. One company employed a consultant who made a series of recommendation on flour handling, in line with the booklet produced by the Health and Safety in Bakeries Liaison Committee. Although the vegetable oil costs were more than the flour used for dusting down, there were savings owing to reduced cleaning costs. This cost saving has also been seen elsewhere, where vegetable oil has been substituted for flour. It is difficult to quantify the cost savings because of the many variables involved, but they are likely to be considerable across the industry as a whole.

COSTS

Business sectors affected

54. For the purposes of this document, the business sectors affected were divided into different categories. These categories are not mutually exclusive and the

different trade associations who returned questionnaires did not always fit easily into one or other of the categories.

(i) Flour mills. Most mills are small concerns with fewer than 24 employees but some employ more than 100 people. The returned questionnaire from the National Association of British and Irish Millers (NABIM) suggests that there are 34 companies operating 75 mills and employing about 4,000 people in this sector. Up to 3,000 of these people are exposed to flour dust. NABIM consider that all of the companies will have some people exposed to flour dust levels above 5 mg.m⁻³ and that 75% of them will have some employees exposed to levels above 10 mg.m⁻³ (as an 8 hour-TWA). The dustiest operations are thought by the trade association to be rip-and-tip operations, bin cleaning, choke cleaning, general cleaning and packing.

(ii) Plant bakeries. These typically employ over 100 people, often with single job tasks in physically separate areas. Flour is usually delivered, in bulk, by tanker and the flour is blown from silos, through in-line sieves to the weighing area. Flour is often used to dust the dough as it proceeds along the production line. Flour may also be sprinkled on the final product, particularly in Scotland.

(iii) Craft bakeries. These typically employ between 5 and 25 people who perform several production tasks many times a day in one or two confined workrooms. Ingredients come in bagged form. At the upper end of the sector, up to 100 people may be employed and larger scale production methods used. In the smaller bakeries, many speciality products are made.

(iv) In-store bakeries. These are attached to a supermarket that sells the products. Although many in-store bakeries buy in “bake-off” products where flour dust exposure is negligible, a few stores do bake from “scratch”. Numbers of employees per bakery are small but often janitors are employed to clean the work surfaces periodically. The use of vegetable oil as a replacement for flour on preparation tables has been successfully tried with a resulting reduction in exposure and cleaning costs.

(v) Other bakeries. These include pizza parlours, pasta restaurants and others that are not included in the previous categories. The Pizza and Pasta Association estimates that there may be about 4,000 outlets in this category with an average of about 5 employees exposed to flour dust on each site.

(vi) Large scale cake bakeries. The Biscuit, Cake, Chocolate and Confectionery Alliance (BCCCA) returned a questionnaire which demonstrated that of the 8 companies (16 sites) surveyed, there were 10,000 employees of whom 1,200 were likely to be exposed to flour dust. The Scottish Association of Master Bakers (SAMB) also represent 7 sites and about 2,200 employees in the biscuit and cake baking industry.

(vii) Other wheat flour establishments. This includes pasta, rusk, mixes and pastry makers. This sector also includes members of the Association of British Ingredients Manufacturers (ABIM) who supply flour-based products to the bakeries.

(viii) Non-wheat flour establishments. This includes all milling and baking of non-wheat flour. We have little direct information on these uses. However, these are often speciality products and may well be produced by companies included elsewhere. From our contacts with the baking industry, we have assumed that all use of non-wheat flour is contained within the other sectors.

(ix) General food processing. This includes the use of flour for other purposes not already included. Flour is used to produce a batter coating on some products and also mixed with other ingredients to produce bagged products. Flour may also be used as a thickener in a variety of foods. The British Frozen Foods Federation have over 90 major companies who could be affected. The British Meat Manufacturers Association and the UK Association of Frozen Food producers represent a number of other companies who may be affected.

55. It is possible that some small catering establishments have not been included in any of the above definitions. Hotels, restaurants and schools will use flour periodically but exposures are unknown and the numbers potentially exposed are difficult to ascertain. For this reason, we are unable to calculate potential costs in this category.

Nature of compliance costs to business, charities and voluntary organisations

56. For each business sector, the extra control costs will be calculated for each potential MEL value. However, some costs are common to all three potential MELs and although calculated for each sector separately, the basis for these costings is given below.

Monitoring

57. Monitoring of flour dust would be required at sites where the risk assessment suggests that there may be a problem. This risk assessment would be based on previous monitoring results if available, results from similar sites or health surveillance. Once a MEL is set, it is possible that most sites would need air sampling for flour dust monitoring initially. These results and the rest of the risk assessment will indicate what sort of actions need to be taken. In many cases, the action taken may mean that no further monitoring is necessary unless conditions change significantly.

58. For the monitoring of flour dust we can calculate some typical costs. A day's time for a consultant is estimated to cost between £500 and £600. A day's time for a technician is estimated to cost between £200 and £300 and the cost of each flour analysis is assumed to be £20. A small business would require one day of a consultant's time with an average of 10 samples making a total of between £700 and £800. A medium sized business would require a consultant and a technician for one day plus the analysis of about 20 samples. This would add up to between £1,100 and £1,300. A large business would require the services of a consultant and a technician for 2 days and the analysis of about 40 samples making a total cost of between £2,200 and £2,700.

Health Surveillance

59. For health surveillance, we have information from the Occupational Health department of a local hospital on the cost of a pre-employment screen which could be used for employees likely to be exposed to flour dust. The quoted cost is £25 per employee for an on-site visit. This includes a questionnaire and basic lung function testing. Although health surveillance will often be necessary, we cannot include this cost in the RIA because it is not a cost produced by a change of regulation. The MEL status of flour dust will not have an impact on the need for health surveillance for flour dust. We can, however, note that the costs involved will be large and dependent on the numbers of employees exposed.

Protective equipment

60. The cost of an RPE programme has been calculated by HSE in a document published in 1996 (*McAlinden JJ, Costing a Respiratory Protective Equipment (RPE) Programme, Specialist Inspector Report Number 50.*) Based on 1994 prices, it gives the total cost of using and maintaining various sorts of RPE. These figures, will be used to estimate the RPE control costs. For a single-use disposable filtering facepiece respirator, assuming only one facepiece is used per user per shift, the annual cost of replacement would be between £288 and £840. The training is assumed take up to 2 hours annually and brings the total cost to between £300 and £850 per person annually in 1999 prices.

61. We have not included the costs of protective clothing and laundering in the total costs. Information from one large craft bakery showed a cost of daily laundering of smocks to be about £100 per employee annually. This measure, if introduced, would reduce the amount of flour being added to the surrounding air from clothing.

Training

62. Based on existing training, a formal training course is estimated to cost £1,000 and this should be suitable for between 10 and 20 people. There will also be a cost of 8 hours pay for attendees at the course. A day's training can therefore be costed at £100 per employee with a cost of £40 (8 x £5) for lost time (equivalent to lost production). We assume that 1 day's training will be required in the first year and half a day's annual training in subsequent years. This means a cost of £140 in the first year and £70 in the following years for each employee.

63. Assuming an employee turnover rate of 20% (estimated by a large company in the milling/baking industry), then the recurring costs will be 1 days training for all the workforce plus 20% of the total workforce having to be trained from scratch.

Mitigation

64. We have information from one company that, after employing a consultant to monitor flour dust exposure, decided to measure how much flour had to be cleaned from floors. As a result it initiated a programme of reducing excess flour usage by simple techniques, such as issuing a smaller scoop for the spreading of flour at pastry brakes.

65. In many cases, especially in the smaller sites, dramatic reductions in flour dust exposure could be achieved by strictly following working practices suggested in the booklet “*Guidance on Dust Control and Health Surveillance in Bakeries*”, produced by the Health and Safety in Bakeries Liaison Committee. A video “*Breathe easy*” is also available from the Federation of Bakers, which also contains essential advice.

66. We can assume that this advice, if followed, would incur no capital cost but could produce operational benefits owing to cleaning costs and a reduced usage of flour. However, supervision and training costs will be added to the total costs but will be similar, regardless of the level at which the value of the MEL was set.

COMPLIANCE COSTS FOR EACH SECTOR OF INDUSTRY

67. The following section estimates compliance costs for each business sector affected. Common costs (i.e. those not generally dependent on the level of the MEL) are discussed first, with the costs that depend on the level of the MEL discussed secondly.

