

Shaping Industrial Health: the Debate on Asbestos Dust Hazards in the UK, 1928–39

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Introduction

IN THE LAST TWO DECADES, growing historiographical attention has been paid to the political, economic and social implications of scientific knowledge when dealing with occupational health. Medical expertise has come under scrutiny and the role of social and economic factors in reaching medical consensus has been submitted to analysis.¹ In contrast, much less attention has been paid to the influence of scientific arguments in conditioning public understanding of industrial health risks.² How and to what extent did scientific expertise shape communal understandings of the growing risks posed by industrial processes? How did the reductionist scientific approach to the workplace contribute to society's underestimation of such risks? These are but some of the questions that warrant further attention from historians. They seem to be particularly appropriate questions if we agree to interpret the debate on occupational health risks in industrial societies as the conversion of a social problem into the search for scientific evidence. The need for a properly established causal relationship between exposure and disease meant that the medical arena became the main stage for this debate, to the detriment of the political and social arenas.³ By gaining the power to define risks and evaluate the state of workers' health, medical experts strongly contributed to shaping public perceptions of industrial health.⁴ On the other hand, recent trends in the sociology

of scientific knowledge have addressed the 'decontextualised' nature of scientific knowledge and the process of public influence on it (which could be termed 'contextualisation').⁵ This feature is particularly evident when dealing with the workplace, where industrial medicine fostered a reductionist view of workers' health problems and progressively neglected to pay attention to the social conditions of work.⁶

Asbestos-related health issues in interwar Britain seem to be a suitable case for exploration. In this paper, I will discuss how medical experts shaped the perception of asbestos health hazards as being potentially controllable in the UK during the interwar years. This perception rested to a high degree on a narrow definition of asbestos-related health problems and on an increasing reliance on technological solutions. Both of these premises arose from the Merewether & Price Report, the scientific paper that formed the basis of Factory Department policy on the asbestos problem. I want to focus on this report, generally acknowledged to be the turning point in medical knowledge on asbestos exposure hazards. I will discuss factors that may explain the wide acceptance of the report: the fact that its authors were able to recast their findings as the outcome of experimental science and to conceptualise the asbestos issue as technologically controllable became determinant for its rapid acceptance. On the other hand, I will briefly explore the role played by the TUC in countering the restrictive image of the social and health problem constructed by medical and legal experts. Certainly, a better understanding of the public perception of the asbestos issue would have required study of oral history sources and workers' autobiographies, and exploration of the role played by the general and workers' press, materials that have not come under scrutiny in this work. My working hypothesis is that, generally speaking, the general press welcomed the technical approach, greeting any new device as a decisive step to overcome dust health risks. To what extent these arguments influenced public perception and workers' construction of asbestos health risks warrants further investigation.

The asbestos issue is a matter of historical controversy. Historians who have addressed this theme all agree that the recognition of asbestos as a health hazard was a late event in Britain. They also point out that the industrial code of regulations adopted in 1931 was negotiated between the Factory Department and leading asbestos manufacturers and ignored proposals from the unions. In their view, it was this spurious nature of the code's creation, shaped by political and economic considerations at the expense of the scientific evidence, that was responsible for its flaws and, eventually, for an underestimation of the asbestos health problem in the

UK during the interwar years. However, Peter Bartrip recently argued that most of this historical work is the fruit of hindsight, because asbestos dust was but one of the emerging health hazards at the time.⁷ This statement has fostered an increasing polarisation, with interpretations ranging from a 'misconduct and concealment' position – which blames employers, doctors and officials for the delay – to a 'pragmatic position' – which highlights how the measures adopted were in accordance with the state of the knowledge at the time.⁸ Both extremes overlook the social nature of scientific knowledge and the decisive role played by scientific expertise in achieving a social consensus on risk technologies such as asbestos. New insight on the subject could be gained by delving into the nature of scientific knowledge – particularly its reductionist approach to industrial health matters – and into the legitimisation that scientific arguments granted to Governmental intervention in the workplace. The decontextualised and restrictive image of the asbestos health problem depicted by medical experts and the subsequent technical intervention shaped the public perception of the asbestos issue as finite and controllable. This will be the framework of my exploration.

The Merewether & Price Report: a Camel Through the Eye of a Needle

THE MEREWETHER & PRICE REPORT was published in March 1930 and, as is well known, its scientific evidence provided the basis for legal and medical measures established in the UK.⁹ It was the main outcome of an inquiry undertaken in 1928 by Edward Merewether, a newcomer to medical factory inspection. The process leading to its setting up and preparation has received wide attention from historians.¹⁰ I would like to emphasise some design aspects of the survey that proved to be important for the comprehension of the asbestos health problem. Research requirements – namely the need to establish a causal relationship between exposure and disease – forged a very restrictive perception of the health risks posed by asbestos. First, this approach focused on the dangers of specific activities or production processes rather than on the harmful nature of asbestos itself and its effects on workers' health, so that any activity was healthy or nonhazardous until scientific evidence proved otherwise. Second, neither social conditions of work, workforce practices, nor the characteristics of factories, some of which had a major impact on workers' health, came under scrutiny. From this point of view, Merewether did not only reproduce the traditional biases of the medical approach to the workplace but also

created the illusion of a genuinely scientific description of the health problem by clothing his study in experimentalism and treating the factory as a laboratory.

Morris Greenberg, himself a former Medical Inspector, has pointed to the body of scientific evidence already available to the Factory Department before 1928 as evidence of its lack of commitment to a serious evaluation of the health problems of asbestos workers in the UK.¹¹ Apart from the early testimony of Lucy Deane, a Women Inspector of Factories – lay evidence presumably ignored by her medical colleague Thomas Legge – much of this body of medical evidence was based on case experience reported by individual doctors after the death of asbestos workers. Sometimes the clinical diagnosis of lung fibrosis was followed by postmortem and histological examination. The Factory Department conducted surveys of the asbestos industry in 1910 and 1917 – presumably they were conceived as studies of mortality rates – and in 1912 some experimental research on animals was carried out at the Department's behest. None of them found any 'definite proof'.¹² It is not my purpose to discuss whether this evidence constituted sufficient grounds for a medical survey of the asbestos industry. My interest is in the nature of the 'definitive' study that should have sustained a causal relationship between asbestos exposure and lung disease.

Demands by the Factory Department in the 1920s and 1930s for industrial medicine to become a scientific discipline were linked to the development of laboratory work. Christopher Sellers has convincingly argued how, in the 1920s, researchers of the Office of Industrial Hygiene in the United States developed a new format for field studies on occupational diseases, achieving a new objectivity by incorporating laboratory analysis alongside the traditional study of working conditions.¹³ Although experimental research had already been introduced in this field in the UK, its findings were rarely put into practice and remained academic.¹⁴ Nevertheless, intense social conflict in the late 1920s and early 1930s led the Factory Department to seek more impartial and neutral grounds for intervention in the workplace and to promote the experimentalist approach, shifting the focus from workers to research laboratories. It could be argued that the Merewether and Price Report is a fine example of the transition from the medical enquiry of old to the new paradigm of a laboratory-based approach to the workplace.

