Occupational health litigation and the development of occupational hygiene: Introduction – Part 1

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“. . . the danger to health is largely caused by solid matter, by dust suspended in the air.”
Dr Clement Le Neve Foster, HM Government’s Inspector of Mines, Expert Witness to the Accidents in Mines Commission on the 27 May 1879

“It is the opinion of the best qualified judges that dust is largely responsible for the respiratory ailments from which the miner so often suffers.”
Dr Clement Le Neve Foster, HM Government’s Inspector of Mines and Professor of Mining, Royal School of Mines, 1894

“Each industrial occupation may be said to involve risks to health...
Probably the worst enemy of the miner is dust . . . . .
The mortality from silicosis on the Rand, especially among the rock-drill men, has been appalling.”
Sir Clement Le Neve Foster, BA, DSc, FRS, 1903

BACKGROUND TO THIS SERIES OF PAPERS
The silicosis litigation class actions against gold mining companies in South Africa in the 21st century have influenced the Occupational Health Southern Africa editors to include a series of papers covering occupational health litigation. This series, written through the eyes of an occupational hygienist, using the definition of ‘litigation’ as “the process of taking legal action”, will travel in general from the 19th century to the current silicosis litigation in South Africa. The second paper in this series, dealing with ‘slavery’, will travel back to antiquity. The series will also trace the development of industrial/occupational hygiene as we know the terms today, to add to the published history on this subject, and because their development can often be linked to occupational health litigation.

In Britain, the work and prosecutions by HM Government’s Inspector of Mines, Dr Clement Le Neve Foster, in the last decades of the 19th century, are an important watershed in the development of industrial hygiene. In the United States, the development of industrial hygiene was influenced by litigation involving the ‘dusty trades’. In South Africa, the current silicosis litigation is intrinsically linked to a lack of industrial hygiene development by the mining companies in the 20th century.

On the Witwatersrand, gold production started as a mere trickle in 1886, but increased rapidly and, by 1898, the Transvaal was producing more than 25% of the world’s newly-mined gold.2 By 1905, South Africa had become the world’s largest gold producer and remained in this position for over a century. The Witwatersrand Basin became the greatest source of gold, globally. From this small area, approximately 47 352 tonnes of gold was produced, or 31.4% of the 150 593 tonnes of gold produced throughout the world up to the end of 2002.3 At a value of US $40 000/kg, this gold would now be worth close to two trillion dollars.

The gold mining industry had research programmes on airborne dust measurement and control, and world-class expertise in these fields; it has been argued that the discipline of industrial hygiene developed in South Africa in the 20th century with efforts to address airborne dust in the gold mining industry. Yet there were basic flaws in the programmes carried out to address airborne dust, and in the legislation to protect workers against dust, and inadequate enforcement of the legislation. The Leon Commission concluded, in 1995, that the Minerals Act and the derived regulations were inadequate for the prevention, control and early recognition of work-related health conditions – a missing critical component being the risk assessment process with the failure to incorporate the processes of hazard identification, exposure measurement, control, and subsequent further monitoring of exposure, to ensure adequate control. The Leon Commission considered that the Mining Inspectorate was under-funded and under-resourced and commented that “Good legislation is only one aspect of enforcement. If the State does not provide an adequate enforcement agency the value of good law and regulation is lost.”

In a National Union of Mineworkers (NUM) 1994 submission to the Leon Commission,5 one of its main conclusions was that:
“Dust levels on South African mines continue to pose a risk to workers. Existing regulations and systems have proved ineffective in adequately reducing the levels of dust.”

The Leon Commission also reported that a NUM submission stated that:
“the loss of life and the destruction of health as a result of mining is staggering”.

On return to South Africa in 1995, the author was concerned about the low standards required for certification of occupational hygienists compared to the UK and USA and commented, in 1997, “The profession of occupational hygiene is critically needed for
the development of healthful and safe working conditions in South
and Southern Africa. To minimize occupational and environmental
trends, knowledgeable and competent professionals with special
advanced skills and knowledge are a necessity. Currently, they are
in very short supply in the region... In the coming years we need
to substantially raise the standards of occupational hygiene cer-
tification and practice in this country to tackle occupational health
problems that are as severe as anywhere in the world.7

The positive aspects of the work of the mining industry to
address airborne dust were reported by the author in 2006 as
part of efforts to understand what further research was required
to address airborne dust.8,9

In this new series of papers, the author will explore what went
wrong with efforts to address airborne dust on the South African
gold mines from the start to the present day. Various factors were
influential, including some that predated the Witwatersrand gold
mining industry. These included the role of the mining interests
in Britain so that metalliferous mines were largely unregulated
until 1872 with regards to protection of health, life and limb; with
the eventual introduction of health and safety legislation their
influence, so that inadequate standards to protect health were
set. Also, gold mining started on the Witwatersrand in the Zuid-
Afrikaansche Republic (ZAR) when some aspects of slavery,
although officially abolished, were still in existence. Despite the
severity of the working conditions, professionally qualified occu-
pational hygienists were not employed on a full time basis by the
South African gold mining companies in the 20th century.

