Workplace Health and Safety Queensland

Submission to the Senate Community Affairs Reference Committee

Inquiry into Workplace Toxic Exposure

Workplace Health and Safety Queensland
Department of Industrial Relations

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Introduction

This submission is limited to silica exposure issues and will not address other toxic dusts. Such toxic dusts would include asbestos, coal dusts, wood dusts, heavy metal dusts including lead, beryllium, graphite, grain and sugar bagasse or other dusts exhibiting endotoxins.

What is silicosis?

Silicosis is a preventable, non-reversible, and sometimes fatal, occupational lung disease caused by inhaling dust containing crystalline silica (SiO_2) (Valiante et al, 2004; U.S. Department of Health & Human Services, 2002; Scafa et al, 2004). The respirable crystalline silica can be in the form of quartz, cristobalite, or tridymite (Franco, 1994). Silicosis is characterised by a diffuse, nodular, interstitial pulmonary fibrosis (Landrigan, 1987).

There is a general consensus amongst the researchers that the latency period of most cases of silicosis is in excess of twenty years from first exposure (Valiante et al, 2004; Rosenman et al, 1996; Landrigan, 1987). The onset of acute silicosis is less than ten years after initial exposure to respirable crystalline silica (Rosenman et al, 1996; Bahrami and Mahjub, 2003; Landrigan, 1987). Bahrami and Mahjub (2003) found that the signs of silicosis appeared in Iranian stone-grinder workers after only 5-7 years of employment. Landrigan (1987) believes that acute silicosis starts between one and five years from initial exposure and that the disease is rapidly fatal.

Silicosis and progressive massive fibrosis (PMF), which is a severe form of silicosis, can appear or even progress, even after exposure has ceased (Soutar et al,2004). In coalminers, the risk of silicosis and PMF is related to the nature of the dust exposure, the height and weight of the individual, the age, the proportion of carbon in the coal, and the presence of mild pneumoconiosis. Infante-Rivard (2005) found that early detection of silicosis or detection of mild silicosis is associated with a survival pattern similar to unaffected persons of the same birth cohort in society. Workers exposed to respirable crystalline silica who are regularly monitored present for compensation at a less severe stage of the disease on average (Infante-Rivard, 2005).

The consequences of silicosis vary. Apart from lung function impairment there is an increased risk of lung cancer, tuberculosis, mycobacterium infection and other pulmonary infections, rheumatic diseases such as scleroderma, connective tissue disease, and chronic renal disease (Valiante et al, 2004; Bahrami and Mahjub, 2003; Wagner, 1997; Landrigan, 1987; Scafa et al, 2004). Scafa (2004) found that the risk of developing tuberculosis increased with the severity of the silicosis. In addition, cigarette smoking increases the incidence and severity of respiratory symptoms of silicosis (Landrigan, 1987). Landrigan (1987) asserts that smoking does not increase a person's chances of developing the disease nor does it assist the progression of the pulmonary lesions. Some sufferers of silicosis can be free of symptoms.

Crystalline silica has been found to be a carcinogen in animals (rats) but it is yet to be proven in humans from epidemiology studies (Verma, Purdham and Roels, 2002). It was this revelation that led the International Agency for Cancer Research (IARC) to classify crystalline silica as a group 1 human carcinogen (Brown and Rushton, 2005; Verma, Purdham and Roels, 2002). Brown's research (2005) did not find any consistent correlation between respirable crystalline silica and the development of lung cancer. The ACGIH lists quartz silica as a suspected human carcinogen (Rosenman et al, 1996).

There have been occupational catastrophes in the past that have led to large numbers of workers dying from silicosis and silicosis related diseases. In the United States, the Hawke's Nest disaster resulted in at least 764 out of 5000 workers dying from silicosis, more than 15%. Most of the dead were working inside the tunnel they were building in quartz rich Gauley Mountain in West Virginia in the 1930's (U.S. Department of Health & Human Services, 2002).

Other catastrophes include the St. Gotthard tunnel in Switzerland in 1872-1880, where many are suspected to have died from silicosis, but were reported to have died from ancylostomiasis (Carnevale and Baldasseroni, 2005). The gold mines in Transvaal in South Africa were the first to reveal acute silicosis. There were also many silicosis tragedies in the mines of the tri state area of Missouri, Kansas, and Oklahoma (Carnevale and Baldasseroni, 2005).

In more recent times, epidemiological studies revealed that 33.7% of chinese tin miners exposed to respirable crystalline silica were shown to be silicotic (Verma, Purdham and Roels, 2002).

Threshold Limit Values (TLV's) for Respirable Crystalline Silica (RCS) vary. In the United States, the Occupational Safety & Health Administration (OSHA) TLV (known as the PEL or permissible exposure limit) is 0.1 mg/m3. This TLV is based on outdated toxicological data from the 1960's. (1) The limit *recommended* by the American Conference of Industrial Hygienists (ACGIH) is 0.05 mg/m3. This is equal to the recommended exposure limit imposed by the (National Institute of Health) NIOSH in 1974 (Rosenman et al, 1996; U.S. Department of Health & Human Services, 2002; Landrigan, 1987). In the UK, the maximum exposure limit (MEL) is 0.3 mg/m3. (8) In the Netherlands it is 0.075 mg/m3 (Tjoe Nij, 2003).