Far from being designed as wide-ranging epidemiological research on a working population at risk, Merewether restricted the inquiry to the textile branch of the asbestos industry. The *Annual Report of the Senior Medical Inspector for 1929*, where the Merewether & Price Report was

first summarised, illustrates the reasons for this choice. Initial delays in the recognition of asbestosis were attributed to the hegemony of free silica, which had led other industrial dusts to be dismissed as comparatively harmless.¹⁵ The pathogenicity of asbestos fibres could only be demonstrated in a laboratory-style design by reducing the scope of the inquiry to workers exposed to the influence of asbestos dust acting alone:

For these reasons it was evident that great care must be exercised to avoid attributing to asbestos dust effects due to recent or remote exposure to other dusts, especially those containing free silica. By elimination of processes in which mixed dusts were encountered, and a meticulous enquiry into the entire medical and industrial history of each individual examined, it was possible to eliminate this and other more obvious sources of error.¹⁶

Thus, the research excluded those manufacturing processes in which workers were exposed to a mixture of dusts that included asbestos. Merewether selected 363 workers from an estimated workforce of 2,200. Citing data from the Census of Production, Tweedale has suggested that Merewether grossly underestimated the exposed population, since 8,500 workers were employed in UK asbestos textiles in 1930. This would mean that the survey had reduced its scope to less than 4.3 per cent of the exposed workforce.¹⁷ Even more striking is that only one manufacturing sector, textiles, came under scrutiny although textile factories represented only 10 per cent of the British factories engaged in processes that used asbestos.¹⁸

As suggested above, the medical and legal perception of silicosis provided the framework for the further understanding of dust-related diseases. One of the most fruitful research trends was the experimental work carried out by A. Mavrogordato in the late 1910s and the 1920s. Originally developed under the supervision of J.S. Haldane, Mavrogordato's work was carried out by confining guinea pigs and exposing them to various dusts. Based on the observation of different elimination rates of the dust from the respiratory system, Mavrogordato hypothesised that this factor was relevant to the development of fibrosis. Dust harmfulness, i.e. its capacity to cause lung fibrosis, depended on the variable tendency of the dust to remain in the respiratory tissue or, in other words, the variable ability of the respiratory tract to eliminate it. In addition to the nature of the dust, the dosage inhaled and the length of exposure became the other factors in the standard pathogenic equation.¹⁹

Despite his lack of experimental research in this area, Merewether adopted the Mavrogordato model and applied it to asbestos exposure. To

cope with the shortcomings of his approach, Merewether shifted from absolute to comparative terms. Once the incidence rate revealed by the inquiry had confirmed the causal relationship between asbestos exposure and lung fibrosis, Merewether pondered the role played by the length of exposure and the dust concentration. Indeed, the social conditions of work and the particular features of the workplace made it impossible to achieve reliable incidence rates for particular productive processes:

There are insuperable difficulties in ascertaining trustworthy figures of the precise incidence of fibrosis amongst workers in particular asbestos processes. This is the result of the common practices in the industry of housing many processes in one room, and of workers transferring from one process to another. These two factors, the influence of dust from neighbouring processes, and prior work in other asbestos processes, operate to obscure the effects due to work in any one process.²⁰

How could these obstacles be overcome? Basically, by expressing the findings in only relative terms. To determine workers' health status according to specific productive processes, workers were grouped according to the activity in which they had been longest employed, combining together similar processes. In addition, dust concentrations in working areas – quantified through some 50 determinations with an Owens jet counter – were grouped and expressed in terms of relative dustiness.²¹

Although dust sampling was in its beginnings, with an empirical approach ('by eye') being the normal procedure to evaluate dustiness at the workplace, Merewether and Price were drawn by the lure of quantification. Certainly, they were well aware of the drawbacks of the dust-counting technology available at the time and the conditions under which it was employed.²² Its limitations were basically its lack of sensitivity to discriminate asbestos fibres from other types of dust, its inadequacy for recording subsequent samples, and – due to the housing of various processes in the same workrooms – the impossibility of isolating readings for individual jobs. In fact, they described the attempt as 'a rough idea of general dustiness', and no direct data on dust concentration levels were included in the Report. Nevertheless, air dustiness quantification embodied the pretension of a more accurate description of the workplace atmosphere and, of greater importance for the future, the possibility to intervene at the workplace on objective grounds. The formula employed was to average the readings for one of the process groups – one classed as producing a 'relatively low concentration' of dust, including spinning without local exhaust ventilation – and to take the resulting figure as unity (1.00). The

readings obtained for other processes were then expressed proportionately to that unit.²³

Indeed, the correlation that was perceived between the comparatively low concentration of dust in the spinning process and the relatively low incidence of fibrosis amongst spinners, and the longer period that elapsed before they developed the disease, provided the evidence to make them the group of reference. This decision eventually converted them into the parameter of health. Again without experimental support, Merewether hypothesised:

In fact, the history, and the medical and radiological features of the cases of fibrosis, together with the results of comparison of the dust counts, all contribute to some degree to the view that with comparative low concentration of dust in the neighbourhood of a process, the resulting cases of fibrosis amongst the workers in that process are longer in developing and remain in a milder stage. It follows, therefore, that in such cases the rate of accumulation of dust in the lung has not greatly exceeded the rate of elimination, and a further point of great practical importance emerges, namely, that in order to prevent the full development of the disease amongst asbestos workers within the space of an average working lifetime, it is necessary to reduce the concentration of dust in the air of the workrooms to a figure below that pertaining to spinning at the time over which these cases were exposed.²⁴

This statement, crucial to the conceptualisation of a technically feasible solution, was based on the assumption of an inverse relationship between the length of exposure to asbestos dust necessary to produce fibrosis and the level of dust concentration, based on an analogy with silicosis.²⁵ The acceptance of this inverse relation allowed him to dismiss any other risk factors involved in the pathogenic equation. On the other hand, he underlined the importance of the practical implications of this hypothesis, which without doubt became the crux of the matter. The removal of dust to certain levels would cause 'first a great increase in the length of time before workers develop a disabling fibrosis, and secondly, the almost total disappearance of the disease, as the measures for the suppression of dust are perfected'.²⁶ Therefore, it was suggested that the spinners' level of exposure should be regarded as the 'dust datum', i.e. the level that would 'prevent the full development of the disease amongst asbestos workers within the space of an average working lifetime'.²⁷

Certainly, such a definition of the dust datum shows a very narrow concept of disability and is a fine example of how workers' impairment could be conceptualised through this laboratory-minded approach. Again, disability was taken out of context, disregarding the industrial working practices and

life styles that intertwined with asbestos exposure and contributed to the onset and evolution of the disease. However, more relevant to my argument is that asbestos health hazards were thus theorised as surmountable through technical intervention. The dust datum came to be regarded as a level of safe exposure and, therefore, dust suppression became consecrated as the main safeguard against asbestos risks. A technical intervention whose prescription rested on quantitative grounds: only those textile processes giving rise to dust above the dust datum would require intervention (what were called 'scheduled areas'). Those textile processes with dust concentrations below that level and the remaining asbestos processes that did not come under Merewether's scrutiny were regarded as healthy. This assumption became the basis for what were to be considered as the two main flaws of the Factory Department policy on asbestos: the conversion of the dust datum into a safety standard and the limitation to a restricted number of asbestos jobs of the dust control measures, medical examinations and compensation schemes.²⁸