This first paper provides an introduction to the development
of industrial/occupational hygiene and a brief overview of the work
of two important figures in the history of occupational hygiene who
both worked for the Home Office in Britain. It covers the work of
Clement Le Neve Foster in HM Government’s Mining Inspectorate
and his inspections and prosecutions in the last decades of the
19th century to improve working conditions in mining. The paper
continues with the work in the first decades of the 20th century
by George Elmhirst Duckering in HM Government’s Factory
Inspectorate on quantitative measurements of worker exposures to
airborne particulates to improve working conditions in factories and
workshops. The paper also gives a brief overview of the current
silicosis litigation against the gold mining companies.

Proposed themes for the future papers in this series are pro-
vided. The silicosis litigation is a slow process and further develop-
ments may take many more years to occur. To allow flexibility,
future papers in this series may change in their order and content
as additional information is gathered and as input is provided from
readers on any additional litigation or related papers they would
like added to this series.

It is hoped that the papers, like the pieces of a jigsaw puzzle,
will come together to show the bigger picture of what happened
in the past and how this impacts on the present, particularly with
regard to the development of occupational hygiene and the cur-
rent silicosis litigation.

“The farther back you can look, the farther
forward you are likely to see.”

Sir Winston Leonard Spencer-Churchill.

THE LITERATURE ON INDUSTRIAL/OCCUPATIONAL
HYGIENE DEVELOPMENT

In the 19th century and the start of the 20th century, the term
‘industrial hygiene’ was generally applied to the pioneering work
of medical doctors practicing what is now termed ‘occupational medi-
cine’. Important medical figures in the development of occupational
hygiene, Bernardino Ramazzini (1633 - 1714) and Charles Turner
Thackrah (1795 - 1833), were both referred to by Thomas Morison
Legge,10 HM Chief Medical Inspector of Factories and Workshops,
as ‘pioneers in industrial hygiene’ in Volume 1 of The Journal
of Industrial Hygiene published in 1919/1920. This journal was
founded with editors David Linn Edsall, Dean of Harvard Medical
School, and Professor Albert Frank Stanley Kent, Professor of
Physiology, University of Bristol. The Honorary Consulting Editor
was Thomas M Legge. Associate editors were also from the US
and Great Britain and, with Volume 2, also Australia and South
Africa (W Watkins-Pitchford, Director of the South African Institute
for Medical Research and Chairman of the Miners’ Phthisis Medical
Bureau). Primarily based on his publication, Diseases of Workers,
Bernardino Ramazzini has long since been referred to as the
‘Father of Occupational Medicine’.

In 1902, the ‘British Medical Association’ established an
‘Industrial Hygiene Section’ and, in 1935, a small group of doctors
working in industry met and formed “The Association of Industrial
Medical Officers”. This association changed its name in 1965 to
‘The Society of Occupational Medicine’. Thus, the medically quali-
fied ‘industrial hygienist’ in Britain became the ‘industrial medical
officer’ and then the ‘occupational medicine practitioner’.

With regard to the term ‘industrial hygiene’ as we know it today,
from an American perspective, Robert L Harris wrote that the
term ‘industrial hygiene’ is probably of 20th century origin,11 but
the origin of the words go further back in history. He commented
that the dictionary meaning of the word ‘industry’ has its English
origin in the 15th century and is described as “systematic labor
for some useful purpose or the creation of something of value”.
For the word ‘hygiene’, the origin goes back earlier to Greek
mythology and Hygieia, a daughter of Aesklepios, the God of Medicine. Hygieia “was responsible for the preservation of health and prevention of disease; thus, when she was dealing with people who were engaged in systematic labor for some useful purpose, was practicing the profession, industrial hygiene.”