(a) Flour mills

68. The common costs for a MEL set at any of the three levels are as follows:

Flour dust monitoring

69. NABIM has estimated that the increased requirement for dust monitoring will have an annual cost of £3,000 to £4,000 per mill. This is not an unreasonable estimate, compared to our cost estimate of between £2.2k and £2.7k for a large site. The NABIM estimate assumes that each mill would need to monitor for flour dust annually after the first visit. As stated, earlier we may assume that this would be the case if a MEL of 1 mg.m^{-3} were set. This may not always be necessary for the two higher potential MELs if other costed changes have taken place, unless conditions alter materially. We have also made the assumption that 10% of mills currently monitor leaving an extra 90% of the population with the extra costs. On the assumption that a MEL of 1 mg/m^3 would require annual monitoring of all sites, then the initial cost, as estimated by NABIM would be between $£3,000 \times (90\% \text{ of } 75) = £202,500$ and $£4,000 \times (90\% \text{ of } 75) = £270,000$ each year. By comparison, our figures suggest continuing average costs of between $(90\% \text{ of } 75) \times £2,200 = £148,500$ and $(90\% \text{ of } 75) \times £2,700 = £182,250$.

70. We have assumed that a percentage of sites will need to continue annual monitoring. We have based this estimate on the percentage of exposures currently above the proposed MEL. Clearly, the true figure will be dependent on the changes made and the control adopted on each site.

71. If a MEL for flour dust was set at 10 mg.m^{-3} , then the initial monitoring would need to be done, as above, with the same costs. Assuming that as a result of the continuing risk assessment, 20% of the sites (from Table 2, the percentage of exposures currently above 10 mg.m^{-3} - this figure is used as a possible indication of what proportion of sites would need to continue to monitor) need to continue to

monitor, then the extra annual costs would be 20% of the initial cost, that is between £29,700 and £36,450. Based on NABIM costs of monitoring, this works out at between £40,500 and £54,000.

72. If the MEL was set at 5mg.m^{-3} then we believe that 50% of sites will need continual monitoring. The extra annual costs will be 50% of the initial cost, that is between £74,250 and £91,125.

Health surveillance

73. NABIM has estimated that the cost of health surveillance will increase by at least £20 per person per annum and £50 per person per annum for those mills who currently do little health surveillance. These figures are in line with our own estimates. Therefore, for all potential MELs there will be a cost of £25 per person annually for the screen and a further cost of £10 per person for administration. For 3,000 employees, this works out at $3,000 \times £35 = £105,000$ annually as a recurring cost. However, this cost is not included in our total figures, for the reasons outlined previously.

Training and supervision costs

74. For 3,000 employees the estimated cost will be $3,000 \times £140 = £420,000$, in the first year and $(3,000 \times £70) + (600 \times £140 \text{ (staff turnover)}) = £294,000$, in subsequent years.

Control costs

(i) For a MEL of 10mg.m^{-3} .

75. NABIM considers that a continuation of the improvements seen over the last 20 years would be sufficient to comply with a MEL at this level. There would also be a need for upgrading of some current local exhaust ventilation and some exhaust systems, extracted bag disposal systems as a routine, better training and supervision for RPE usage, increased monitoring and increased health surveillance.

76. The dustiest operations would need to be addressed. They can be divided into bag emptying and disposal, cleaning and packing operations. For cleaning operations, the use of vacuum cleaners is necessary and there will be a need to increase the frequency of the cleaning operations to prevent a build up occurring. One vacuum cleaner for an extra 50% of the mills at a cost of £1,000 each produces a one-off cost of £37,500.

77. For bag emptying, an opening booth with local exhaust ventilation (LEV) is estimated to cost between £20,000 and £40,000 with an annual maintenance bill of £3,000. An estimate of £30,000 was supplied by the industry and we believe that this would be an average cost. The real costs of LEV will depend on size and complexity but we can assume £30,000 is in line with a reasonably complex unit, based on figures produced by an internal HSE report - *Costings of Local Exhaust Ventilation Systems* - produced by J.R. Cain in 1997. We assume one unit would be needed for 50% of the mills at a cost of between $37.5 \times £20,000 = £0.75$ million and

37.5 x £40,000 = £1.5 million. The annual running costs will be 37.5 x £3,000 = £112,500. We have assumed that this is in addition to any current LEV already available.

78. For packing operations, there will be a need for more efficient extraction at the hopper, efficient sealing operations and RPE may be required for dealing with split bags. A dust extraction unit could cost between £5,000 and £10,000 with maintenance costs of about £500 annually. For between 20% and 50% of the mills (up to all of the older mills), the capital cost is between 15 x £5,000 = £75,000 and 37.5 x £10,000 = £375 with running costs of between £7,500 and £18,750.

79. RPE would still be required for certain operations like choke clearing and in the bagging end, for cleaning bag spillages. We can therefore add the RPE costings for an extra 10% of the workforce. We have assumed that this represents 50% of the current exposures above 10mg.m⁻³. This amounts to between 300 x £300 = £90,000 and 300 x £850 = £255,000 annually.

80. We believe that control costs, for a MEL of 10 mg.m⁻³, could be restricted to these particular operations. The total control costs for compliance with a MEL set at 10 mg.m⁻³, are therefore:

Initial costs = between £950,000 and £2.2 million.

Extra running costs = between £210,000 and £390,000 annually.

(ii) For a MEL of 5 mg.m⁻³.

81. Compared with the 10 mg.m⁻³ MEL assumptions, the main differences would be that we assume that all mills would need to fit bag emptying booths with LEV and a dust extraction unit for bagging. This difference means that the costs for bag opening would increase to between 75 x £20,000 = £1,500,000 and 75 x £40,000 = £3 million with running costs of 75 x £3k = £225,000. We have assumed that this is in addition to any current LEV.

82. We also assume that more dust extraction units for bagging would be needed. For between 60% and 80% of the mills (all of the old mills and between 20% and 60% of the new mills) the extra cost of another unit would amount to between 45 x £5,000 = £225,000 and 60 x £10,000 = £600k with annual running costs of between 45 x £0.5k = £22.5k and 75 x £0.5 = £37.5k.

83. Increased RPE usage would cost between 600 (20% of workforce) x £300 = £180,000 and 600 x £850 = £510,000 annually, assuming that an extra 20% (all of the current exposures above 10mg/m³) are necessary.

The total control costs for compliance with a MEL set at 5 mg.m⁻³ are therefore:

Initial costs = between £1.94 million and £4.15 million

Recurring costs are between £427,500 and £772,500

(iii) For a MEL of 1 mg.m⁻³.

84. NABIM believes that current breaches of the 1 mg.m⁻³ level are virtually continuous. In the older mills, it believes that background levels of flour dust could be reduced by an increased use of extraction and the use of automatic bag-splitting and tipping systems. Disposal of bags would need to be automated and extracted. For bagging of flour, automated packing systems would mean that RPE would be needed only when loading. Palletising operations would also need efficient exhaust systems. In the analytical laboratory, short term exposures would need to be controlled by the use of RPE.

85. Even in the most modern mills, it believes that it would be virtually impossible, with current technology, to reduce exposure to flour dust to below an 8-hour TWA of 1 mg.m⁻³ without regular use of RPE. We agree with much of this. There is no doubt that several routine operations would require RPE usage to achieve compliance with this MEL, even in the most modern mills. The older mills would also need more extraction equipment. The analytical laboratories would require major changes in work operations and in some cases, the use of extraction hoods or cupboards.

86. Bag emptying booths would be needed for all mills with a MEL set at this level. Assuming an extra booth per mill, this would cost between 75 x £20,000 and 75 x £40,000 = £1.500 million and £3, million, with annual running costs of 75 x £3,000 = £225,000.

87. One extra dust extraction unit for bagging every mill would cost 75 x £10,000 = £750,000 with annual costs of 75 x £500 = £37,500

88. Increased RPE usage for some short term tasks (for an extra 50% of the workforce representing all the older mills) would cost between 1,500 x £300 = £450,000 and 1,500 x £850,000 = £1.3 million annually.

89. We must also assume that 50% of the laboratories would need extra extraction facilities costing 37.5 x £5,000 = £187,500 and running costs of 37.5 x £500 = £18,750.