Merewether and Price were asked in 1929 to prepare a further report focusing on methods for dust suppression in both textile and non-textile factories where asbestos was in used, which was included as Part II of the Report.²⁹ Not surprisingly, the first step adopted by the Factory Department after the Report was issued was to invite asbestos textile manufacturers to a conference to settle the basic agreements on technical intervention, which formed the basis for the final code of regulations.³⁰ This way of conceptualising and coping with the asbestos issue perfectly corresponds to what Dietrich Milles has identified as the industrial society's optimistic approach to work-related risks: the confidence to overcome new hazards through technological development.³¹

Wilmot has convincingly described the central role played by the apparent availability of air pollution-reduction technologies in tackling public concern over alkali chemical industry health risks in late nineteenth-century Britain. By contrast, it was the lack of an agreed appropriate technology which exempted the copper-smelting industry from the first phase of legislation on 'noxious vapours'.³² To some extent, it could be claimed that the conceptualisation of the work-related risks posed by asbestos dust as affordable in technical terms was not only determinant in generating a public feeling of trust in the measures adopted. It also constituted a new filter to remove from 'scientific reality' workers involved in productive processes in which this technological intervention was not viable. The Factory Department's refusal to extend the regulations to boiler stripping illustrates this new reduction very well. The difficulties of applying exhaust ventilation to this task – usually carried out in ship reconditioning

– removed it from the coverage of the regulations and thus from its consideration as dangerous to health.³³

The Report's underestimation of the exposed workforce, its perception of a comparatively small number of workers engaged in 'dusty' occupations, the relatively low incidence rates found (95 of the 363 workers examined had asbestosis, or 26.2 per cent),³⁴ and the proposal of a prescriptive tool based on technical intervention, all fostered the confidence of the Factory Department. When compared with the widespread silicosis, asbestos health problems seemed to be finite and controllable.³⁵

Notwithstanding the confidence engendered by the Report, some Factory Department Officials insisted that some aspects warranted further attention. John C. Bridge, Senior Medical Inspector, was well aware of some of the limitations of Merewether's approach. In October 1929, Bridge addressed a memorandum to the Chief Inspector of Factories, accompanying a copy of the Report. Together with the report's main outputs, Bridge pointed out the 'great deal of work to be done in connection with the effects of asbestos dust combined with other dusts ... and subsidiary processes into which asbestos enters' – precisely those manufacturing processes excluded from the survey.³⁶ This second research step was intended to provide a more comprehensive perception of asbestos health risks, compensating at least in part for the excessively reduced scope imposed by the search for a causal relationship.

Official demands for further research went largely unheeded. Indeed, the Factory Department's policy on asbestos during the 1930s became almost completely confined to the Report's findings. A more general approach to the industrial and public health risks posed by asbestos exposure was not attempted, despite the marked growth of new applications for asbestos use in British industry.

Asbestos Industry Regulations: Protecting the Faith

BRIDGE'S MEMORANDUM INCLUDED RECOMMENDATIONS that became the backbone of Factory Department policy on asbestos. The Asbestosis Scheme theoretically tackled three aspects of the social problem posed by asbestos exposure. The Scheme included: the consideration of asbestosis as an industrial disease, which entitled the worker to compensation under the Workmen Compensation Act; a medical programme to screen workers entering the industry and to monitor their subsequent health conditions; and the Asbestos Industry Regulations, a code of health regulations that would protect the workforce from disease.³⁷

Indeed, the Asbestos Industry Regulations became the basis for the Factory Department's self-confidence. This confidence derived from the Report's conceptualisation of asbestos health risks as technically manageable. The existence of a safety level of exposure and thus the possibility of controlling the health risks posed by asbestos by dust suppression gave the Asbestos Industry Code of Regulations the appearance of scientific legitimacy.

Belief in safe exposure levels first took hold in the British and German chemical industries during the second half of the nineteenth century. The placing of limits on the levels of contaminants in effluents and air from chemical plants formed the backbone of antipollution policy in Britain from the last decades of the nineteenth century.³⁸ At the turn of the century the chemical industry was championing the adoption of limits to workers' exposure as safety measures at the workplace. Theoretically supported by the assumption of a dose-response relationship, standards were established by comparing prevalent concentrations of those substances in working areas – quantified through systematic chemical analysis – with workers' health status, in addition to some experimental research with laboratory animals.³⁹ The development of experimental toxicology strengthened this scientific basis.⁴⁰ The ideal model – phrased in a mathematical equation, $(c-e) \times t = E$ – established a relation between the amount of damage (E) and the time of exposure (t), the level of concentration (c) and an elimination factor (e) – which expressed the capacity of the body to expel the toxic substance.⁴¹ No attention was paid to personal or collective factors that could increase sensitivity or to factors inherent to productive processes, such as combined exposure to other occupational toxicants or dusts. The use of this model led to the wide acceptance of the existence of a level of exposure below which the risk was considered negligible. In the early 1920s, the establishment of standards of permissible air concentration at the workplace for some chemicals became a common practice in Europe and America, evolving – as Sellers has pointed out – into an indispensable prescriptive tool of industrial hygiene at the workplace.⁴²

Again, Merewether and Price showed a remarkable ability to meet the public perception and expectation of standards as an objectively established measure of safety.⁴³ With very weak empirical support and the lack of any experimental research, Merewether and Price saw no obstacle to extending this chemically-conceived model by analogy to air dustiness. This extension was welcomed by the Factory Department, which publicly only expressed some reservations about the provisional nature of the standard.⁴⁴ Internal memoranda reveal much more sceptical positions. At a conference

attended by representatives of all the main asbestos textile manufacturers, held at the Home Office on July 1930, Bridge pointed out 'the impossibility of setting up a standard at the present time'.⁴⁵

In fact, the difficulties standing in the way of establishing safe criteria for air dustiness were well recognised at the time. In 1929, E.L. Middleton, Medical Inspector of Factories and a renowned expert on dust-related lung diseases, had summarised the main obstacles to be overcome before safety standards in air dustiness could be defined. First, the critical levels or amounts of inhaled dust for the induction of fibrosis were unknown. Second, not enough medical evidence was available on the role played in the onset of fibrosis by a variety of relevant factors. These included not only the concentration of dust in the atmosphere, but also the period of time over which exposure occurred and, importantly, the presence of other dusts, with either restraining or accelerating effects on the action of the dust under scrutiny. And third, the gravimetric and numerical methods of dust concentration measurement available at the time presented major shortcomings. Improvement in the accuracy of dust measurement was necessary to assess variations in the intensity of air dustiness.⁴⁶