Landrigan (1987) asserts that the OSHA standard of 0.1 mg/m3 is not low enough to prevent silicosis. He also believes that the NIOSH standard of 0.05 mg/m3 is not low enough to protect against silica-induced lung cancer. Verma et al (2002) believe that some jurisdictions are locked into outdated standards because the process of changing them is too convoluted and difficult. The OSHA standard is one example. In addition, the current standards are based on the assumption that silica-induced lung cancer is only a risk to those with silicosis, and therefore preventing silicosis will prevent silica-induced lung cancer. This assumption is still being debated (Verma, Purdham and Roels, 2002).

Scope of the submission

Much, if not the majority, of dust related research of quality has been conducted on populations in mining because of their nature and relatively long working population survivorship. A considerable amount of work studying dust exposure in coal and metalliferous mining and its effects has been conducted by the Queensland Department of Mines (now Natural Resources and Mines) since around 1972. Workplace Health and Safety Queensland has no responsibility for mining so reference to that body of knowledge can only be made through the Department of Natural Resources and Mines. However reference will be made in this submission to research which has been reported from the mining industry within Australia from time to time to illustrate certain issues for which there has been no parallel research in Queensland's general industry.

By and large, this submission will not attempt to address the complex issues surrounding different diseases which are believed to be caused by silica exposure. There is significant debate being conducted at present, both nationally and internationally, particularly on the contribution of silica exposure to the development of lung cancer which remains a major disease in the community from smoking. However, in addition to its role in silicosis and lung cancer following significant cumulative exposures, silica exposure appears to be a causative factor in other diseases such as end-stage renal disease, immune disease and loss of respiratory volume. The position of silica, or indeed any very small particles known as nanoparticles, cannot be addressed by this agency at this time.

Rather, the submission restricts itself to those terms of reference relating to the identifiable history relating to silica dust exposures and attempts which have been made during the last 30-40 yearsto control that exposure. Significant reference is made to our available information on abrasive blasting as this is recognised as a primary focus of the Senate Inquiry.

Some discussion is also provided in relation to foundries where exposure to silica has traditionally occurred and still occurs.

Terms of Reference

(a) Health impacts of workplace exposure to toxic dust including exposure to silica in sandblasting and other occupations

Workplace Health and Safety Queensland programs in health and safety are initiated by a combination of knowledge of the risks which are known currently to exist in Queensland workplaces, from anticipation about future adverse outcomes or from those risks revealed through investigation, audit or complaint, and from historical outcomes arising from a range of sources including those from aggregated workers' compensation histories. Some of these drivers will be identifiable in the work reported in this submission particularly with respect to abrasive blasting.

The Senate Inquiry has highlighted that there are many workers from some decades past who may be identified with silicosis. Presumably the majority of such cases would be expected to be workers presenting with identifiable silicosis resulting from exposure during past decades, since it is much less likely that workers and employers operating under current regulatory regimes would allow similar circumstances now. Further, the capability of the regulatory agencies to address matters of significance in dust exposure has been greatly enhanced across all of Australia during the last 15 to 20 years. Nonetheless, evidence has been provided through this submission that during the period up to the late 1980s that some silica exposures would have been occurring during abrasive blasting operations which did not comply strictly with the regulatory requirements of the time.

It was, in fact, this non-compliance which appears to have contributed to the abrasive blasting industry reviewing its procedures in conjunction with the regulator during the late 1980s, and which resulted in the production of an Abrasive Blasting Health and Safety Manual in 1993 (Division of Workplace Health and Safety, 1993). How much the silica dust exposure which did occur during the 1960s, 70s and 80s is likely to have contributed to silicosis cannot be fully identified as reliable compensation statistics have been provided only as far back as 1992. Given that the latency of silicosis will be around 20 to 30 years (depending on years of first exposure and other factors), radiological confirmed cases ought to have been appearing from 1990 through to the present.

Statistics on silica related disease in Queensland 1992 – 2004

A review of the known compensable cases of silica related disease has been made. Table 1 has been provided by the Queensland Employee Injury Data Base (QEIDB) covering the years 1992 to 2004. Although the post 2000 data shown here give an indication of a increasing trend in cases of silicosis, the (from 2 cases to 4), there have been only 6 cases compensated for silicosis during that period and none has had a history in the abrasive blasting industry. This number of cases is probably too small for predictive purposes.

Thus the evidence related to incidence of compensable silicosis is rare and extremely limited for Queensland's workers as a whole and for abrasive blasting workers in particular. While the increase in longevity of almost some 15 years since 1950 may yet furnish cases of silicosis in those of advanced years, the evidence in Queensland is not strong for such a trend either.

Queensland’s experience of very low numbers of compensable dust disease related to silica exposure is mirrored by some other jurisdictions in other industries. In Western Australia (De Klerk and Musk, 1998; Wan and Lee, 1999), there have be no compensable silicosis cases from miners employed since the introduction of ventilation controls to meet new dust exposure standards introduced around 1975.

Diseases other than silicosis related to silica exposure

Where some unforseen outcomes could possibly occur in the future may be with those diseases other than silicosis which are being revealed elsewhere by pooled epidemiological studies An elevated risk of both lung cancer and renal disease have been identified with high cumulative silica exposures in some studies. Steenland (2005) suggests that from pooled analysis from ten studies, the excess risk from 45 years exposure at 0.1 $mg.m^3$ (cumulative exposure of 4.5 mg/m^3-yr) of lung cancer death is 1.7%. The excess risk of end-stage renal disease is 5.1% based on a single cohort, but reduces to 1.8% based on three pooled cohorts. An earlier study by Finkelstein (2002) suggested that the excess lung cancer risk from lifetime cumulative exposure at 0.1 mg/m^3 (eg between 3.0 - 4.5 mg/m^3-yr) could be increased by 30% or more.