90. The total costs for compliance with a MEL set at 1mg.m⁻³ are therefore:

Initial costs = between £2.925 million and £5.25 million

Running costs = between £731,250 and £1,556,250

91. Overall costs for a MEL set at various levels are summarised in Table 3.

Table 3 : Initial costs and running costs for flour mills to comply with a MEL set at different levels. (Costs of controls given in 000's of pounds, except for the total ten year costs which have been rounded and given in millions. Initial costs are given in Roman, running costs are italicised, in brackets)

Operation	Cost for MEL of 10 mg.m⁻³	Cost for MEL of 5 mg.m⁻³	Cost for MEL of 1 mg.m⁻³
Health surveillance	-	-	-
Dust monitoring	148.5 - 182.25 <i>(29.7 - 36.45)</i>	148.5 - 182.25 <i>(74.25 - 91.125)</i>	148.5 - 182.25 <i>(148.5 - 182.25)</i>
Training and supervision	420 <i>(294)</i>	420 <i>(294)</i>	420 <i>(294)</i>
Controls	952.5 - 2,167.5 <i>(210 - 386.25)</i>	1,942.5 - 4,147.5 <i>(427.5 - 772.5)</i>	2,925 - 5,250 <i>(731.25 - 1,556.25)</i>
Ten year costs (present value, £ million, rounded)	£5.7m- £8.4m	£8.7m- £13.8m	£12.7m- £21.7m

92. NABIM, using different assumptions and figures, produces a value of £3-4 million for initial costs and £1-2 million for extra running costs for a MEL set at 10mg.m⁻³. Given the large assumptions necessary for the calculations, these values are not totally out of line.

93. For a MEL set at 5 mg.m⁻³, NABIM figures suggest that the initial cost to the industry would be £5 million and recurring annual costs of £4-5 million.

94. If a MEL is set at 1mg.m⁻³, NABIM figures suggest that the initial cost to the milling industry would be £10 million with recurring annual costs of £4-5 million.

(b) Plant bakeries

95. The Scottish Association of Master Bakers (SAMB) represents three plants on six sites with 350 employees but the majority of plant bakers are members of the Federation of Bakers (FoB).

96. The FoB returned a series of questionnaires which indicated that there were 58 sites employing 17,000 people. There was a wide variation in the estimates of the percentage of employees exposed to flour. These ranged from 5% to 80%. We have assumed that about 10,000 (59%) of these employees are exposed.

97. Some FoB members made the point that modified ingredients, such as the use of liquid improvers would make significant differences to exposure if a MEL were

set at a low figure. High risk activities were considered to be weighing, mixing, bag tipping and sieving where done, hand dusting and maintenance.

98. The common costs for a MEL set at any of the three levels are as follows:

Flour dust monitoring

99. A large company has looked at the potential costs of external dust control monitoring. They estimate costs at £1,000 a day and assume that the survey takes between 2 and 5 days depending on the size of the site. This is in line with our estimates that an initial survey would cost between £2,200 and £2,700 for a large site. For 58 sites, the cost of initial monitoring will be between $58 \times £2,200$ and $58 \times £2,700 = £127,600$ to $£156,600$.

100. For a MEL of 1 mg.m^{-3} , we have assumed that there will be a need to monitor at every site on an annual basis at a cost of between £127,600 and £156,600.

101. For a MEL set at 5 mg.m^{-3} , there will be the same initial cost but assuming that 46% (the proportion of exposures above 5 mg.m^{-3} in Table 2) of sites will need to continue to monitor, the annual cost will be between £58,700 and £72,000

102. For a MEL of 10 mg.m^{-3} , there will be the same initial cost and we have assumed that about 25% of the sites will still need to monitor following their revised risk assessment. This is based on the fact that 25% of all high risk exposures (Table 2) are currently above this level. The annual cost will then be between £32,000 and £39,000

Health surveillance

103. A large company in this sector has estimated health surveillance costs at £25 for an initial screening and the same cost again at 6 weeks and 6 months. Assuming a referral to a doctor (cost £60), at a rate of 7% of the number screened, produces a cost of £13. It also assumes a 20% turnover of labour.

104. We assume a more limited schedule of one annual screen per year. 10,000 exposed employees means an annual bill of $10,000 \times £35 = £350,000$. However, as discussed earlier, these costs are not included in the RIA for the reasons given.

Training and supervision costs

105. For 10,000 employees, training costs are likely to be $£140 \times 10,000 = £1.4$ million in the first year and $(£70 \times 10,000) + (20\% \text{ of } 10,000 \times £140) = £980,000$ in subsequent years.

Control costs

106. We have assumed that training and supervision of work practices, costed above, will reduce flour exposure. Significant expenditure on LEV for high risk activities has already been made by the plant bakers.

(i) For a MEL of 10 mg.m⁻³.

107. The FoB states that the industry is committed to reducing exposure levels to 10 mg.m⁻³ and “by and large” it is achieving this figure. We believe that there will be small extra control costs to ensure compliance with a MEL set at this figure. These will be an extension of the use of vacuum cleaners and some further use of RPE for short duration tasks.

108. Assuming an extra 12.5% (that is 50% of those current exposures above 10mg.m⁻³ =1,250) of employees will need to use RPE for some short term tasks, the cost will be between 1,250 x £300 = £375,000 and 1,250 x £850 = £1.06 million annually.

109. An increased use of vacuum cleaners on 20% of the sites would cost (20% of 58 sites) x £1,000 = £17,000.

110. Total initial control costs, for a MEL set at 10 mg.m⁻³, would be between £392,000 and £1.08 million with annual costs thereafter of between £375,000 and £1.06 million.

(ii) For a MEL of 5 mg.m⁻³.

111. At this level, some companies believe that they will need to bring in extra dust control systems. We have assumed between 40% and 50% of the sites will need to spend an extra average of £50,000 on LEV and dust booths. This is based on the fact that 46% of current values in high-dust activities are above this value. This amounts to an initial cost of between 23.4 (40% of 58) x £50,000 = £1.17 million and 29 x £50,000 = £1.45 million with recurring maintenance costs of 10%, that is between £117,000 and £145,000.

112. At this level it is likely that an extra 23% (50% of the high-activity values) of the employees will need to use RPE for short duration tasks. This extra cost will amount to between 2,300 x £300 = £690,000 and 2,300 x £850 = £1.955 million annually.

113. Total initial control costs, for a MEL set at 5 mg.m⁻³, would be therefore be between £1.877 million and £2.1 million with annual costs thereafter of between £807,000 and £2.1 million. By comparison, FoB from members' figures, calculated initial costs to be over £1.1 million for compliance with a MEL of 5mg.m⁻³.

(iii) For a MEL of 1 mg.m⁻³.

114. We have little doubt that all companies would need to upgrade their dust extraction for a MEL set at this level.

115. We have assumed that bag emptying booths will need upgrading at many sites. Assuming an extra station per site the cost would be 58 x £30,000 = £1.74 million with an annual maintenance cost of £174,000.

116. Hand sprinkling of products will require increased RPE usage as will cleaning operations. In fact, virtually all employees would need to use RPE for short periods

at some stage of the day. We assume that this would involve an extra 50% of the employees (5,000), assuming that 50% already use RPE at some stage, costing between $5,000 \times \pounds 300 = \pounds 1.5$ million and $5,000 \times \pounds 850 = \pounds 4.25$ million annually.

117. Extraction, on a plant bakery line, which can recycle flour sprinkled during the progress of the dough piece would also be required. This can cost between $\pounds 60,000$ and $\pounds 80,000$ per line. We will assume only one line per site, because some lines already have this facility. This amounts to between $58 \times \pounds 60,000 = \pounds 3.48$ million and $58 \times \pounds 80,000 = \pounds 4.64$ million, with maintenance costs (10%) of between $\pounds 348,000$ and $\pounds 464,000$ annually.

118. Total initial control costs for a MEL set at 1 mg.m^{-3} , would therefore be between $\pounds 6.74$ million and $\pounds 10.65$ million, with annual costs thereafter of between $\pounds 2.02$ million and $\pounds 4.9$ million.

119. Overall costs for a MEL set at various levels are summarised in Table 4.

Table 4 : Initial costs and running costs for plant bakeries to comply with a MEL set at different levels. (Costs of controls given in 000's of pounds, except for the total ten year costs which have been rounded and given in millions. Initial costs are given in Roman, running costs are italicised, in brackets).