Vernon E Rose reflected that: “As with most professions, identifying the origins of the practice is difficult, if not impossible… The recognition of a causal link between workplace hazards and disease was a key step in the development of the practice of industrial hygiene. The observations by physicians, from Hippocrates to Ramazzini, and extending into the 20th century, of the relationship between work and disease, are the foundation of the profession.”12 However, he considered that recognition of hazards without intervention and control, i.e. without prevention of disease, should not qualify one as an industrial hygienist. After discussing the British Factory Acts in the 19th century, Rose considered that: “The real watershed in industrial medicine and hygiene, however, came in the British Factories Act of 1901 which provided for the creation of regulations to control dangerous trades. The development of regulations created the impetus for investigation of workplace hazards and enforcement of control measures.” Rose also mentioned the suggestion that industrial hygiene did not “emerge as a unique field of endeavour until quantitative measurements of the environment became available.” The latter statement was in regard to a paper by Harold V Brown13 who argued, in 1965: “Industrial hygiene can be said to have started in South Africa, for there the various separate parts of the practice came together harmoniously for the first time - air sampling done repetitively by a reproducible method, which was correlated with medical findings, and these in turn were used to establish a ‘safe working level’. The tentative safe dust level was used as a criterion for devising engineering controls, the effectiveness of which was checked by more air sampling and medical follow-up. This is a pattern that has been followed repeatedly all over the world by industrial hygienists. The mines of the Transvaal were the source, not only of one of the most abundant supplies of gold, but also of one of the most abundant ‘supplies’ of industrial hygiene knowledge, experience, and inspiration, especially relating to dust problems.”

In future papers in this series, dealing with the themes of Phthisis, and silicosis litigation in South Africa, the validity of the first part of this statement by Brown will be explored as well as the second part, dealing with the abundant “supplies” of knowledge, experience, and inspiration.

An obituary in the British Occupational Hygiene Society journal, The Annals of Occupational Hygiene, for Theodore F Hatch (1901-1986),14 one of the founding fathers of industrial hygiene in the US, reported that he originally intended to become an architect and took his first degree in civil engineering at the University of Maine. There he was first influenced to develop a career in industrial hygiene, by Professor Embert Hiram Sprague “whose experience in South African diamond and gold mines, where life expectancy was then short, had impressed upon him that engineers were in a position to do harm as well as good. Hatch thus developed his life-long conviction that there was a place for engineers with concern for the impact of technology on man.”

Three papers published in 2003/4 in the Annals of Occupational Hygiene were on important developments in occupational hygiene: JW Cherrie gave Jerry Sherwood’s work on personal sampling in the late 1950s the accolade of “The beginning of the science underpinning occupational hygiene” 15. Stan Roach’s work on exposure patterns, body burdens and the risk of harm in the 1970s was cited by SM Rappaport and M Flynn as a first,16 together with Roach’s paper on the impact of turbulent diffusion upon industrial ventilation. The paper by Tim Carter on British Occupational Hygiene Practice 1720 -1920,17 supports a much earlier origin for occupational hygiene practice than generally acknowledged; an origin that was closely intertwined with the industrial developments of Britain and which also involved major innovations in other European nations. He states “The first recognition of the profession of occupational hygienist was preceded by at least 200 years of developments in disease prevention practices in the workplace, many of which could readily be characterized as occupational hygiene.” Carter briefly mentions the work of Duckering on anthrax and this would appear to be the only mention of Duckering in the Annals of Occupational Hygiene. A search of the Annals of Occupational Hygiene gave no mention of Clement Le Neve Foster.

SIR CLEMENT LE NEVE FOSTER, DSc, FRS (1841 - 1904)

Papers reviewed by the author on the history of industrial/occupational hygiene have not given sufficient credit to the work of Clement Le Neve Foster DSc, HM Government’s Inspector of Mines, to improve working conditions in mines, following the Metalliferous Mines Regulation Act of 1872. While recognised as a distinguished author, geologist, metallurgist, mining engineer, scientist, Professor of Mining, HM Government’s Chief Inspector of Mines and Home Office Editor for the British Mining Statistics of the World, his work to improve working conditions in mining and his related publications are an important watershed in the development of industrial/occupational hygiene. Despite the vagueness of the requirements for mine ventilation under the Act of 1872
Le Neve Foster on 28 April 1904, states:22

A watershed period in the development of industrial hygiene to improve working conditions in British factories and workshops is that of deleterious substances inhaled by workers per working day and the work of the skilled chemist, George Elmhirst Duckering, HM Principal Specialist Inspector (Occupational Hygiene). He considered that Duckering was, in effect, the first UK specialist occupational hygiene inspector and that his work was exemplary.23

Duckering played no small part in the success of combating this disease in his work with bacteriologists and the Anthrax Investigation Board. Duckering investigated dust exposure in processes preparatory to the manufacture of wool, goat hair and camel hair – the work being published in 1913. He spearheaded the effort to find ways to kill the anthrax spores without ruining the fleeces and devised, in great detail, an entirely satisfactory, economic, disinfecting process for anthrax-infected wool, using formalin. In 1919, the Anthrax Protection Act was passed. No mohair, raw wool or alpaca was allowed into Britain unless it had first been decontaminated. In 1921, a Home Office Disinfection Station was opened in Liverpool (a principal port by which wool entered Great Britain). It was capable of treating 10-12 million tons of imported wool and hair per year.