At present the compensation statistics do not indicate significant evidence of large numbers of silicosis cases, but there are no statistics from the same source for Queensland in relation to lung cancer or kidney disease and silica exposure. However, as the exposure recommendation in Queensland has been 0.2 mg/m^3 for the last 35 years and as some abrasive blasting exposures are shown later to be potentially well above this figure, some excess incidence of lung cancer should not be excluded. Contribution of tobacco smoking will need to be thoroughly accounted for as will proper estimates of past cumulative exposure. In studies by Berry, Rogers and Yeung (2000 and 2001) on NSW Dust Diseases Board compensation cases, the excess lung cancer risk amongst compensated silicotics corrected for smoking, was found to be 1.90 (confidence interval 1.54 to 2.33) is highly significant so lung cancer remains an issue. Whether it remains to be so in the absence of silicosis is not yet fully clear and is expected to become a battleground for plaintiff lawyers and compensation bodies during the next 10 to 20 years.

An interesting point with respect to silica exposure and its role in lung cancer, which may have ramifications into the future, involves the recent 1998/9-2004 process under the National Occupational Health and Safety Commission of reviewing and revising the exposure standard for silica. Though the consultants’ report (De Klerk, Ambrosini and Musk, 2002) made its recommendation specifically highlighting lung cancer risk following its terms of reference, this was not so prominently reflected in NOHSC’s final Regulatory Impact Statement, and apparently reflecting public comment that crystalline silica might be identified as a carcinogen in Australia. Although the risk of non-fatal silicosis is well controlled by the proposed standard, the proposed reduced standard was intended to minimise the risk of lung cancer (invariably fatal) to a level acceptable by the community.

Table 1 QEIDB statistics on the cases of dust disease form 1992 to 2004

Industry	Occupation		Nature of Injury	
MINERAL SAND MINING	991111	Mining Support Worker	OTHER RESPIRATORY CONDITIONS DUE TO SUBSTANCES	INHALING FINE DUST OVER MANY YEARS/SILICOSIS OF LUNGS
SILVER-LEAD-ZINC ORE MINING	791111	Miner	PNEUMOCONIOSIS DUE TO OTHER SILICA OR SILICATES	MINING AT MT ISA MINES OVER A PERIOD OF TIME SILICOSIS FORMS IN THE LUNGS.
GRAVEL AND SAND QUARRYING	000000	UNKNOWN/NOT STATED	OTHER RESPIRATORY CONDITIONS DUE TO SUBSTANCES	SILICOS
GRAVEL AND SAND QUARRYING	999979	Labourers and Related Workers nec	OTHER RESPIRATORY CONDITIONS DUE TO SUBSTANCES	SILICOSIS OF THE LUNGS
CLAY BRICK MANUFACTURING	921913	Clay Processing Factory Hand	OTHER RESPIRATORY CONDITIONS DUE TO SUBSTANCES	BREATHING DUST IN AT WORK OVER THE YEARS/LUNG INJURY - SILICOSIS
CONCRETE SLURRY MANUFACTURING	122211	Production Manager (Manufacturing)	PNEUMOCONIOSIS DUE TO OTHER SILICA OR SILICATES	INHALATION OF FINE PARTICLES OF SAND,SILICOSIS LUNG DISEASE/PNEUMONCONOSIS RESPIRATORY SYSTEM

No of Claims		
	1992 – 2001	0
	2001/2002	2
	2002/3	4

(b) the adequacy and timeliness of regulation governing workplace exposure, safety precautions and the effectiveness of techniques used to assess airborne dust concentrations and toxicity

2.1 There are five interrelated issues in this term of reference which encompass about a century of labour, fundamental research, development and refinement of toxicological and epidemiological knowledge on dust disease and its regulatory control throughout the industrialised world. They are:

- regulation adequacy
- regulation timeliness
- safety precautions taken with toxic dust exposures
- techniques for assessing airborne dust concentrations
- toxicity of the dust.

Clearly all that accumulated knowledge and research and its impact cannot be adequately communicated to this Inquiry, but some of the important steps covering the last forty years of Queensland's history are presented. One of the ***omissions from the terms of reference*** which Workplace Health and Safety Queensland notes is that there is no express invitation to comment on the ***adequacy of the actual exposure standards or the methods by which they are established***, as distinct from the regulations, which have applied at different times over those 40 years. Regulation can be entirely different from exposure standards, for example, quartz can be banned from certain processes making exposure standards irrelevant. Indeed, the process of establishing exposure standards to be taken up by the State jurisdictions is at the very heart of the entire national effort to control ALL respiratory disease related to inhaled toxic dusts, not simply the adequacy of a State regulation. In the case of exposure to silica, this will include not only silicosis, but should include lung cancer, airways disease, renal disease, auto-immune disease, etc. For the purposes of this Workplace Health and Safety Queensland submission, the term of reference on adequacy of regulation has to be interpreted as the adequacy and timeliness of the exposure standards. The issue even extends to how those standards ought to be applied. These matters could require an examination by the Senate Inquiry of the Australian Federal Government's own performance and the critical resources it has moved from this most important of undertakings over the last 10 years.