Operation	Cost for MEL of 10 mg.m^{-3}	Cost for MEL of 5 mg.m^{-3}	Cost for MEL of 1 mg.m^{-3}
Health surveillance	-	-	-
Dust monitoring	127.6 - 156.6 <i>(32 - 39)</i>	127.6 - 156.6 <i>(58 - 72)</i>	127.6 - 156.6 <i>(127.6 - 156.6)</i>
Training and supervision	1,400 <i>(980)</i>	1,400 <i>(980)</i>	1,400 <i>(980)</i>
Controls	392 - 1,079.5 <i>(375 - 1,062.5)</i>	1,877 - 3,422 <i>(807 - 2,100)</i>	6,737 - 10,647 <i>(2,022 - 4,888)</i>
Ten year costs (present value, £ million, rounded)	£12.7m- £18.9 m	£17.8m- £29.6 m	£32.7m- £59.2 m

120. By comparison, the FoB (from members' figures), calculated initial costs around $\pounds 1.0$ million to comply with a MEL of 10 mg.m^{-3} . The FoB anticipated members' costs to be about $\pounds 2.3$ million initially.

(c) Craft bakeries

121. SAMB represents about 300 bakeries in Scotland who employ 9,000 bakers. The National Association of Master Bakers (NAMB) represents 1300 craft bakers and about 80 small plant bakers with a total of 16,000 employees. The small plant bakers represented by NAMB are included in this classification for ease of

calculation as is another large group of bakers representing 60 bakeries and 3,750 employees. This means that the total for this category is 1,760 sites and 28,750 employees of which between half and three quarters are exposed to flour dust. We estimate that about 20,000 employees in this group will be exposed to flour dust. This may be an underestimate, since some craft bakers are not represented by NAMB and, thus, we have no information on their size and number of employees exposed to flour dust.

122. We have received a lot of useful information from NAMB about the size and complexity of companies in this sector and this had been gratefully drawn on in the compilation of these figures.

123. The common costs for a MEL set at any of the three levels are as follows:

Flour dust monitoring

124. Most of the craft bakers will be small companies and some will be very small. If a MEL was set at 1 mg.m^{-3} , it is inevitable that monitoring would be required for all of them. We have assumed that, from figures supplied by NAMB and SAMB, 70% of the sites (1,232) which have fewer than 10 employees and are therefore assumed for these calculations to be 'small'. 20% of the sites (352) have between 10 and 30 employees and are assumed to be 'medium' sized. The remaining 10% of the sites (176) are in the 'large' category.

125. The initial costs for monitoring would therefore be $1,232 \times (\text{£}700 - \text{£}800) + 352 \times (\text{£}1,100 - \text{£}1,300) + 176 \times (\text{£}2,200 - \text{£}2,700) =$ between $\text{£}1.64$ million and $\text{£}1.82$ million. This is very much a theoretical cost as we believe it is unlikely that all sites will or will need to monitor. It should be possible for many sites to "read across" from similar sized firms with a similar structure and assume a similar exposure. This would reduce the initial monitoring costs considerably.

126. For a MEL set at 10 mg.m^{-3} , with work practices altered and substitution as suggested earlier, it is likely that only some of the sites would require annual monitoring following revised risk assessment. We have assumed that 20% of the sites, that is the proportion of current exposures above this level (from Table 2), will need to monitor on an annual basis. This means that the annual costs will then be between $\text{£}327,400$ and $\text{£}363,600$.

127. For a MEL set at 5 mg.m^{-3} , it is likely that, following the initial monitoring and changes in work practices covered under training and supervision, annual monitoring would only be required at some sites. We have assumed that 43% (from Table 2, the proportion of values currently above 5 mg.m^{-3}) of the sites, that is 757, will need this annual monitoring. This would cost between $\text{£}703,000$ and $\text{£}782,000$ annually.

128. If a MEL was set at 1 mg.m^{-3} , we have assumed that annual monitoring would be necessary at all sites, at a similar cost to the initial monitoring.

Health surveillance

129. At present, there is very little health surveillance done at any craft bakeries. It is likely that the costs of health surveillance would be around 20,000 (employees exposed) x £35 = £700k annually. As explained previously, these costs are not included in the RIA.

Training and supervision costs

130. It is particularly important in craft bakeries that work practices are optimal to reduce exposure because of the often restricted room available. There is a tradition of using flour in an extravagant manner and this is responsible for some of the very high exposures seen in the past. Some of the training costs will be recouped in savings on flour usage and reduced cleaning.

131. Training costs are likely to be £140 x 20,000 = £2.8 million in the first year and (£70 x 20,000) + (20% of 20,000 x £140) = £1.96 million in subsequent years.

Control costs

132. We have assumed that training and supervision, costed above, will reduce flour dust exposure dramatically. We have also assumed that substitution of flour for vegetable oil is made where possible.

(i) For a MEL of 10 mg.m⁻³.

133. We have assumed, and NAMB agrees, that for a MEL set at this level, as long as work practices are monitored, there will be no need for any extra bag emptying booths.

134. However, for bag emptying and sieving, there will be a need for the use of RPE at these short-duration tasks. We can assume that an extra 20% (the proportion of current exposures above this level) of the total number of employees (4,000) will need to be involved in RPE usage and will produce an annual costing of between 4,000 x £300 and 4,000 x £850 = £1.2 million and £3.4 million.

135. All sites will require a mixer lid that is either solid or has a hatch that can be raised for inspection. This could cost between £50 and £150 making the total costs between 1,760 x £50 = £88,000 and 1,760 x £150 = £264,000. (These are average figures. NAMB states that some mixers may not be capable of modification or covering without a tipping unit, and that spiral mixer lids may cost £500 to £1,000.)

136. We also assume that 50% (880) of the sites will need to buy an efficient vacuum cleaner at a total cost of £1,000 x 880 = £880,000. This assumes that currently 50% of the sites already have an adequate vacuum cleaner.

137. Although it could be argued that some of these potential costs should have been addressed before, the total extra control costs required for compliance with a MEL of 10mg.m⁻³ adds up to a total initial cost of between £2.2 million and £4.5 million with an annual cost thereafter of between approximately £1.2 million and £3.4

million. By comparison, NAMB calculated a cost of between £1.0 million and £2.5 million, but assumed that there would be no need for monitoring or extra LEV.

(ii) For a MEL of 5 mg.m⁻³.

138. As well as the costs associated with a MEL of 10 mg.m⁻³ there will be some extra costs required for a MEL set at 5 mg.m⁻³. A bag emptying booth will be required a proportion of sites. We have assumed that those sites with more than 30 employees (about 10% = 176 sites) will need to invest in this equipment at a cost of between 176 x £30k = £5.28 million, with annual maintenance costs of about £528,000. However, the smaller sites will still need an increased usage of RPE as calculated for the 10mg.m⁻³ MEL.

139. Flour sprinkling is the other main cause of exposure in craft bakeries. Work practices, the use of vegetable oil and the use of non-stick surfaces should reduce the need for flour sprinkling. In some of the large companies we estimate that extra automatic flour sprinklers will need to be introduced at a cost of 176 (10% of the total number of sites = all of the larger ones) x £5,000 = £880,000 and an annual maintenance cost of 10% = £88,000.

140. This adds up to a total initial control cost of between £8.4 million and £10.7 million, with an annual cost thereafter of between £1.8 million and £4.0 million. By comparison, NAMB calculated an initial cost of £3.13 million for a MEL set at this value, but were unsure of the possible need for LEV.

(iii) For a MEL of 1 mg.m⁻³.

141. If a MEL was set at this level we estimate that all sites would require a bag emptying booth. Assuming 5% of the sites already have this facility, the costs would be 1,672 (95% of 1,760) x £30,000 = £50.16 million, with maintenance costs of 1,672 x £3k = £5.0 million.

142. All sites would need an average of one automatic flour sprinkler at a cost of 1,760 x £5,000 = £8.8 million, with maintenance costs of 10% = £880,000. All the costs associated with the higher MELs, such as vacuum cleaners and mixer lids would also be required.

143. We also believe that extra staff involved would have to use RPE for some short duration activities. The bag emptying booth will obviate the need for some RPE usage but there would still be a proportion of other short duration activities where RPE will be needed. We have assumed that an extra 70% of the employees will be involved. This is likely to be the smaller companies (fewer than 10 employees) where large extraction equipment is problematical. This would cost between 14,000 x £300 = £4.2 million and 14,000 x £850 = £11.9 million. We have to assume the full costs will still apply even though only it will be necessary for only a small proportion of the time.

144. This adds up to a total initial control cost of between £64.1 million and £72.0 million with an annual cost thereafter of between £10.1 million and £17.8 million. Faced with these sort of costs a lot of small bakers would probably close.

145. Overall costs for a MEL set at various levels are summarised in Table 5. “Read across” possibility for firms of similar complexity, only 10% of sites need to monitor initially. Running costs will therefore be reduced also.