Middleton's misgivings about the setting up of safety standards were outweighed by the Medical Inspectorate's desire to implement this prescriptive tool. In 1930, a Committee on Industrial Pulmonary Diseases (IPDC) was set up after a request made by the Home Office to the Medical Research Council (MRC) to undertake further investigation into industrial pulmonary diseases.⁴⁷ The Committee was asked to keep a close relationship with the Medical Branch of the Factory Department.⁴⁸ In fact, the central research demands drawn up by the IPDC matched the main concerns of the Medical Inspectorate regarding dust-related diseases. The research programmes implemented by the IPDC were directed to improving diagnosis for purposes of compensation, ascertaining the concentrations of dust liable to cause lung damage and, eventually, to seeking criteria for safe conditions that would enable authorities to institute preventive dust control measures.⁴⁹ The recommendations worked out at the International Silicosis Conference held at Johannesburg in August 1930 were welcomed by the IPDC and strengthened their already existing research programmes,⁵⁰ leading to the creation within the MRC of a Dust Estimation Department and a Pathology Department (mainly focused on animal experimentation).⁵¹

Although the IPDC programmes were pertinent to asbestos, this issue did not play a major role in the Committee's agenda. It could be argued that the rapid encapsulation of the asbestos issue through the Asbestosis Scheme pushed the reassessment of the dust datum into the background. Certainly,

asbestos dust was but one of the emerging health hazards that caused concern to the Factory Department in interwar UK and it had a much lower public profile than did silicosis,⁵² and after the institution of a regulatory code and the introduction of a medical and compensation scheme it did not demand urgent attention. Even though an improvement in dust sampling remained near the top of the IPDC agenda, silicosis and coal mining were to become the main concerns of this body during the 1930s.⁵³

On the other hand, initial IPDC attention to asbestosis concentrated on the ongoing work of Matthew Stewart, a member of the Committee, at Leeds. A Professor of Pathology at Leeds University, Stewart had become interested in asbestosis in the late 1920s when he was engaged as a pathologist by the J.W. Roberts asbestos factory in Armley.⁵⁴ In 1929, he received funding from the MRC. Established before the IPDC research programme had been launched, his lines of inquiry were mainly focused on the postmortem pathological examination of workers and the exposure of experimental animals in asbestos factories, with little mention of dust sampling.⁵⁵

In July 1930, Stewart reported to the IPDC on a third thread then in the process of arrangement in Leeds. The study was based on the Leeds subset of asbestos workers diagnosed by Merewether in his 1928 survey. With assistance from local physicians, the investigation was designed to 'carry out a number of functional tests of asbestos workers, and their findings ... correlated with the clinical condition and the industrial history of the cases ... and with the radiological appearances in the chest'.⁵⁶ A design that met what became widely acknowledged as the most important lesson to be learnt from the International Silicosis Conference – the correlation of clinical, radiological and pathological findings – had not only proved of greatest importance in standardising diagnoses of dust-related diseases but also, when associated with the knowledge of the concentration of dust which produced those conditions, became a key point for the introduction of effective preventive measures.⁵⁷ Nevertheless, Stewart's proposal was postponed *sine die* in the face of opposition from the manufacturers and the reluctance of the Factory Department to supply the identity of workers.⁵⁸ On the other hand, Stewart's regular reports to IPDC on his experimental work with guinea pigs exposed to asbestos dust offered no relevant outcome.⁵⁹ It has been argued that the anodyne results provided by this experimental study were due to its limited scope – with no link with clinical or dust measurement research – and the low profile of Stewart as an experimental researcher.⁶⁰ In addition, Tweedale has pointed out the close links between Stewart and the asbestos manufacturers, which reached a peak in 1943 when he was appointed as Turner & Newall's consultant pathologist.⁶¹

The Factory Department conducted its own research on airborne dust sampling during the late 1930s, with particular attention to the setting of standards. Some measurements were related to asbestos and, apparently paradoxically, they contributed to reinforce the dust datum as a safety standard rather than examine its validity. It could be expected – as some authors have remarked – that the availability of more accurate data would lead to the setting of a new standard. On the contrary, the Factory Department was gaining confidence in standards and in the capacity of modern engineering equipment to guarantee protection of the workforce from the overwhelming burden posed by dust-related diseases. It was not a time for a review of the standards or the spreading of doubts but rather a time to encourage a technical approach to the dust issue.

The starting point for this involvement was the invention of a new and promising dust sampling instrument – the thermal precipitator – whose employment in 1935 for investigating industrial dusts was fostered by the IPDC. The main advantage of the new method lay in its capacity to take 'long term' samples as opposed to the 'snap' samples provided by the Owens jet counter.⁶² The testimony of the Factory Inspector Kenneth L. Goodall, the physicist who led much of the work on dust sampling at that time, offers an insight into the increasingly technical profile sought by the Factory Department in the mid-1930s.⁶³ According to Goodall's account, Middleton consulted the inventors on their suitability for assessing silica and asbestos dusts and then, in 1935, prompted the purchase by the Factory Department of two thermal precipitators (the very first to be manufactured commercially), which were sent to the Stoke-on-Trent District Office. The potential of the new technique was first explored by Goodall in the pottery industry. Even though tinged by the hindsight that can be expected in a scientist persuaded of the progressive and neutral nature of scientific enterprise, his account is a fine description of the empirical framework employed in his first measurements and the growing commitment to rely on technical intervention at the workplace: 'I felt that if one could measure a health hazard from toxic materials quantitatively one was more than half way towards a solution, especially if "standards" could be set'.⁶⁴ Quantitative comparison and correlation with clinical examinations were to be the basis for the establishment of standards, perceived by Goodall not only as a scientific and neutral intervention tool but as a powerful ally to persuade employers.⁶⁵ In his account he makes no mention of the negotiation process intrinsically linked to setting standards, where manufacturers maintained a considerable influence.⁶⁶

From the end of 1937, Goodall's services began to be increasingly

demanding by the Factory Inspectorate, and his work on dust sampling was carried out in other industries, including the asbestos industry. Wikeley has reconstructed in detail Goodall's work on asbestos dust sampling. It was carried out during 1938, before Goodall was transferred to the Inspectorate's Engineering Branch at London. In the course of testing the efficiency of a filter employed in asbestos spraying, Goodall was requested by Merewether to take counts of the dust levels associated to flyer spinning – the dust datum – in one of the same locations in which Merewether got his original readings.⁶⁷ Merewether's aim was in no way to submit the dust datum to scrutiny using the new and presumably more accurate dust sampling method, but rather to make it comparable with dust counts in asbestos spraying recorded with the thermal precipitator.⁶⁸ New counts of flyer spinning were classed by Goodall as 'definitely high', even though he carefully avoided comparison with the former readings.⁶⁹ The new method evidenced the existence of a wide range of variation in dust counts depending on location and time – a parameter not contemplated by Merewether – because dustiness naturally increased throughout the working day. In any case, the priority of the Department was not to challenge the already established dust datum value, but rather to use the new readings for comparative studies:

It is hoped that the results of the present series of counts [of the dust datum] will be a useful standard by which to judge dust conditions associated with other asbestos processes.⁷⁰

Therefore, under the new dust sampling technique, the dust datum became confirmed as the reference value for evaluating safety and dust suppression effectiveness when dealing with asbestos dust hazards. It opened up a new era of confidence in threshold limit values, officially declared and publicly perceived to be the most objective safety measure for dealing with industrial health hazards.