Consequently, because of the pervasiveness of crystalline silica in so much of extractive industry and building product manufacturing in which bans are rarely feasible, the issue of exposure standards (not only how to make measurements) has been absolutely central to every regulator, every industry operator, every OH professional, to measuring equipment suppliers, to control technologists, to technical standards writers and to the workers interested in their exposures and in fact, has been the driving force to all work in this field at least for the last half a century. The economic impact upon industry of regulatory change is no more able to be ignored by regulators than is the cost to the community of dust related disease. Although the Senate Committee members may feel that any questions related to the dust exposure standards and their setting are not important, Workplace Health and Safety Queensland would encourage the Committee also to embrace in its work the deliberate consideration of the processes and resources needed for Australia to gain the best guidance its workforce deserves. The recent events demonstrated in the process of reviewing the respirable crystalline silica, a process which took the federal government a period of almost six years to complete and during which the Australian government disbanded the resources necessary to coordinate the research, indicates that this process is perhaps fatally flawed. There is no longer any federal agency with the capacity to act in the national interest in such fundamental areas as occupational health research and data collection and analysis, all of which are critical to the establishment of occupational health exposure standards.

2.2 Development of new dust standards or refined methods for measuring dust exposure typically have preceded the promulgation of any new dust regulations. These have been the dominant considerations in Queensland (and most of Australia) in order to understand the contributions of exposure to disease and then how to put in place adequate controls. Because of the latency of disease, some of that appearing now will have had its genesis up to 40 years ago, the Workplace Health and Safety Queensland review commences around the 1960s. During the last 100 years, exposure to dust has resulted in dust diseases which, in Australia, have claimed thousands of lives and caused some incapacity and suffering to tens of thousands of others. During the same period, control of dust exposures following increasingly stringent dust standards has, with the noted exception of asbestos, reduced present and future incidence of dust disease to a tiny fraction of that previously observed. Examples from coal mining best illustrate. The prevalence of coalworkers' pneumoconiosis in some studied mines in Australia which had been as high as 27% before World War II (Moore and Badham, 1931) and 16% in 1948 (Glick, 1968) has been reduced to virtually non-existent levels by the turn of the 21^{st} century. Setting of standards is now governed by more precise epidemiological studies and processes which must include the cost of regulatory impact, but the spectacular improvements witnessed during the last century can no longer be duplicated.

Industry generates the problems which the community expects governments will know how to solve. The following account should highlight, at least in skeleton detail, of its part in the vast global undertaking to rein in dust exposures and control dust disease. It has never been an uncomplicated exercise in any part, partly because of the competing needs for economic development in which many became dust exposed and the desire for better health outcomes, and partly because better retrospective epidemiological studies reveal new adverse outcomes.

The principal legislation which Workplace Health and Safety Queensland administers covering respirable crystalline silica (RCS) exposures is the *Workplace Health and Safety Regulation – Part 13 Hazardous Substances*. This applies to all non-mining occupations in Queensland, other than those where federal OHS legislation might apply. Where RCS is the component of the dust central to any health consideration, the Queensland regulation, along with all the other State OHS jurisdictions, adopts as its reference, the *National Exposure Standard for Atmospheric Contaminants in the Occupational Environment* (NOHSC, 1995). Some of the mining regulatory authorities have in recent years applied slightly different standard to their particular industry sectors.

Abrasive blasting is now supported in Queensland by additional subordinate legislation in the form of an industry developed and supported document which will be examined later.

Effectiveness of techniques used to assess airborne dust concentrations and toxicity

Short history of silica and dust standards in Queensland other than in mining

The history of this process must be foreshadowed by the general comment that in the years prior to 1984, there was no coordinated system within the Australian States leading to systematic management of occupational health and safety, even in issues as complex, pervasive and costly as those of occupational respiratory diseases related to coal dust, silica or asbestos. All States followed their own counsel. A loose alliance of the few available occupational hygiene and occupational medicine practitioners with responsibilities and a common interest in worker health, banding together regularly under the auspices of the National Health and Medical Research Council, carried out some basic studies and made some considered recommendations. It was out of the major dust concerns and two Australian pneumoconiosis conferences that the drive arose to form both the National Occupational Health and Safety Institute and the National Occupational Health and Safety Commission. From those two bodies the expertise was developed to understand the size and the complexity of dust diseases and just how it should be researched and addressed into the future in Australia, and also to coordinate State activities to achieve better outcomes for the dust-exposed workers of Australia.

Ironically as the stature of the National Institute and its contribution and influence grew, the OHS institutions in the States which conducted much of the fundamental research, field work and investigations into dust problems in Australian industry diminished or virtually ceased their operations as the regulatory ethos took over. It is history now that the Federal Government since 1996 set on a program to actively dismantle the National Institute and to disband the expertise which had been assembled. The reconstitution of a federal body in the Department of Workplace Relations does not possess the same expertise so the issue has been essentially handed back to the States. Little capacity exists for any significant research to be conducted by the States on these issues, other than in the mining jurisdictions. The lack of expertise in assembling and analysing data for preventive activities on a national basis is at a critical point.