Table 5 : Initial costs and running costs for craft bakeries to comply with a MEL set at different levels (Costs of controls given in 000’s of pounds, except for the total ten year costs which have been rounded and given in millions. Initial costs are given in Roman, running costs are italicised, in brackets)

Operation	Cost for MEL of 10 mg.m ⁻³	Cost for MEL of 5 mg.m ⁻³	Cost for MEL of 1 mg.m ⁻³
Health surveillance	-	-	-
Dust monitoring	1,636.8 - 1,818 <i>(327.4 - 363.6)</i>	1,636 - 1,818 <i>(703 - 782)</i>	1,636 - 1,818 <i>(1,636 - 1,818)</i>
Dust monitoring (with “read across”)	164 - 182 <i>(164 - 182)</i>	164 - 182 <i>(164 - 182)</i>	1,636 - 1,818 <i>(1,636 - 1,818)</i>
Training and supervision	2,800 <i>(1,960)</i>	2,800 <i>(1,960)</i>	2,800 <i>(1,960)</i>
Controls	2,168 - 4,544 <i>(1,200 - 3,400)</i>	8,328 - 10,704 <i>(1,816 - 4,016)</i>	64,128 - 72,004 <i>(10,096 - 17,796)</i>
Ten year costs based on full initial monitoring (present value, £ million, rounded)	£33.8m - £53.8m	£47.7m - £68.1m	£175.4m- £225.9m

146. NAMB’s initial figures from its members suggested that the initial costs of compliance for a MEL set at 10 mg.m⁻³ would be between £1.0 million and £2.5 million. In their view a MEL set at 5mg.m⁻³ would cost well in excess of £4.0 million. NAMB did not give a final costing for a MEL set at 1 mg.m⁻³, but it was sure that it would be in excess of £20 million initially.

(d) In-store Bakeries

147. This is a sector that is increasing steadily. Five supermarket groups run in-store bakeries that bake from scratch. Bake-off premises have been disregarded as the potential for flour dust exposure is negligible. There were about 1,400 in-store scratch bakeries of this kind, employing about 10,000 people exposed to flour dust.

148. The common costs for a MEL set at any of the three levels are as follows:

Flour dust monitoring

149. For 1,400 sites the initial monitoring costs could theoretically be based on a cost per site of between £700 and £800. However, many of these bakeries are run, within a supermarket group, in a very similar manner with a similar layout. We believe that monitoring would only be required initially in a representative sample of about 10%. This percentage will vary depending on the diversity of the group's in-store bakeries. This initial monitoring cost would be between $140 \times £700$ and $140 \times £800 =$ between £98,000 and £112,000.

150. For a MEL of 10 mg.m^{-3} , monitoring should be required, following a risk assessment in only a few stores, given that the required changes are implemented. We have assumed that only 10 stores (2 per group) of the total number of stores would require monitoring annually. This would cost between £7,000 and £8,000 each year.

151. For a MEL of 5 mg.m^{-3} , monitoring should be required for more stores to demonstrate compliance. We have assumed that it will be necessary to monitor about 10% of the stores, unless there are major changes. This will cost between $140 \times £700$ and $140 \times £800$ annually which amounts to between £98,000 and £112,000 each year.

152. For a MEL of 1 mg.m^{-3} , we assume that monitoring will need to be repeated annually and we have to assume that all stores will need monitoring. This will cost between $1,400 \times £700$ and $1,400 \times £800 =$ £980,000 and £1.12 million annually.

Health surveillance

153. For 10,000 employees there will annual cost of $10,000 \times £35 =$ £350,000. As described earlier, this is not included in this RIA.

Training and supervision costs

154. For 10,000 employees, the first year cost would be $10,000 \times £140 =$ £1.4 million and thereafter the annual cost would be $(10,000 \times £70) + (2,000 \times £140) =$ £980,000.

Control costs

155. The use of vegetable oil instead of flour for dusting down of preparation tables is essential in all circumstances where it is possible. This sector has shown a greater willingness successfully trial this measure.

(i) For a MEL of 10 mg.m^{-3} .

156. Based on our interviews, a copy of a 1998 Occupational Hygiene survey of nine in-store bakeries in one group, and a 1999 HSL survey of one scratch bakers where flour dust was considered a potential problem, we have concluded that the only minor control costs would be required to comply with a MEL of 10 mg.m^{-3} . Substitution where possible could reduce these costs further.

157. Dry sweeping was identified as a very poor control measure and the provision of efficient vacuum cleaners is essential. In small cramped bakeries, wet cleaning may also be feasible. The extra cost of vacuum cleaners, in 50% of the stores would amount to $700 \times £1,000 = £700,000$. Substitution of flour where possible would reduce cleaning costs with no added expenditure.

158. During tipping and mixing of ingredients, as well as better work practices and supervision and training to ensure this, there will be a need for the use of some extra RPE for the short periods during which exposure may be higher. Assuming there are an extra 1,000 (10%) employees involved, this will cost between $1,000 \times £300 = £300,000$ and $1,000 \times £850 = £850,000$ annually. This cost is precautionary and may not be required if suitable work practices and substitution are introduced.

159. This adds up to a total control cost of between £1.0 million and £1.55 million, with an annual cost of between £300,000 and £850,000.

(ii) For a MEL of 5 mg.m^{-3} .

160. We believe that the only extra controls required for a MEL set at 5 mg.m^{-3} , over and above the changes in work practices already and the controls recommended for a MEL of 10 mg.m^{-3} , will be the use solid lids for mixers and the use of flour dispensers where dough brakes are used. The wearing of RPE at some short-term tasks like confectionery custard mixing will also be required.

161. Assuming 50% of stores (700) need solid or hinged lids for mixers, the cost will be between $700 \times £50 = £35,000$ and $700 \times £150 = £105,000$. We have also received an estimate for the cost of a replacement lid at between £375 and £420 although it is dependent on the size of the mixer.

162. The cost of 140 (10% of sites) flour dispensers would be about $140 \times £5,000 = £700,000$ with annual maintenance costs of £70,000

163. Assuming that an extra 20% of employees need RPE for short term tasks the cost will be between $2,000 \times £300 = £600,000$ and $2,000 \times £850 = £1.7 \text{ million}$ annually.

164. This adds up to a total initial control cost of between £2.0 million and £3.2 million, with an annual cost thereafter of between £670,000 and £1.8 million.

(iii) For a MEL of 1 mg.m^{-3} .

165. There will be major costs associated with a MEL set at this level. The tipping, weighing and mixing areas will need to be within an extracted booth. Any flour addition to the pastry or dough will require extraction. although it is difficult to be precise about these costs, we estimate that the extra costs above those already calculated for a MEL set at 5 mg.m^{-3} , would be:

(i) Each site would require a bag emptying booth costing between an initial $1,400 \times £20,000 = £28 \text{ million}$ and $1,400 \times £40,000 = £56 \text{ million}$ with running costs of between £2.8 million and £5.6 million annually.

(ii) Assuming the need for automatic flour sprinklers to be installed in 50% of the sites, the cost would be 700 x £5k = £3.500 million, with running costs of 10% (£350,000).

(iii) It is likely that an extra 50% of staff would require RPE for some short term tasks. This is based on the distribution of tasks within the bakery and would cost between 5,000 x £300 = £1.5 million and 5,000 x £850 = £4.25 million annually.

166. This adds up to a total initial cost of between £35 million and £64 million, with an annual cost thereafter of between £4.6 million and £10.0 million.

167. Overall costs for a MEL set at various levels are summarised in Table 6.

Table 6 : Initial costs and running costs for in-store bakeries to comply with a MEL set at different levels. (Costs of controls given in 000's of pounds, except for the total ten year costs which have been rounded and given in millions. Initial costs are given in Roman, running costs are italicised, in brackets)

Operation	Cost for MEL of 10 mg.m⁻³	Cost for MEL of 5 mg.m⁻³	Cost for MEL of 1 mg.m⁻³
Health surveillance	-	-	-
Dust monitoring	98 - 112 <i>(7 - 8)</i>	98 - 112 <i>(98 - 112)</i>	980 - 1,120 <i>(980 - 1,120)</i>
Training and supervision	1,400 <i>(980)</i>	1,400 <i>(980)</i>	1,400 <i>(980)</i>
Controls	1,000 - 1,550 <i>(300 - 850)</i>	2,035 - 3,205 <i>(670 - 1,770)</i>	35,000 - 63,750 <i>(4,650 - 10,000)</i>
Ten year costs (present value, £ million, rounded)	£12.5m - £17.4m	£17.2m - £27.1m	£89.0m - £160.7m

(e) Other Bakeries

168. Large scale pizza producers are included in this sector. An HSL sampling visit to a major dough ball producer showed flour dust levels to be of concern (Table 1) but exposure was restricted to weighing and mixing. Changes in work practice were likely to reduce exposure considerably. Minor alterations to the mixing/weighing set up would also reduce exposure, and it was thought that a MEL set at 5 mg.m⁻³ or at 10 mg.m⁻³ could be easily complied with following these changes. A MEL set at 1 mg.m⁻³ would be much more difficult to achieve without major alterations.