Cases of inhalation anthrax in the wool industry diminished sharply after this.24 Duckering was the first director of the Liverpool Disinfection Station where he remained until his retirement in 1940. At the Station he conducted further research on the use of steam, ultra-violet light and other methods of disinfection. In 1925 he was honored by appointment as an ‘Officer (Civil Division) of the Most Excellent Order of the British Empire’ (OBE). The so called ‘Duckering Process’, using formalin, is still recommended by the WHO today for disinfection stations for dealing with the import of wool, hair or bristles from endemic regions.

Reliable, systematic measurements of the exposures of workers to deleterious substances and an understanding of how those exposures occurred, was to become an important component of industrial/occupational hygiene practice to ensure adequate control to minimise exposure, and further in the future exposure records would be important for litigation defence (and attack).

**USE OF THE TERMS ‘INDUSTRIAL HYGIENE’ AND ‘OCCUPATIONAL HYGIENE’**

In the 19th century, the term ‘industrial hygiene’ was in use in Britain, France, Germany and the US, and the term ‘occupational hygiene’ was reported to have been in use in Russia.25 This will be discussed in future papers in this series.

In Britain, the 9 March 1923 edition of *Chemistry and Industry*, the journal of ‘The Society of Chemical Industry’, stated that “Industrial hygiene is of interest to all readers of this journal and is becoming a subject of considerable importance.”26 An account was given of the work of GE Duckering at the wool-disinfection station and in a paper read to the London branch of the Society by Dr TM Legge. The journal reported “The Home Office... is to be warmly congratulated on having such men as Dr Legge and Mr Duckering to advise it. Among the experts, their reputation is very high, and it should be equally high among all those who are interested in the application of science to the benefit of mankind.”

In the paper by Legge in 1923 to ‘The Society of Chemical
Industry' titled 'Industrial Poisoning and the Works Chemist', he asked for the assistance of the works chemist in industrial hygiene and said "if chemists, during their training, could get systematic information about the toxic properties of the materials they had to handle, it would be of great advantage." 27 During the discussion it was considered: "Co-operation between the medical man and the works chemist would be of the greatest value;", "...chemists should understand the early symptoms of industrial poisoning, so as to investigate suspicious cases before the effects were serious," and "the chemist could be effective in dealing with industrial poisoning in many works if he were encouraged by the management to work hand in hand with the medical staff." Dr Legge had the highest regard for the work of Duckering28 and, in presenting his paper, was undoubtedly influenced by this and the work of other chemists for the inspectorate and industry. The term 'occupational health' was in use by circa 1920 or earlier, and the split into the two core disciplines 'occupational medicine' and 'occupational hygiene' can be said to have grown particularly from the collaborative occupational health research of Legge and Duckering (the medical man and the skilled chemist) at the HM Factory Inspectorate in the first two decades of the 20th century.

The chemist (and other disciplines) with specialised education and training became the 'industrial hygienist' and then the 'occupational hygienist' with the formation, in 1953, of the British Occupational Hygiene Society. At the time, it was thought that the word 'industrial' might be construed as excluding agriculture.

CURRENT SILICOsis LITIGATION IN SOUTH AFRICA

Following the success of legal teams in obtaining compensation for asbestos workers in South Africa, legal proceedings were launched in 2004 on behalf of South African former gold miners and their families, against the Anglo American Corporation of South Africa, Ltd. Eighteen miners from the President Steyn mine and five miners from other Anglo American mines in the Free State were demanding compensation for silicosis and silico-tuberculosis. After nine years, a confidential settlement was reached in 2013. At the time of the settlement, seven of the 23 claimants had died since 2004 and the health of others was very fragile.29 This was reported to be the first such settlement of silicosis claims in South African history. The settlement is separate from a 2013 class-action suit the company faces in South Africa and the silicosis litigation in the English courts. As with the test cases, Anglo American denies any liability in the class action proceedings. In 2012, claims were commenced in the Johannesburg High Court against AngloGold Ashanti Ltd. on behalf of 31 former gold miners who allege that they contracted the lung diseases, silicosis and silico-tuberculosis, from excessive dust exposure during their employment on the Vaal Reefs gold mine complex. Two of the 31 miners have since died. The claimant group has now expanded to more than 1 250 former Vaal Reefs miners.