1960 – 1970

It needs to be recorded that in the era prior to the Workplace Health and Safety Act of 1989, there were no specific standards relating to dust or silica exposure in legislation for non-mining industries in Queensland. Recommendations to industrial workplaces based on the most current NHMRC recommendations at the time were usually given by Queensland Health Department officers when investigations were made, but these held no regulatory standing. When the modern Robens type legislation was introduced in 1989, there still existed no regulatory requirements which could have utilised the NHMRC recommendations relating to silica dust exposure levels. [Asbestos was the only substance so regulated.] It was not until after the introduction of the Queensland's new Hazardous Substance Regulations in 1995 which followed the

National Model Regulations (NOHSC, 1994*)* utilising the exposure standards released in 1990 (NOHSC, 1990) that some firm legislative coverage was extended to workers in general industry.

Because of the latency of silica related diseases (usually 20 or 30years +), it is appropriate to consider the development of crystalline silica standards, their change over time and the way they were applied in the past. This is considered warranted because the current Senate Inquiry has an interest in potential outcomes which have their genesis in industrial exposures expected to have occurred in the 1960s and 1970s. Some of this history in standards development and application will be duplicated in other States because of the recognised need for each State to follow the most up to date developments in assessing health risks associated with crystalline silica. It has been influenced also by a combination of steady development of new measurement technologies and the findings of epidemiological studies carried out in different countries amongst their dust-exposed populations. That process is constantly underway and continues today.

In the 1960s, the earliest period of consequence to this submission and for which Workplace Health and Safety Queensland has some recoverable knowledge, dust exposure was able to be measured only by counting of dust particles. Apart from mining, measurements of dust containing silica were made spasmodically in Queensland by the Department of Health using instruments such as the Standard Thermal Precipitator (STP) and the Owens Jet Dust Counter. There were no measurements conducted by the then Department of Industrial Affairs or its predecessor Department of Labour(?) using the Rules of the Shops and Factories Acts. Guidance on what was an appropriate “dust count standard” was available from the National Health and Medical Research Council’s (NHMRC) *Schedule* (NHMRC, 1964). The following values for siliceous dusts are taken from that publication:

Siliceous Dusts-	*Particles per cubic Centimetre of air*
a) Free Silica 1 per cent to 10 per cent	700
b) Free Silica 10 per cent to 50 per cent	400
c) Free Silica over 50 per cent	200
Mineral dusts not otherwise included	700

One of the enduring difficulties of dealing with any of these dust exposure scenarios is that of making sense of retrospective exposure histories in the light of epidemiological findings which appear decades later. It is invariably complicated by paucity (even complete lack) of exposure data, inadequacy in measurement, changes in the technology for measuring the risk, changing emphasis in disease risk, potential economic constraints and even changes in demography of the dust exposed population (eg. greatly increased life expectancy and shorter or longer periods of exposure). All of these issues have had impact on the growth of understanding of silica related disease in working populations.

The period prior to about 1970 in which particle count assessment approaches dominated is characterised by scant and poor knowledge of exposures of those in dusty industries. Between 1970 to 1978 gradual improvements in measuring technology were made, though opportunities to utilise them were not coordinated sufficiently to gain a wide appreciation of the extent of the problem.

1970 – 1980

By 1970, international research into dust exposure and disease issues in silica was firmly leaning in favour of making assessments of dust exposure by means of either ***respirable mass*** of the dust in the air or on the ***respirable surface area*** of the dust. Traditional dust counts currently in recommendations or regulation were being abandoned internationally as such measurements bore little relation to the risk of disease. In Queensland in the early 1970s, the Department of Health initially adopted a respirable surface area parameter, particularly for its collaborative investigations with mining regulators (Couper, Grantham and Rathus, 1972). However, the NHMRC was firmly favouring respirable mass (though instrumentation was scarce) as the appropriate metric, and Queensland and the rest of Australia fell into line with that recommendation by 1978. Respirable quartz was recommended at 0.2 mg/m^3 (NHMRC, 1978). However, there was still no regulatory provision for silica exposure in general industry.

1980 – 1995

During this period, any exposure assessment work followed the 1978 recommendations of the NHMRC until the specific regulations limiting exposure were introduced in 1995. Respirable mass measurements became uniform with most measurements being conducted with cyclone elutriators.

1995 to present

From 1995, the *Workplace Health and Safety Queensland Regulations - Part 13 Hazardous Substances* introduced the first regulatory requirements relating to silica dust exposure. These were 0.2 mg/m^3 for the period 1995-2004 and 0.1mg/m^3 from 2004 to the present.

Resume on the effectiveness of techniques for assessing workplace exposures

So far as the techniques are concerned, Queensland, through the Department of Health research from 1969 to around 1985, pursued the most up to date methodologies for measuring or assessing workplace dust exposures that were being developed internationally. This was also the case for most Australian States, and was probably greatly facilitated because of the general absence of a regulatory framework which permitted much experimentation, instrument trailing and cooperative development between the States.