169. Pizza outlets which produce pizzas from scratch, and pasta restaurants, are also included in this sector. It is very difficult to assess costs in this sector because of the wide variation in size of site and practices. Information from the Pasta and Pizza Association leads us to believe that there may be about 4,000 outlets and a

total of about 20,000 employees exposed to flour dust. Much of this exposure is sporadic and we have no information about likely levels of exposure.

170. The common costs for a MEL set at any of the three levels are as follows:

Flour dust monitoring

171. In the absence of more definitive information, we believe that initial monitoring costs would be between 4,000 (number of sites) x £700 = £2.8 million and 4,000 x £800 = £3.2 million.

172. In subsequent years, the need for monitoring would depend on the risk assessment findings which will vary with the controls installed and the changes in work practices. We have assumed that exposures will be similar to a less intensive craft bakery. Where appropriate, we have taken 50% of the corresponding figure for a craft bakery.

173. Assuming that work practices have changed in line with those recommended, it is likely that for a MEL set at 10mg.m^{-3} , there would be a need for monitoring at only a small proportion of sites. Based on the figures for craft bakeries, we have assumed that 10% (50% of the figure for craft bakeries) of sites will need to continue monitoring, costing between $400 \times £700 = £280,000$ and $400 \times £800 = £320,000$.

174. For a MEL set at 5mg.m^{-3} , we have made the assumption that 21.5% (50% of the figure for craft bakeries) of sites will need to continue to monitor. This will cost between $860 \times £700 = £602,000$ and $860 \times £800 = £688,000$ annually.

175. For a MEL set at 1mg.m^{-3} , we have assumed that all sites will need to continue annual monitoring. This will cost between $4,000 \times £700 = £2.8$ million and $4,000 \times £800 = £3.2$ million annually.

Health surveillance

176. There is a potential cost of $20,000 \times £35 = £700,000$ annually if everyone was given a basic screen. As described earlier, this cost is not included in the RIA.

Training and supervision costs

177. Assuming a potentially exposed population of 20,000 the initial cost would be $20,000 \times £140 = £2.8$ million with annual costs thereafter of $(20,000 \times £70) + 4,000 \times £140 = £1.96$ million.

Control costs

178. We assume that training and supervision will reduce exposures considerably.

(i) For a MEL of 10mg.m^{-3} .

179. In the absence of more definite information, we assume that there would be no extra costs for a MEL set at this level apart from an increased use of vacuum

cleaners. We have assumed that 50% of the sites would need to one at a cost of $2,000 \times \text{£}1,000 = \text{£}2.0$ million.

(ii) For a MEL of 5 mg/m^3 .

180. We assume that, for a MEL set at this level, as well as an increased use of vacuum cleaners, bag emptying booths would be required at a few larger sites. Based on the craft bakery sector, we have assumed that 50% of the proportion required for the craft bakery sector would be required for sites in this sector (5% of all sites). We have assumed that about half of these larger sites already have this facility (2.5%). The extra costs would be $100 \times \text{£}30\text{k} = \text{£}3.00$ million with running costs of $\text{£}300,000$. Total initial control costs would therefore be $\text{£}5.0$ million, with running costs of $\text{£}300,000$ annually.

(iii) For a MEL of 1 mg.m^{-3} .

181. Although to a lesser extent than with the craft bakeries, there is likely to be a considerable increase in costs to comply with a MEL set at this level. As well as the costs associated with the MEL set at the higher levels there would be many extra costs. Bag emptying booths would be required for all the larger concerns. We have included an extra 20% of the sites in this category, costing $400 \times \text{£}30,000 = \text{£}12.0$ million, with running costs of $\text{£}1.2$ million each year.

182. We assume that there would be a much increased need for RPE usage for some short term tasks like bag emptying in the rest of the sites. If an extra 50% of the total exposed population would need to use RPE for some short term tasks, the annual costs will be between $10,000 \times \text{£}300 = \text{£}3.0$ million and $10,000 \times \text{£}850 = \text{£}8.5$ million.

183. This adds up to a total initial control cost of between $\text{£}17.0$ million and $\text{£}22.5$ million, with an annual cost of between $\text{£}4.2$ million and $\text{£}9.7$ million.

184. Overall costs for a MEL set at various levels are summarised in Table 7.

Table 7 : Initial costs and running costs for “Other bakeries” sector to comply with a MEL set at different levels. (Costs of controls given in 000’s of pounds, except for the total ten year costs which have been rounded and given in millions. Initial costs are given in Roman, running costs are italicised, in brackets)

Operation□	Cost for MEL of 10 mg/m ³	Cost for MEL of 5 mg/m ³	Cost for MEL of 1 mg/m ³
Health surveillance	-	-	-
Dust monitoring	2,800 - 3,200 <i>(280 - 320)</i>	2,800 - 3,200 <i>(602 - 688)</i>	2,800 - 3,200 <i>(2,800 - 3,200)</i>
Training and supervision	2,800 <i>(1960)</i>	2,800 <i>(1960)</i>	2,800 <i>(1,960)</i>
Controls	2,000 <i>(-)</i>	5,000 <i>(300)</i>	17,000 - 22,500 <i>(4,200 - 9,700)</i>
Ten year costs (present value, £ million, rounded)	£25.1m- £25.8m	£32.9m- £34.0m	£92.5m- £144.3m

(f) Large scale cake bakeries

185. SAMB represents one large-scale cake bakery and 6 biscuit manufacturers. The Biscuit, Cake, Chocolate and Confectionery Alliance (BCCCA) represents 8 companies on 16 sites. The total number of sites is 23, and the total number of employees affected will be 3,400.

186. The common costs for a MEL set at any of the three levels are as follows:

Flour dust monitoring

187. For 23 sites, we estimate that initial monitoring costs (based on 50% of the sites being large and 50% of the sites being of medium size and evidence that possibly 3 sites already monitor) would be 10 x between £1,100 and £1,300 + 10 x between £2,200 and £2,700 = between £33,000 and £40,000.

188. For a MEL of 10 mg.m⁻³, we have assumed that, based on the plant bakery data in Table 2, 20% of the sites need to continue to monitor annually. This is 25% of 20 (three already monitoring) = 5 sites. The total cost would be between £7,700 and £10,700 annually. However, one company in the sector estimated that the cost of an extra external dust monitoring exercise would be as much as £8,000.

189. For a MEL set at 5 mg.m⁻³, from the plant bakery data in Table 2, we have assumed that 46% of the 20 sites not already monitoring would have to do so

annually - a total of 9 sites. This would cost between $4.5 \times £700 + 4.5 \times £2,200 = £13,100$ and $4.5 \times £800 + 4.5 \times £2,700 = £15,800$ annually.

190. For a MEL set at 1 mg.m^{-3} , we have assumed that all sites would need to monitor annually, so the total cost would be between £33,000 and £40,000 annually.

Health surveillance

191. Our estimate is that for 3,400 employees, there would be a cost for health surveillance of $3,400 \times £35 = £119,000$ annually for any MEL that was set. One company, employing over 300 people exposed to flour dust, estimated that their health surveillance costs for 1998 were £17,000. This works out at about £50 per employee. Again, as in other sections this potential cost is not included in the RIA.

Training and Supervision

192. We estimate that for 3,400 employees, the cost in the first year would be $3,400 \times £140 = £476,000$, and $(3,400 \times £70) + 680 \times £140 = £333,000$ annually.

Control costs

193. It is assumed that training and supervision will reduce flour dust exposure. There are a wide range of products produced in this sector and the range is being steadily widened. This means that there is more use of specialist flours and a greater need for bag opening rather than silo usage.

(i) For a MEL of 10 mg.m^{-3} .