On 3 March 2011, a landmark Constitutional Court ruling was made in favour of former miner, Thembekile Mankayi, that he had the right to sue AngloGold Ashanti for loss of earnings, pain and suffering, and medical costs arising from his mining-related illness in the form of tuberculosis and chronic obstructive airways disease. The Constitutional Court judgement overrides an earlier ruling by the Johannesburg High Court and the Supreme Court of Appeal in Bloemfontein that miners who had already been compensated in terms of the Occupational Diseases in Mines and Works Act (ODMWA), could not sue their former employers for further damages. Mankayi had been paid R16 320 under ODMWA from the Compensation Commissioner and was seeking to claim R2.6 million in damages from AngloGold Ashanti. Tragically, Mankayi died on the 25th February 2011, five days before the Constitutional Court judgement, but this judgement opened the doors to claims against gold mining companies from afflicted miners and their families from South Africa, Botswana, Malawi, Mozambique and Lesotho. An estimate has been given of 480 000 ex-mine workers suffering from compensable occupational lung diseases in the southern African region.30,31 In December 2012, the largest silicosis class action suit in South African history was launched against some 30 gold mining companies. This class action suit for silicosis was consolidated in 2013, with two other class actions by other legal teams.

A class action against the South African coal mining companies for occupational-related lung disease is currently being explored. Legal actions against other mining companies, such as those mining manganese, could follow.

FUTURE PAPERS IN THIS SERIES

Part 2 of this introductory paper (to be published) will discuss the themes for the future papers in this series which will address: slavery; early health and safety legislation and the legal obstacles to workers compensation; royal commissions on mining health and safety; the role of the news media in influencing workplace health and safety improvements; Dr Clement Le Neve Foster and his work to improve working conditions in mining; exposure measurements and the pioneering work of George Elmhirst Duckering; the development of industrial hygiene in the US; litigation cases suggested by readers; coal mining litigation and compensation; chemical poisoning litigation; asbestos litigation; the phthisis problem in mining manganese, could follow.
South Africa and how it was addressed; current silicosis litigation in South Africa; and lessons learnt.

FURTHER CONTRIBUTIONS TO THIS SERIES OF PAPERS

The author and the editors of Occupational Health Southern Africa would be glad to consider any particular occupational health-related literature that readers would like to add. Any other contributions to this series of papers would be appreciated, such as additional information, a guest author paper dealing with occupa-
tional health litigation, the development of occupational medicine, or the development of occupational hygiene.

The author would be grateful for any information on examples of the early use of the terms ‘occupational health’, ‘occupational hygiene’ and ‘occupational medicine’.

ACKNOWLEDGEMENTS

This series of papers owes much to the World Wide Web and the ability to search large numbers of books, journals, magazines, newspapers, reports and theses. In addition, the availability of well-
stocked local libraries, and the ease of purchase of publications through the websites of specialised book sellers were valuable contributors. In particular, it gave me the drive and opportunity to include some information from unpublished work conducted in major libraries of the UK and US in the 1970s, to prepare an extensive annotated chronological bibliography on ‘The History of Airborne Particulate Sampling 1656 - 1975’. An interest in the history of occupational health also arose from the preparation of the ‘Chapter on South Africa’ for the International Commission on Occupational Health (ICOH) book on the Origins of Occupational Health Associations in the World, published in 2003.

An influence in 2014 for this series of papers includes the extensive diaries by ‘stieffen’ on the US website Daily Kos’ and, particularly, the series under the Tag ‘How regulation came to be’ and a series of papers on ‘British Mining Memoirs’ on the website of The Northern Mine Research Society, Sheffield, UK. This includes the papers by Peter J Challis, R Alan Williams, and Christopher J Williams, which discuss British mining in the 19th century and the work of Dr Clement Le Neve Foster. Peter J Challis also wrote his MSc thesis in 2000 on ‘The Professional Life of Sir Clement Le Neve Foster’ and was responsible, together with the Conwy Borough Council, for the erection of a Memorial Plaque at the former home of Dr Clement Le Neve Foster (now the Min y Don Hotel), in Llandudno, north Wales. The books by Elaine N Katz and Catherine Mills were an early starting point for me to look at how events in Victorian Britain impacted on the Witwatersrand.

A large number of additional references were utilised in the preparation of this series, many of which will be included in the future papers.

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