Contextualising Asbestos Risks: Trades Union and Political Pressure on the Asbestos Issue

IN THE ABOVE SECTIONS, I have shown how the image generated by the Merewether & Price Report contributed to a very restrictive interpretation of the risks linked to asbestos exposure. Tweedale and Hansen explored the operation of the Asbestosis Scheme from the 1930s to 1960s. By studying the performance of the Medical Boards in charge of screening workers entering the industry and then monitoring their health and granting compensation when appropriate, they were able to reveal how

these limitations operated.⁷¹ In this last section, I will describe attempts by other social agents to offer a more contextualised image of the risks of asbestos than that generated by industrial medicine. These were timid attempts, partially conditioned by the need to count on a scientific backing, and were often ineffectual. These initiatives serve to show once more the tremendous argumentative force of scientific findings in the formation of Factory Department policy, which limited the Department's intervention to a defence of the 'scientific orthodoxy' contained in the Merewether & Price Report. This policy was viewed with an obstinate optimism that was blind to any conflicting evidence.

Nugent, Rosner and Markowitz, among others, have pointed out the fundamental role played by the pressure of the social agents who participated in the public debate in conditioning the development of scientific research and the very conceptualisation of industrial health problems.⁷² The rapid encapsulation of the asbestos issue within the medical and legal domains hindered a more general approach to the topic. The different trades unions hardly contributed anything to redefine the problem from a more comprehensive perspective of reality. As well as the rapid encapsulation of the problem, the small part played by the unions resulted from the little room for negotiation that the Factory Department allowed them. Eventually, the restrictive coverage of the Asbestos Industry Regulations was considered a lesser evil by the unions and as an area for future campaigning, although this did not stop them from congratulating themselves on the rapid adoption of the measures. Nevertheless, it is worth highlighting the decision by the TUC to move the fight to the medical arena – by appointing a medical adviser – and to offer a more contextualised vision of the risks implied by asbestos exposure. As I shall have occasion to demonstrate, this contextualisation became evident in the TUC argument to extend the Asbestos Industry Regulations to other productive processes and in their questioning of the dust datum.

From the late 1920s, the TUC developed a policy of campaigning on the scheduling of new industrial diseases, backed up by the presentation of scientific evidence to counter the findings of the Workmen Compensation Medical Committee. To this extent, the appointment in 1930 of Sir Thomas Legge, former Senior Medical Inspector, as the TUC's medical adviser represented a victory. In fact, the TUC policy on asbestos was vigorously shaped by Legge's opinions and by the idea that greater problems of more difficult solution were involved. In 1931, most of the contact was between D.R. Wilson, Deputy Chief Inspector of Factories, and J.L. Smyth, Secretary of the TUC Social Insurance Department.

Not surprisingly, Legge's perception of the asbestos problem did not appreciably differ from that of his former colleagues at the Factory Department. Legge emphatically lauded the Merewether & Price Report, which he described as 'a commendable success', and the 1931 *Report on Methods for Suppressing Dust in Asbestos Textile Factories*. Legge endorsed the pathological interpretation proposed by Merewether and welcomed the dust datum proposal, technological approach and optimistic outlook of the Factory Department.⁷³

The aspirations of the TUC and of the unions most directly involved required the support of scientific evidence that was more contextualised than that initially advanced by Legge. This evidence was gathered by Reginald Tage, whose contacts with Legge led the latter to adopt a somewhat more critical attitude towards the official Factory Department policy. Wikeley has explored in detail the research and informal advice given to the TUC on asbestos health matters by Tage, who called himself an 'Asbestos Research Worker'.⁷⁴ Tage's collaboration was especially active and important in preparations for the meeting with the Factory Department in July 1931 to discuss the draft Asbestos Regulations, which were finalised in March 1932 and directly influenced, as we shall see, by Legge's opinions.

This meeting clearly showed the limitations on the negotiations imposed by the Factory Department and the restrictive interpretation of the problem fostered by the Merewether & Price Report. The arguments of the TUC were mainly focused on the extension of the Regulations to other processes within and outside the asbestos textile industry. Lay epidemiology played a role in supporting the claims of the TUC:

The [TUC] Deputation pressed the point that it was essential to include all textile processes under protective Regulations. New processes were constantly being applied and all of them were bound to be more or less dangerous to health, even if definite medical evidence of quickly resulting disease had only been obtained from certain departments.⁷⁵

Wilson rejected these claims with three main arguments: lack of medical evidence to support inclusion; non-viable application of exhaust ventilation; and employer opposition to the inclusion of new processes.⁷⁶ Factory Department policy was clearly restricted to what was technically feasible and practical and to what was acceptable for asbestos manufacturers. Despite this rejection and the decision by the TUC not to delay the setting up of the Regulations, the new union proposals for draft no. 7 abounded in scientific arguments. For the first time, questions were raised about the arbitrary nature of the dust datum, although not about its existence:

While appreciating the work done in the endeavour to find a dust datum, we are struck by the absence in Dr Merewether's and Mr Price's reports of any precise statement of the number of particles of asbestos dust which had been found in the fifty determinations (p. 12) on which it was based. When we saw the figures published on pp. 246-7 of the further paper in the *Journal of Industrial Hygiene*, the discrepancy between the figures for spinning and plaiting and those for carding and other dusty processes were not so striking as to justify taking spinning, winding, doubling, braiding and plaiting as a dust datum below which application of exhaust ventilation should be regarded as unnecessary from a health point of view. And in the 51 samples taken, not one dealt with either winding or doubling.⁷⁷

Given the 'provisional nature' of the standard, the TUC urged that new determinations be made and that a new consensus be reached on the critical dust level.

The conflict between a restrictive interpretation of reality and the contextualised view of the risks of working with asbestos is reproduced to some degree in the different approaches to the issue espoused by the two 'experts' who advised the TUC: Legge and Tage. I have already mentioned Legge's enthusiasm for the approach proposed by the Factory Department, a model which was perceived at the time as almost ideal for controlling industrial health problems: an experimental study to provide scientific evidence of a causal relationship; intervention in the work setting based on technical solutions, with the least possible disturbance of the productive process or working practices; and the immediate translation of these proposals into a code of regulations. In this context, the way that Tage worked was at the very least heterodox, not so much in his gathering of information, but rather in the unorthodox way that he legitimised it in terms of the industrial medicine of the time. Wikeley has proposed that the suspicions awoken by Tage's behaviour, which presumably did not accord with the scientific ethos, explained the growing disagreements between Legge and Tage that eventually led to Tage being discredited and asked to resign as adviser to the TUC.⁷⁸ In my view, we should not underestimate the challenge posed to Legge, then in his late 60s, by Tage's questioning of the pathogenic theory. Tage was endowed with skills and a capacity for observation that was matched by his reluctance to follow official doctrine.⁷⁹ From what we could call his 'semi-lay' standpoint, based on his research in Barking, Tage called into question the scientific foundations of the dust datum and by extension of the whole philosophy of the Asbestos Industry Regulations, namely the existence of an acceptable level of risk based on the need to inhale a certain amount of asbestos in order to develop lung

fibrosis. Indeed, the conclusions that Tage presented to Smith in January 1932, as the product of his 'Survey on Health at the Barking Cape Asbestos Factory and Asbestosis in General', point to mere exposure as the trigger of the disease process:

Firstly, I believe it is correct to state that the disease commences as from the time of first exposure to asbestos dust and its progression is not of serious concern to the patient until the reserve capacity of the Lung has been almost fully called upon and that stage is arrived at in the greater majority of cases about 5 years from the date of first exposure to asbestos dust – even then the sufferer is capable of a few more years work before he ultimately collapses, and the terminal event is usually Bronchial pneumonia.⁸⁰

Tage also described another factor that could contribute to camouflage the causal relationship or make it disappear, a gender-linked factor that explained the existence of different working habits to those normally found in males:

It is to be observed from the facts previously given that the majority of the employees are girls. Their period of exposure is usually not more than three years and they probably leave to get married, at that time they are apparently quite healthy, but after about 6 years their health gets progressively worse, and the ultimate can only be death. There is no compensation for these cases which will be, I suggest, in the majority.⁸¹

Merewether had ruled this factor out on strictly biological grounds. I believe that Tage's approach to the asbestos health issue allows us to see more clearly the limitations inherent to the official medical scientific approach to the problem. Tage brought a much more contextualised view of the work activity and habits of the workers, which were undoubtedly determinant for the onset, development and outcomes of their employment-related health problems.

After Legge's death in 1933, Dr Hyacinth Bernard Morgan, Labour MP for NW Camberwell since 1929 and a medical practitioner but with no previous experience in industrial medicine, was appointed as the new TUC medical adviser.⁸² His involvement with the asbestos issue, although limited, created some resistance from the Factory Department, who were wedded to an out-and-out defence of the positive qualities of the Industry Regulations. Any new asbestosis case that came to public light was attributed by the Department to exposure incurred prior to the enforcement of the Asbestos Industry Regulations. This became almost the official statement of the Senior Medical Inspector in the *Annual Report of the Chief Inspector of Factories and Workshops* since 1933. This was also the main argument used

by the Home Secretary in response to questions raised in Parliament,⁸³ mostly by W. Thorne, Labour MP for Barking, who had been actively engaged in the issue since 1928.

The optimism of the Factory Department and its faith in the effectiveness of the regulations were not even dimmed by the appearance in the late 1930s of growing evidence of fatal cases that occurred under the 'new' working conditions.⁸⁴ Questions on these cases received the same answer as that given to those on deaths of asbestos workers employed in nonscheduled areas.⁸⁵ The lack of consistent political pressure on the issue and the emergence in the mid-1930s of new problems, including a sudden increase in industrial accidents (linked to a resurgence in industrial activity after the unemployment crisis of the late 1920s and early 1930s), pushed the asbestos issue further down the Factory Department's list of priorities.

Conclusion

INDUSTRIAL SCIENCE AND THE REQUIREMENTS of the laboratory-based approach to occupational health matters not only provided the basis for the Department's restrictive perception of the asbestos issue but also reinforced its policy against any public criticism. Public perception of the health risks posed by asbestos exposure was thus virtually confined to what could be appraised at the time as an 'acceptable explanation' shared by the Factory Department, Industry managers and, to some extent, by Union officials. To what extent this consensus contributed in shaping workers' attitudes to risk and society's reliance on the technical control of the asbestos issue warrants further exploration.

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Notes

- 1 For a brief update see the prologue of Christopher C. Sellers, *Hazards of the Job. From Industrial Disease to Environmental Health Science* (Chapel Hill & London, 1997).
- 2 Dietrich Milles has briefly explored the naturalisation process of work-related diseases in nineteenth-century industrial society. Industrial pathogenicity became no longer considered as an 'artificial' or produced risk, but rather as a 'natural' acceptable risk. See 'What are Occupational Diseases? Risk and Risk Management in Industrial Medicine in Germany, c. 1880–1920', in Roger Cooter and Bill Luckin (eds.), *Accidents in History. Injuries, Fatalities and Social Relations* (Amsterdam, 1997), pp. 179–95. Gunnar Stollberg has explored the construction of health risks in German workers at the turn of the twentieth century, a process later mediated by insurance and compensation. See his works 'Industrialization and the Construction of Health Risks in German Workers' Autobiographies from the Late 19th and Early 20th Centuries', *Dynamis*, 13 (1993), 235–46, and 'Health and Illness in German Workers' Autobiographies from the 19th and Early 20th Centuries', *Social History of Medicine*, 6 (1993), 261–76.
- 3 Dietrich Milles, 'Medical Opinion and Sociopolitical Control in the Case of Occupational Diseases in late Nineteenth Century Germany', *Dynamis*, 13 (1993), 139–53.
- 4 Angela Nugent, 'The Power to Define a New Disease: Epidemiological Politics and Radium Poisoning', in D. Rosner and G. Markowitz (eds.), *Dying for Work: Workers' Safety and Health in Twentieth-Century America* (Bloomington & Indianapolis, 1989), pp. 177–91.
- 5 Michael Bloor, 'The South Wales Miners Federation, Miners' Lung and the Instrumental Use of Expertise, 1900–1950', *Social Studies of Science*, 30 (2000), 125–40.
- 6 Dietrich Milles, 'From Workers' Diseases to Occupational Diseases: The Impact of Experts' Concepts on Workers' Attitudes', in Paul Weindling (ed.), *The Social History of Occupational Health* (London, 1985), pp. 55–77.
- 7 Peter Bartrip, 'Too little, too late? The Home Office and the Asbestos Industry Regulations, 1931' *Medical History*, 42 (1998), 421–38.
- 8 This controversy is documented in the 'reply' by Morris Greenberg and Nick Wikeley to Bartrip's paper and the 'rejoinder' of the latter, both published in *Medical History*, 43 (1999), 508–13. More recently, two books based on an analysis of Turner and Newell's archives have further revealed the growing polarisation of interpretations: Geoffrey Tweedale, *Magic Mineral to Killer Dust. Turner & Newell and the Asbestos Hazard* (Oxford, 2000); and Peter Bartrip, *The Way from Dusty Death: Turner and Newell and the Regulation of Occupational Health in the British Asbestos Industry, 1890s–1970* (London & New York, 2001).