194. We have assumed the need for a bag emptying booth at every site. This would cost $23 \times £30\text{k} = £690,000$ with annual running costs of £69,000. An extra vacuum cleaner at every site would cost $23 \times £1,000 = £23,000$.

195. Using information from one of the larger companies, which seems to be typical for the sector, we have assumed that RPE usage will increase for some short-term tasks. We have assumed that, again based on the plant bakery figures in table 2, this will involve an extra 12.5% of the workforce (assuming 25% are involved but half of them are already using RPE) and will cost between $425 \times £300 = £127,500$ and $425 \times £850 = £361,250$ annually.

196. This adds up to a total initial control cost of between £840,500 and £1.1 million with an annual cost thereafter of between £196,500 and £430,250.

(ii) For a MEL of 5 mg.m^{-3} .

197. As well as the costs associated with a MEL of 10 mg.m^{-3} , we have assumed an extra usage of RPE for short-term tasks. If an extra 46% (from Table 2) of the work force now require RPE, the cost, allowing for the 12.5% already assumed to be using RPE, will be between $1,139 \times £300 = £342,000$ and $1,139 \times £850 = £968,000$ annually.

198. This adds up to a total initial cost of between £1.03 million and £1.66 million with an annual cost of between £411,000 and £1.04 million.

(iii) For a MEL of 1 mg.m⁻³.

199. At a MEL of this level, our “typical” company estimated that there would need to be major rebuilding because of the “open plan” nature of the site. This would be to reduce background flour dust levels following any leakage from the enclosed systems. Based on this information, we have assumed that partitioning and rebuilding would amount to about £500,000 per site. This would total 23 x £500,000 = £11.5 million as a capital cost.

200. There would also be a need for all employees to use RPE for short intervals. This would cost between 2,975 x £300 = £890,500 and 2,975 x £850 = £2.6 million annually, assuming that we allow for our supposed present usage.

201. This adds up to a total initial control cost of between £12.4 million and £14.0 million, with an annual cost of between £890,000 and £2.6 million.

202. Overall costs for a MEL set at various levels are summarised in Table 8.

Table 8 : Initial costs and running costs for the large scale cake bakeries sector to comply with a MEL set at different levels. (Costs of controls given in 000’s of pounds, except for the total ten year costs which have been rounded and given in millions. Initial costs are given in Roman, running costs are italicised, in brackets)

Operation	Cost for MEL of 10 mg.m ⁻³	Cost for MEL of 5 mg.m ⁻³	Cost for MEL of 1 mg.m ⁻³
Health surveillance	-	-	-
Dust monitoring	33 - 40 <i>(7.7 - 10.7)</i>	33 - 40 <i>(13.1 - 15.8)</i>	33 - 40 <i>(33 -40)</i>
Training and supervision	476 <i>(333)</i>	476 <i>(333)</i>	476 <i>(333)</i>
Controls	840.5 - 1,074.25 <i>(196.5 - 430.25)</i>	1,032 - 1,658 <i>(411 - 1,037)</i>	12,392.5 - 14,028.75 <i>(892.5 - 2,528.75)</i>
Ten year costs (present value, £ million, rounded)	£5.6m- £7.6m	£7.4m- £13.0m	£22.7m- £37.2m

(g) Other wheat flour establishments

203. ABIM has suggested that it has about 18 member companies on about 20 sites with about 600 employees potentially exposed to flour dust. This trade

association, formerly known as BATA, has supplied us with useful information on possible exposures to flour dust.

204. The common costs for a MEL set at any of the three levels are as follows:

Flour dust monitoring

205. Because of the relatively lower potential exposures, it is assumed that monitoring will not be needed if a MEL is set at 10mg.m^{-3} .

206. If a MEL is set at 5 mg.m^{-3} , we assume that an initial monitoring will be required to judge compliance but we do not anticipate annual monitoring being necessary unless unexpected problems are revealed by the subsequent risk assessment. The initial monitoring would cost between $20 \times 1,100 = \text{£}22,000$ and $20 \times \text{£}1,300 = \text{£}26,000$, based on medium sized companies.

207. For a MEL of 1 mg.m^{-3} , we assume that annual monitoring costing between $\text{£}22,000$ and $\text{£}26,000$ will be required.

Health surveillance

208. For 600 employees the annual cost will be $600 \times \text{£}35 = \text{£}21,000$. This cost is not included in the RIA, for reasons explained earlier.

Training and supervision costs

209. It is assumed that 600 employees will be involved and the annual cost will be $600 \times \text{£}140 = \text{£}84,000$ initially and $(600 \times \text{£}70) + (120 \times \text{£}140) = \text{£}59,000$ per year thereafter.

Control costs

210. It is assumed that training and supervision (costed above) will reduce flour dust exposure significantly.

(i) For a MEL of 10 mg.m^{-3} .

211. Flour dust exposures above 10 mg.m^{-3} are rare for companies in ABIM and when these levels occur, the dust is often of a starchy nature and less likely to be of a respirable size. We have assumed that there will be no extra control costs for a MEL set at this level over and above the extra and supervision in work practices and the use of an extra vacuum cleaner on each site costing $20 \times \text{£}1,000 = \text{£}20,000$.

(ii) For a MEL of 5 mg/m^3 .

212. Extra LEV at some mixing and bagging plants is likely to be required. For 20 sites we have assumed a unit cost of $\text{£}20,000$ with annual maintenance costs of $\text{£}2,000$ suggesting an initial cost of $\text{£}400,000$, and $\text{£}40,000$ annual maintenance costs. Extra vacuum cleaners at all sites will cost $20 \times \text{£}1,000 = \text{£}20,000$.

213. This means that the total initial control cost of complying with a MEL of 5 mg.m⁻³ will be between £420,000, with annual costs thereafter of between £40,000.

(iii) For a MEL of 1 mg.m⁻³.

214. We believe there would be major costs if a MEL was set at this level. Based on information from the industry we have assumed that the cost of extra dust extraction would be between £50,000 and £100,000 per site, making a total cost of between 20 x £50,000 = £1.0 million and 20 x £100,000 = £2.0 million, with running cost (10%) amounting to between £100,000 and £200,000.

215. Annual RPE costs for all employees during some of the day would amount to between 600 x £300 = £180,000 and 600 x £850 = £510,000

216. This means that the total initial control cost of complying with a MEL of 1 mg.m⁻³ will be between £1.2 million and £2.5 million, with annual costs of between £280,000 and £710,000.

217. Overall costs for a MEL set at various levels are summarised in Table 9.

Table 9 : Initial costs and running costs for other wheat flour establishments to comply with a MEL set at different levels. (Costs of controls given in 000's of pounds, except for the total ten year costs which have been rounded and given in millions. Initial costs are given in Roman, running costs are italicised, in brackets)

Operation	Cost for MEL of 10 mg.m⁻³	Cost for MEL of 5 mg.m⁻³	Cost for MEL of 1 mg.m⁻³
Health surveillance	-	-	-
Dust monitoring	-	22 - 26 (-)	22 - 26 (22 -26)
Training and supervision	84 (59)	84 (59)	84 (59)
Controls	20 (-)	420 (40)	1,180 - 2,510 (280 - 710)
Ten year costs (present value, £ million, rounded)	£0.53m	£1.3m	£4.1m- £8.8m

(h) Non-wheat flour establishments

218. No information is available. Costs are assumed to be included in other sectors elsewhere.

(i) General food processing

219. The mixing of dry powders is potentially a very dusty operation and one large company visited has a full RPE programme in place and has plans to install dust extraction for its three mixers at a cost of £100k.

220. Two companies, who are members of BMMA, have suggested that there would significant costs involved in complying with a MEL of 10mg.m^{-3} . A MEL of 5mg.m^{-3} would be very costly and a MEL set at 1mg.m^{-3} would have such major cost implications that it would “make it a no go area for the meat manufacturing industry”. The BMMA itself, has over 35 companies of various sizes and the number of employees exposed to flour could be high.

TOTAL COMPLIANCE COSTS

Table 10: Potential costs for industry sectors to comply with a MEL, for flour dust, set at various levels, present values over ten years.