Significant milestones in development of monitoring of exposure were

1968	First Australian Pneumoconiosis Conference in 1968
1970	Introduction and trial of the Diffraction Size Analyzer
1970	NHMRC recommendation of gravimetric respirable mass measurement using the Johannesburg/BMRC mass selection criterion
~1970	Introduction of the MRE horizontal elutriator for respirable

	dust measurement (particularly in mining)
1972-4	Abandonment of old particle count methodologies Widespread introduction of personal sampling methodology using personal gravimetric cyclone elutriators
1975-8	Development of modern analytical techniques based on infrared spectroscopy or X-Ray Diffractometry to measure quartz content of respirable dust samples
1978	Second Australian Pneumoconiosis
~1980-2	Introduction of Australian quartz reference material A-9950
1984	Publication of *Methods for Measurement of Quartz in Respirable Airborne Dust by Infrared Spectroscopy and X-Ray Diffractometry* by NHMRC
1987	Introduction by Standards Australia of *AS 2985-1987 – Workplace Atmospheres – Method for Sampling and Gravimetric Determination of Respirable Dust*
2004	Revision of the AS 2985 to change the measurement of respirable dust from the Johannesburg/BMRC convention to the International Standards Organization (ISO) definition of respirabilty, and its adoption by NOHSC

Most of the changes from around 1970 up until 1987 usually occurred within five years, but usually 2 to 3 years, of developments elsewhere in the world. The one major international change in assessment which was delayed significantly was the change in measurement conversion from Johannesburg/BMRC to the ISO standard which was proposed internationally around 1987 and was introduced in the UK in 1997. This finally followed in Australia 7 years later in 2004. That delay, resulting from the combination of the 1992 Technical Committee (NOHSC, 1996) findings hiatus, the disbanding of the National Institute, the winding down of the NOHSC and the draining of technical capabilities out of the former State occupational hygiene facilities, serendipitously permitted another full decade of surveillance in the mining industry under the one measurement convention.

The ability to investigate compliance with existing exposure standards and to develop new standards and methods of measurement for toxic materials has been diminished due to the loss of a national body of expertise and the focus on legislative compliance. Increasingly burdensome administration and consultation have exacted a time penalty on the rate at which new initiatives could be developed and delivered.

A reasonable assessment in terms of the effectiveness of techniques for assessing workplace exposures for <u>respirable silica containing dusts</u> in Queensland is that they are state of the art. However, because retrospective epidemiology is identifying potential roles for particulates other than the respirable ones in airways disease (larger inhalable or thoracic fraction particulate) and cellular oxidative stress (very small eg. nanoparticles), there is now need to assess other parameters. That research is long term and is a task which really only can be undertaken nationally, were the facilities and mechanism for that research to exist.

Workplace Health and Safety Queensland's assessment is that issues of assessment of workplaces for plain silicosis are well served. Factors relating to the contribution of other fractions of particulate dust clouds remain relatively un-researched.

Resume on the adequacy and timeliness of regulation governing dust exposure

Queensland, as may have been the case in some other Australian States, has only relatively recently introduced ***specific regulation*** governing silica dust exposure covering non-mining industry. This has been achieved only in the last 10 years and has hinged on the development of programs of national uniformity provided by NOHSC. Prior to that, general direction or advice given to industry based on NHMRC recommendations had no legislative standing though it must be argued that industry often attempted to comply with the recommendations made.

In short, although the methodology for assessing the risk was always timely, the capacity to introduce specific regulation was limited.

Extent of compliance with the newly released NOHSC exposure standard of 0.1 mg/m^3 in two sectors of continuing interest, construction and foundries, is unknown.

Abrasive blasting: specific regulation, codes and activities

Regulation for abrasive blasting has changed its emphasis during the last three to four decades with the most significant changes occurring in the last 12 to 14 years. These changes have been in keeping with the moves from prescriptive regulation towards self regulation. Interestingly the Senate Inquiry terms of reference concentrate upon "sandblasting" whereas the jurisdictions have for at least four decades referred to the activity as "abrasive blasting" reflecting the fact that sand has had only a minor, often prohibited, role in the process of blasting and coating industry if containing significant amounts of silica. Sometimes, though, industry had a contrary view.

The Factories & Shops Rules

For example, Rule 3 in the Schedule to the Factories and Shops Acts 1960 to 1964 as introduced in 1951 and amended in 1967, 1973, 1974 and 1976 regulated issues to do with abrasive blasting. Abrasive blasting has been traditionally employed in foundries for metal cast cleaning as well as in construction and other metal based industries. Subsection 9 of Rule 3 governing the activities of Foundries and Abrasive Blasting stated that

> *"Sand or any substance containing free silica shall not be used as an abrasive in any blasting operation"*.

Substances other than sands commonly used in abrasive blasting included metal shot grit, water or any other substances used or intended to be used for abrasive purposes in blasting or blast cleaning. Although the definition recognised that sand could be an abrasive blasting material, subsection 9 prohibited its use.

For purposes of containment of dust, blasting was to be conducted in a blasting enclosure, spent abrasive material could be recycled only after removing the fine respirable particles, exhaust ventilation was to be provided to remove the airborne dust and control systems were to be tested by competent persons every week. Air filtering was required in enclosures where the abrasive blasting was conducted.
For the purposes of protecting against inhalation of dust generated in abrasive blasting (Subsection 15), blasting helmets were required by the Rules. Although there was no standard specified for the kind of helmets were to be used those employed would have been what was on offer by commercial protective equipment suppliers at the time. A regimen for decontamination of any protective equipment had been introduced in the Rule as a measure to limit any inadvertent inhalation of dust.

Around the mid 1980s, the blanket prohibition on the use of sand per se was relaxed slightly the Rule was amended by imposing a maximum concentration of 2 % quartz in abrasive blasting media.

How well were the blasting operators protected?