- 9 Edward R.A. Merewether and Charles W. Price, *Report on the effects of asbestos dusts on the lungs and dust suppression in the asbestos industry* (London, 1930). Price was an Engineering Inspector.
- 10 Nick Wikeley, 'The Asbestos Regulations 1931: A Licence to Kill?', *Journal of Law and Society*, 19 (1992), 365–78; Nick Wikeley, *Compensation for Industrial Disease* (Aldershot, 1993), pp. 95–102; Morris Greenberg, 'Knowledge of the Health Hazard of Asbestos Prior to the Merewether and Price Report of 1930', *Social History of Medicine*, 7 (1994), 493–516; Bartrip, 'Too little, too late?'; Tweedale, *Magic Mineral to Killer Dust*, pp. 11–39; Barry I. Castleman, *Asbestos: Medical and Legal Aspects* (Englewood Cliffs, 1996), pp. 11–17; Bartrip, *The Way from Dusty Death*, pp. 1–30.
- 11 Greenberg, 'Knowledge of the Health Hazard of Asbestos', 495–501.
- 12 Edward R.A. Merewether, 'A Memorandum on Asbestosis', 15 (1933), *Tubercle*, 69–81, 109–18, 152–59 (pp. 71–72).
- 13 Christopher C. Sellers, 'The Public Health Service's Office of Industrial Hygiene and the Transformation of Industrial Medicine', *Bulletin of the History of Medicine*, 65 (1991), 42–73 (pp. 43–44).
- 14 Particularly important in this respect was the involvement of the Medical Research Council's Industrial Health Research Board. Helen Jones, 'Industrial health research under the MRC', in Joan Austoker and Linda Bryder (eds.), *Historical Perspectives on the Role of the MRC. Essays in the history of the Medical Research Council of the United Kingdom and its predecessor, the Medical Research Committee, 1913–1953* (Oxford, 1989), pp. 137–61; Arthur J. McIvor, 'Manual work, technology and industrial health, 1918–39', *Medical History*, 31 (1987), 160–89.
- 15 For an exploration of the relegation of other dust hazards, particularly coal dust in miners, see Andrew Meiklejohn, 'History of Lung Diseases of Coal Miners in Great Britain', *British Journal of Industrial Medicine*, 8 (1951), 127–37; 9 (1952), 93–98, 208–20; Eileen Seitz Metress, *A Historical Comparison of the Medical Recognition of Coal Workers' Pneumoconiosis in the United States and Great Britain* (PhD thesis, University of Toledo; Ann Arbor, 1975); Alan Derickson, *Black Lung: Anatomy of a Public Health Disease* (Ithaca, 1998).
- 16 *Annual Report of the Chief Inspector of Factories and Workshops For the Year 1929* (London, 1930), p. 90.
- 17 Tweedale, *Magic Mineral to Killer Dust*, p. 20, n. 38.
- 18 'District Inspectors Report', (ms, 31 March 1930). PRO. LAB 14 70. This report does not provide figures of workers exposed to asbestos dust. Textile processes were included within a list of 25 manufacturing processes where asbestos was in use.
- 19 Assertions of Mavrogato's research have been taken from the discussion carried out by Metress, *Historical Comparison*, pp. 83–86.
- 20 Merewether and Price, *Report on the effects of asbestos dusts*, p. 11.

- 21 Merewether and Price, *Report on the effects of asbestos dusts*, p. 12.
- 22 Tweedale, *Magic Mineral to Killer Dust*, pp. 25–26. See also Nick J. Wikeley, 'Measurement of Asbestos Dust Levels in British Asbestos Factories in the 1930s', *American Journal of Industrial Medicine*, 24 (1993), 509–20; Castleman, *Asbestos*, pp. 280–89.
- 23 Merewether and Price, *Report on the effects of asbestos dusts*, p. 12.
- 24 Merewether and Price, *Report on the effects of asbestos dusts*, p. 12.
- 25 Merewether and Price, *Report on the effects of asbestos dusts*, p. 15.
- 26 Merewether and Price, *Report on the effects of asbestos dusts*, p. 15.
- 27 Merewether and Price, *Report on the effects of asbestos dusts*, p. 15.
- 28 Tweedale, *Magic Mineral to Killer Dust*, pp. 27–30. In the case of the British asbestos giant, Turner & Newall, it meant that less than a quarter of the workforce came under the Asbestos Scheme's protection.
- 29 Merewether and Price, 'Part II. Processes Giving Rise to Dust and Methods for its Suppression', in *Report on the effects of asbestos dusts*, pp. 18–43.
- 30 Home Office, *Report on Conferences between Employers and Inspectors concerning Methods for Suppressing Dust in Asbestos Textile Factories* (London, 1931). For a detailed account of contacts between Factory Department Officials and textile manufacturers see Wikeley, 'The Asbestos Regulations 1931', 366–69.
- 31 Milles, 'What are Occupational Diseases?', p. 186.
- 32 Sarah Wilmot, 'Pollution and Public Concern: The Responses of the Chemical Industry in Britain to Emerging Environmental Issues, 1860–1901', in Ernst Homburg, Anthony S. Travis and Harm Schröeter (eds.), *The chemical industry in Europe, 1850–1914. Industrial growth, pollution, and professionalization* (Dordrecht, Boston & London, 1998), pp. 121–47 (p. 122).
- 33 'Report of Preliminary Meeting with representatives of the Unions concerned and Deputation to the Deputy Chief Inspector of Factories on proposed draft asbestos Regulations', (ms, 8 July 1931). Modern Records Centre, Warwick. Mss. 292/144.3/6.
- 34 Merewether and Price, *Report on the effects of asbestos dusts*, pp. 9–10. The presence in the examined sample of a high proportion (75.5 per cent) of workers employed five years and over, justified – in Merewether's opinion – the need to apply a correction to approximate to a general more accurate incidence rate. That was estimated at less than 1 in 8 of the workforce.
- 35 'The problem of the control of asbestosis is definitely finite as compared with the control of silicosis ...'. Merewether, 'Memorandum on Asbestosis', p. 159.
- 36 J.C. Bridge, 'Inquiry into the health of workers exposed to asbestos dust' (ms, 17 October 1929). PRO. LAB 14 70, F8610/4fy.
- 37 For a general overview on the Scheme see Tweedale, *Magic Mineral to Killer Dust*, pp. 20–22; Wikeley, *Compensation for Industrial Disease*, pp. 102–11.