Industry sector	Estimated number of exposed employees	Costs of MEL set at 10 mg.m⁻³ (£million)	Costs of MEL set at 5mg.m⁻³ (£million)	Costs of MEL set at 1mg.m⁻³ (£million)
Flour mills	4,000	£5.7m-£8.4m	£8.7m-£13.8m	£12.7m-£21.7m
Plant bakeries	10,000	£12.7m-£18.9 m	£17.8m-£29.6 m	£32.7m-£59.2 m
Craft bakeries	20,000	£33.8m-£53.8m	£47.7m-£68.1m	£175.4m-£225.9m
In-store bakeries	10,000	£12.5m to £17.4m	£17.2m-27.1m	£89.0m-£160.7m
Other bakeries	20,000	£25.1m-£25.8m	£32.9m-£34.0m	£92.5m-£144.3m
Large scale cake bakeries	3,400	£5.6m-£7.6m	£7.4m-£13.0m	£22.7m-£37.2m
Other wheat flour establishments	600	£0.53m	£1.3m	£4.1m-£8.8m
Non-wheat flour establishments	-	-	-	-
General food processing	Unknown	Unknown	Unknown	Unknown
Total present value (ten years, £m)	A minimum of 68,000	£96.0m-£132.4m	£133.0m-£186.7m	£429.0m-£676.0m

IMPACT ON SMALL AND MEDIUM SIZED BUSINESSES, "LITMUS TEST"

221. The National Association of Master Bakers is greatly concerned about the disproportionate cost to the small craft bakers.

222. The craft bakery sector contains many small businesses. Often they have a small turnover and occupy cramped premises. This means that if a degree of automation and extraction is required the cost is prohibitive. For a baker producing a couple of dozen loaves of bread daily and a mixture of speciality products, automation is hardly an option. Some bakeries operate from converted houses and the installation of LEV would create many problems as regards space, noise and

cleaning. Many small bakeries operate old mixers and modification would be difficult and expensive. The costings produced by HSE bear out this problem. There are many small sites and many employees who would be affected. In a traditional industry like craft baking, the smaller sites are often family businesses and there is little recognition of the potential harm from high exposure to flour dust. As a result, the costs of fully complying with a MEL for flour dust were always likely to be high. This has proved to be the case.

223. The costs of compliance could be reduced considerably if the industry were to adopt work practices already recommended. A greater willingness to substitute, for flour, where possible, would also reduce these potentially high costs.

224. Small family restaurants, especially those producing pasta-based foods, will also be affected by these proposed regulations. In these restaurants, pizzas are often made from the basic ingredients and constraints of space mean that flour dust exposure could be above the short term limits proposed.

225. The National Council for Voluntary Organisations was approached and asked for information on charities which could be affected by the proposed legislation. Seven charities were identified by this organisation as having the potential to be affected. All seven charities were contacted by phone and the possible consequences of the change in legislation were explained. The Charities Safety Group uses small quantities of flour and pay employees but total usage was less than 100 kg monthly and very little dusting down takes place. It is assumed that charitable organisations will not be adversely affected by the proposed flour dust MEL.

Costs to HSE

226. HSE's administrative, secretarial, inspectorial and scientific staff have been used for a variety of purposes. The total cost is difficult to quantify.

Other costs

227. Staff from the baking and other industries, particularly in the trade associations, have spent a lot of time and energy helping HSE in the reviewing of data and in compiling information. This is appreciated but the costs are difficult to quantify.

Total costs to society

228. The vast majority of the societal cost is borne by industry. This is detailed above.

ENVIRONMENTAL IMPACTS

229. There are no environmental impacts other than the health effects already discussed. The external environmental effects of diffusing flour dust by using local exhaust ventilation are negligible.

BALANCE OF COSTS AND BENEFITS

230. According to our figures, a MEL set at 1 mg.m^{-3} would cost well in excess of £150 million in the first year. The total cost of a MEL at this level is expected to be around £430 million to £680 million in present values over ten years. These figures inevitably reflect a number of uncertainties in them, but there is no doubt that a MEL set at this level would be extremely expensive for British industry.

231. MELs set at 5 mg.m^{-3} and 10 mg.m^{-3} would also be expensive, both initially and thereafter. The total cost of a MEL 10 mg.m^{-3} is expected to be at least £100 million in present values over ten years. However, there are a lot of work practice changes which could be introduced and the reduction in flour dust exposure as a result could be dramatic. It is difficult to quantify the likely reduction in flour dust exposure resulting but in some sectors we believe that this alone could be sufficient for compliance with a MEL set at 10 mg.m^{-3} . There will be some mitigation to these costs in that flour usage should be reduced and cleaning costs will be reduced as a consequence of changes in work practices.

232. The craft bakery sector has a large number of small companies and many sites. This means that the costs of monitoring and extra training and supervision are disproportionately large for this sector. There is also the problem of a large capital cost for extraction equipment on a company with a small turnover and cramped facilities. This will be exacerbated by a MEL set at 5 mg.m^{-3} rather than one set at 10 mg.m^{-3} .

233. By comparison, the total benefit in monetary terms, of eliminating all cases of occupational asthma and allergic rhinitis over the next ten years is estimated at between £47 million and £142 million in present terms. In addition, eliminating more minor illnesses could result in a benefit of around £25 million, but we have less evidence for this benefit. The Health and Safety Commission accepts that an unknown proportion of the benefits may relate to cases of occupational asthma caused by bread improver.

SUMMARY AND RECOMMENDATIONS

234. There will be a large cost associated with compliance with a MEL for flour dust set at any value. Changes in work practices could reduce flour dust exposures considerably but there will still be a cost to some industry sectors if a MEL for flour dust was to be set at either 5 mg.m^{-3} or 10 mg.m^{-3} .

235. If the MEL was set at 1 mg.m^{-3} , it is likely that the cost of compliance would be prohibitive for large sections of British industry. The costs to industry would be well in excess of £150 million pounds in the first year. The total cost of a MEL at this level is expected to be around £430 million to £680 million in present values over ten years.

236. The total cost of a MEL at 5 mg.m^{-3} is expected to be £133 million to £187 million in present values over ten years. This is also therefore expensive, both initially and thereafter. A MEL set at 5 mg.m^{-3} would affect the smaller companies in some of the sectors proportionately more than the larger companies.

237. The total cost of a MEL at 10 mg.m^{-3} is expected to be £96 million to £132 million in present values over ten years.

238. In the case of a MEL of 1 mg.m^{-3} or 5 mg.m^{-3} , costs are high seen against a total benefit, in monetary terms, of eliminating all cases of occupational asthma and allergic rhinitis over the next ten years. However, these benefits, estimated at between £47 million and £142 million in present terms (not counting unquantified benefits), do seem reasonable when compared with the costs of a MEL of 10 mg.m^{-3} . The Health and Safety Commission recognises that setting a MEL for flour dust will only achieve a proportion of these benefits. However, it is usual to err on the side of prevention when there is uncertainty concerning the estimate of both costs and benefits, especially when there is the possibility of considerable unquantified cost savings.

Uncertainties

239. There are many uncertainties in any estimate of compliance costs for a MEL. These uncertainties are increased where an industry has a variety of sectors and many small companies with a variety of activities.

240. We have not been able to fully examine the food processing sectors who have a range of activities using flour. The number of people exposed to flour dust has been difficult to determine, even with the active help of the trade associations.

241. We have been unable to cost accurately the savings in flour usage and cleaning costs associated with the improved work practices likely to result from the training recommended and costed for. The reductions in flour dust exposure following this training have inevitably been speculative but could be considerably more than assumed. It is also likely that the initial monitoring costs will be less than specified because of the possibility of “read across” from company to company, where appropriate.

242. Because of these uncertainties, the bottom line figures need to be understood in this context.

Results of consultations

243. HSC consulted publicly on a limit for flour dust for 3 months during 2000. Views were sought on the establishment of an 8-hour time-weighted average MEL set at 10 mg.m^{-3} , and on the establishment of a STEL (15-minute reference period) set at either 20 mg.m^{-3} , 30 mg.m^{-3} or somewhere between these two levels. As a result of the consultation, ACTS recommended, and HSC endorsed, a MEL set at 10 mg.m^{-3} and a STEL set at 30 mg.m^{-3} . These limits came into force in April 2001.

Arrangements for monitoring and evaluation

244. The MEL is enforced by HSE at the premises where it is the enforcing agency and by the Local Authority at premises where it is the enforcing authority. Because of the change to a MEL, there will be an increased emphasis on flour dust exposure at all premises. This may result in an increased workload for all inspectors

and an increase in prosecutions for health and safety offences for the sectors concerned.

Contact:

Richard Pedersen

Health and Safety Executive

Chemicals and Flammables Policy Division

International Chemicals Unit

7NW Rose Court, 2 Southwark Bridge, London SE1 9HS

Tel: 020 7717 6216

May 2004