How well all these provisions functioned is difficult to gauge in total some 20 - 30 since first significant investigation, but some monitoring surveys of abrasive blasting reviewed for this Inquiry provide a guide. Despite the prohibition of sand as a blasting agent in the early regulation, and its subsequent limitation, there continued to be cases of both open and clandestine use of different kinds of sands containing quartz or free silica but diminishing in frequency up to the present. Beach and river sands have represented a very cheap resource which has the added benefit of not discolouring the substrate being blasted. That feature has been important in some architectural construction work. The Annual report for the Department of Health for year 1985/86 indicates that tests were made on 30 abrasive blasting samples to assess industry's compliance with the prohibition. Of 6 reports sampled at random, three (50%) indicated compliance with the 2% maximum free silica while the other three (50%) were clearly either beach or river sands ranging in concentration from 32-72% quartz. One survey identified high silica sands exclusively.

Inference of exposures to respirable free silica by prediction

In the absence of any large scale exposure monitoring program, the extent of protection against quartz can be gauged from inference from measurements of dust cloud and nominal performance of respiratory protective equipment. One program revealed <u>respirable dust</u> concentrations in the dust cloud external to the hood between 58 and 100 mg/m^3. Typical field performance of airline respiratory protection provides protection factors of 100 to 300, though the factor may be as low as 50 in adverse circumstances of poor fitting or ill maintained equipment. For abrasive blasting media which complied with the maximum 2% silica rule, respirable crystalline silica exposures would have ranged from around 5 -20 µg/m^3 and for non-compliant abrasive blasting media up to as much as 700 µg/m^3 of respirable quartz. Adjusted to gain a realistic estimate of the time weighted average exposure, perhaps of 5 hours per day blasting, some workers even with the highest level of respiratory protection are likely to have been exposed to regularly to quartz levels of around 0.1mg/m^3 to 0.45 mg/m^3. The cumulative exposure of such operators will have depended on the amount of work they did each day, the number of days spent blasting each week and the number of their years in the industry.

Results of monitored free silica exposures in several abrasive blasting operations

The predictions made in the above paragraph are based on some actual in-field measurements and typical known performance factors of air-supplied breathing apparatus. Monitoring surveys at several different abrasive blasting operations in the mid 1980s were reviewed to see if those results above could be generalized to some other workplaces in similar circumstances.

These operations aggregated below were typical industry operations dry blasting using high quartz containing sands or river gravel, most likely contrary to the accepted regulatory practice at the time. While the environment immediately surrounding an abrasive blasting operator will be grossly contaminated (total inhalable dust, range 10-46 mg/m^3 outdoors, 150 - 340 mg/m^3 inside a blasting enclosure), the interest of the investigations was to determine the extent to which the respiratory protection in the form of the usual air-supplied helmets would provide adequate protection. That was clearly a belief of the operators at that time. The following unidentified operations produced respirable quartz concentrations inside the protective helmet as shown.

These test were conducted outside a blast chamber. If blasting was conducted inside a chamber (as the Rule may have required), exposures would have been expected to be greater.

Blasting Operator – working outside blasting chamber

Operator	Total respirable dust mg/m^3	Respirable free silica mg/m^3
1	1.4	0.26
2	2.0	0.47
3	1.1	0.21
4	0.48	N.D.
5	0.49	N.D
6	1.3	0.51
7	1.1	0.39

Other non-blasting worker exposures

Various tests were conducted to gauge the possible extent of exposure to other workers in addition to the blasting operator. Because of the extent of dust generation, and because respirable dusts being essentially not visible in ordinary circumstances, there was sufficient likelihood that persons operating in the near vicinity to blasting with high silica sands could also be exposed. Respiratory protection was not indicated.

Operator	Total respirable dust mg/m^3	Respirable free silica mg/m^3
1*	5.2	2.2
2	1.8	0.69
3	1.9	0.84
4	0.3	N.D.

* conducted a short period of blasting

Some perimeter and yard sampling undertaken indicates the extent of potential high exposure zones around these operations.

Location	Total Inhalable dust mg/m^3	Total Respirable dust mg/m^3	Respirable free silica mg/m^3
Perimeter	7.9		
Perimeter	1.4		
Yard – 30 m	1.2		
“	1.7		
“	1.4		
Yard – 10 m		1.7	0.72
Yard – 5 m		5.7	2.0

Data from 1965, although measured in an approximate way using older particle count techniques, confirmed that dust contamination at distances 50 to 120 yards from a dry blasting operation were 5x and 1x the levels recommended by the NRMRC at that time.

Exposure of others around abrasive blasting operations

One study of helpers involved in cleaning up around an abrasive blasting operation in 1994 with a non-complying abrasive containing 74% free silica identified silica exposures from personal sampling of 0.07 and 0.11 mg/m^3. That survey confirms two points, (i) that the use of high silica sand continued at a time when it was prohibited by the existing regulation, and (ii) that significant silica exposures have not been limited to those actually undertaking blasting. Of course the risk would have been significantly reduced if low quartz content minerals were used.

How did these exposures compare with recommended levels?
Compliance with the use of low free silica sands according to the regulatory requirements at that time was not complete. One recycled copper slag contained 14 % quartz.

During most of that time, the NHMRC recommended free silica standard was 0.2 mg/m^3 (or 200 µg/m^3); some exposed workers are likely to have had individual exposures up to 3X the then recommended level, and around 5x the exposures based on the recent (2004) NOHSC declared RCS standard ***IF DRY BLASTING WITH BEACH OR RIVER SAND OCCURRED.***

For blasting workers fitted with respiratory protective devices with protection lower than that expected by the Rule, exposure is expected to have been even greater. One program examined the use of Powered Air Purifying Respirators (non-direct face sealing type) and found the protection factors ranged between 5 and 40. Such devices could have provided sufficient protection for light duty work with low toxicity dusts such as ilmenite but could never be used with dry “sand” blasting. However, even with the routine use of air-supplied respiratory devices, there is likely to have been potential for significant exposures to respirable crystalline silica when prohibited materials were used.