- 38 Wilmot, 'Pollution and Public Concern', pp. 136–38.
- 39 Dietrich Henschler, 'Exposure Limits: History, Philosophy, Future Developments', *Annals of Occupational Hygiene*, 28 (1984), 79–92.
- 40 For a brief evolution of what the authors term 'inhalation toxicology' see Jacqueline Karnell Corn and Morton Corn, 'Changing Approaches to Assessment of Environmental Inhalation Risk: A Case Study', *Millbank Quarterly*, 73 (1995), 97–119.
- 41 Henschler, 'Exposure Limits', pp. 81–82.
- 42 Sellers, *Hazards of the Job*, pp. 175–76.
- 43 For the American case see Gerald Markowitz and David Rosner, 'The Limits of Thresholds: Silica and the Politics of Science, 1935 to 1990', *American Journal of Public Health*, 85 (1995), 253–62.
- 44 *Annual Report of the Chief Inspector of Factories and Workshops For the Year 1930* (London, 1931), pp. 49–50. Similar prevention was included in the Home Office, *Report on Conferences between Employers and Inspectors*, p. 4.
- 45 PRO, LAB 40 70, F8610/4far.
- 46 E.L. Middleton, 'The Present Position of Silicosis in Industry in Britain', *British Medical Journal*, ii (1929) 485–89.
- 47 The recommendation for setting up the IPDC was included in the *Report of the Departmental Committee appointed by the Secretary of State to Advise as to the Medical Arrangements which could be made for the Diagnosis of Silicosis* (London, 1929).
- 48 PRO, FD1 7313. Bridge and Middleton themselves became members of the Committee, the latter acting as secretary.
- 49 IPDC. Note on the Administrative aspect, 13 March 1930. PRO, FD1 7313.
- 50 International Labour Office, *Silicosis. Records of the International Conference held at Johannesburg, 13–27 August 1930* (Geneva, 1930).
- 51 IPDC Memoranda addressed to the MRC, 27 March 1931 and 16 April 1931. PRO, FD1 7314.
- 52 Bartrip, 'Too little, too late?'
- 53 PRO. FD1 7316, 2862, 7317, 7319.
- 54 Morris Greenberg, 'Professor Matthew Stewart: Asbestosis Research 1929–1934', *American Journal of Industrial Medicine*, 32 (1997), 562–69; Tweedale, *Magic Mineral to Killer Dust*, p. 27.
- 55 IPDC Minutes, 3 July 1930. PRO, FD1 7314.
- 56 IPDC Minutes, 3 July 1930. PRO, FD1 7314.
- 57 IPDC Minutes, 7 November 1930. PRO, FD1 7314.
- 58 Greenberg, 'Professor Matthew Stewart', p. 566.
- 59 IPDC Minutes. PRO, FD1 7314, 2867. His last report on experimental asbestosis was given at the IPDC meeting held on 26 April 1932. PRO, FD1 7315. Stewart

- only published a short note, surprisingly on the first stage of the research. M.J. Stewart, 'Asbestosis Bodies in the Lungs of Guinea-Pigs after Three to Five Months Exposure in an Asbestos Factory', *Journal of Pathology and Bacteriology*, 33 (1930), 848.
- 60 Greenberg, 'Professor Matthew Stewart', p. 568.
- 61 Tweedale, *Magic Mineral to Killer Dust*, p. 91.
- 62 H.L. Green and H.H. Watson, *Physical Methods for the Estimation of the Dust Hazard in Industry (With special Reference to the Occupation of the Stonemason)* (London, 1935), pp. 9–22.
- 63 Kenneth L. Goodall, 'Introduction to Collected Papers on the Early Years of Airborne Dust Sampling in British Factories, leading to the establishment & growth of the Occupational Hygiene Laboratories of H.M. Factory Inspectorate' (ms, June 1977). PRO, LAB 62/3. Goodall mentions that, notwithstanding the early promises to create a laboratory, it was not until 1935 that the first Factory Inspectorate occupational hygiene lab became a reality at Stoke-on-Trent.
- 64 Goodall, 'Introduction to Collected Papers', p. 11.
- 65 Goodall, 'Introduction to Collected Papers', p. 11.
- 66 Markowitz and Rosner, 'The Limits of Thresholds'.
- 67 Wikeley, 'Measurement of Asbestos Dust Levels', pp. 512–18.
- 68 'It was suggested to me by Dr E.R.A. Merewether that if thermal precipitator counts of the dust arising in the process of flyer spinning of asbestos under normal conditions without exhaust [the dust datum] could be obtained, then we should have some more or less standard values of dustiness levels by which to decide whether the dust passing the asbestos railway carriage spraying filter was too high for safety or otherwise'. Kenneth L. Goodall, 'Report on Dust Counts on the Asbestos Flyer Spinning process under normal conditions without exhaust at J.W. Roberts Ltd. Armley, Leeds' (ms, 23 August 1938). PRO, LAB 62/18.
- 69 Goodall, 'Report on Dust Counts', p. 13. Merewether's dust determinations were included in his paper 'Occurrence of Pulmonary Fibrosis and other pulmonary affections in asbestos workers', *Journal of Industrial Hygiene*, 12 (1930), 198–222, 239–57 (p. 246) and have been reproduced in Wikeley, 'Measurement of Asbestos Dust Levels', p. 511.
- 70 Goodall, 'Report on Dust Counts', p. 13.
- 71 Geoffrey Tweedale and Philip Hansen, 'Protecting the Workers: The Medical Board and the Asbestos Industry, 1930s–1960s', *Medical History*, 42 (1998), 439–57; see also Tweedale, *Magic Mineral to Killer Dust*, pp. 53–87.
- 72 Nugent, 'The Power to Define a New Disease'; David Rosner and Gerald Markowitz, *Deadly Dust: Silicosis and the Politics of Occupational Disease in Twentieth-Century America* (Princeton, 1991).
- 73 Interdepartmental correspondence from Sir Thomas Legge to Mr Smyth, 3 April 1930. Modern Records Centre, Warwick. Mss. 292/144.3/6. The Home Office,

- Report on Conferences between Employers and Inspectors*, also received enthusiastic comments from Legge in an internal communication addressed to Smyth in 4 May 1931. Modern Records Centre, Warwick. Mss. 292/144.3/6.
- 74 Nick J. Wikeley, 'Asbestos and Cancer: An Early Warning to the British TUC', *American Journal of Industrial Medicine*, 22 (1992), 449–54. Further details on Tague can be found in Morris Greenberg, 'Reginald Tague: A UK Asbestos Prophet – A Postscript', *American Journal of Industrial Medicine*, 24 (1993), 521–24.
- 75 'Report of Preliminary Meeting'.
- 76 Wilson to Smyth, 14 July 1931. Modern Records Centre, Warwick. Mss. 292/144.3/6.
- 77 Legge to Smyth, 15 July 1931. Modern Records Centre, Warwick. Mss. 292/144.3/6.
- 78 Wikeley, 'Asbestos and Cancer', pp. 451–52.
- 79 In a internal memorandum sent to Smyth on 26 January 1932, Legge summarised his ambivalent position towards Tague: 'I think Mr Tague's report on the whole is very good and shows remarkable investigating capacity unbalanced though it is by too much reliance on his own ideas and lack of knowledge of what others have done'. A note sent to Citrine one-and-a-half months later developed the criticism further: 'I do not think Mr Tague has any serious scientific knowledge and he could not be of further use, seeing that the matter is now in hands of the Factory Inspectors. He is inclined to develop wrong ideas about the possible effects of asbestos'. Modern Records Centre, Warwick. Mss. 292/144.3/6.
- 80 Modern Records Centre, Warwick. Mss. 292/144.3/6.
- 81 Modern Records Centre, Warwick. Mss. 292/144.3/6.
- 82 Modern Records Centre, Warwick. Mss. 292/140.9/1; 292/144.3/6.
- 83 Parliamentary questions on the theme have been reviewed in the 'Parliamentary Intelligence' and 'Medical Notes in Parliament' sections of *The Lancet* and *The British Medical Journal*, respectively.
- 84 'Medical Notes in Parliament', *British Medical Journal*, March 11, i (1939), 542–43.
- 85 'Medical Notes in Parliament', *British Medical Journal*, July 4, ii (1936), 53.