The overall risk of individuals developing disease will then be dependent on the extent of the cumulative exposures and the number of years worked, not the result of some instantaneous exposure measurements.

Wet blasting with high silica sands

Two commercial processes were available in Queensland at various times for wet blasting with high silica containing sands. One was the Kue process and the other was labelled Hydroblast. Use of injected water or water shrouds were very effective dust suppressing techniques which permitted use of non-colour imparting white sands for various tasks. Tests undertaken during the 1970s with the Kue process revealed that the level of dust generated at the both the operator’s position and downwind was less than 100 μm^2 (measured in terms of the Respirable Surface Area). This was a figure less than approximately 0.1 mg/m^3 in modern measurements.

The fate of these processes is unknown, though the rate of production was relatively slow and the use of water injection may have had some adverse effects on the rapid development of micro-corrosion. Nonetheless, their application did demonstrate that wet abrasive blasting with high silica sands could result in acceptably low exposures, although there could be a potential clean up problem with large quantities of respirable dust containing a high proportion of free silica.   Use of titanium containing sands in blasting around processes for the production of alumina has at some stage led to continued use of abrasives with no heavy mineral contamination.

The Workplace Health and Safety Regulation 1989

During the late 1970s and through the 1980s blasting technology improved considerably, particularly with the application of wet blasting. Medical and epidemiological knowledge about the contribution of silica to respiratory disease also advanced considerably. The coverage of this regulation was less confined to just foundry work, but included abrasive blasting carried on in relation to all kinds of operations, therefore it would cover construction work, shipbuilding, plant maintenance etc. In the 1989 regulation, section 239(a), a blanket prohibition on the use of sand per se was relaxed slightly as is seen in the following extract

> *The employer shall not permit or allow the following materials to be used in abrasive blasting –*
>
> > *Any material containing more than 2% free silica (crystalline silica dioxide) if used in dry abrasive blasting.*

Other restrictions on excessive contamination with heavy metals, or radioactive substances were also introduced into the regulation, and requirements for beneficiating any spent dry abrasive material into recyclable product were maintained.

The earlier prohibition, though directed to the frank use of beach and river sands high in quartz, would have been neither entirely enforceable nor practicable, since products such as ilmenite, rutile, zircon and garnet are highly practical alternatives but usually contain very small amounts of quartz (eg. $< 0.5\%$). The old Rule would have also effectively prohibited their use.

The *1989 Workplace Health and Safety Regulation* introduced particular standards for respiratory protection based on Section 12 of *Australian Standard AS 1716 Respiratory Protective Devices.* The minimum standard applicable was the use of an airline respirator of the portal helmets type requiring and inner bib, shoulder cape jacket with protective suit.

Release of the Abrasive Health and Safety Manual in 1993

As the result of an interdepartmental enquiry into abrasive blasting conducted in the late 1980s, the Division of Workplace Health and Safety released, in conjunction with the Abrasive Blastcleaners and Protective Coaters Qld and the Operative Painters and Decorators Union, a **Health and Safety Manual for the Abrasive Blasting Industry** to assist the industry to manage the risks in that industry. The document's appearance reflected the need to have a better source of information and guidance for the industry, although its coverage was far more than simply the abrasive blasting and silica exposure component.

This document in a sense marked the commencement of the process to remove specific reference to abrasive blasting from regulation. That process was well within the framework of the general development of most issues dealing with hazardous substances where it has been long recognised that individual regulations for a whole range of activities were not possible.

Regulatory development with abrasive blasting since 1995

The general provisions for foundry and abrasive blasting persisted essentially without change into the Workplace Health and Safety (Miscellaneous) Regulation released in 1995.

In 1998, the Abrasive Blasting Health and Safety Manual was re-released, this time as a new *Workplace Health and Safety in the Abrasive Blasting Industry*. It was re-released in 1999 as the *Abrasive Blasting Industry Code of Practice* when the Foundry and Abrasive Blasting Regulation was rescinded. In 2004 after a further 5 years, the document was reviewed and released as the *Abrasive Blasting Industry Code of Practice 2004.*

When the Industry Code of Practice (COP) was first released, the previous regulatory ban on use of abrasive blasting agents containing more than 2 % free silica was effectively removed but the direction of the COP with respect to silica maintained the same general direction; eg "*Blast media which should not be used* in dry abrasive blasting included materials containing more than 2% free crystalline silica".

More explicit advice was provided on alternatives, but the active process of banning high silica abrasive blasting media legislatively was removed. However, while the legislative process appears to have been directed towards having less control over the use of high quartz containing materials for abrasive blasting, the legislative drive has been more firmly into the performance arena for hazardous substances regulation. All employers using hazardous substances, of which quartz or free silica is a prime example, are now expected to pursue the standard risk assessment and control strategies found in the Workplace Health and Safety Regulation 1997, Part 13 – Hazardous Substance. How well that performance standard has been met can be judged by the following Blitz Program.

Blitz on Abrasive Blasting Operations throughout Queensland

The blitz program assessed respiratory protection, abrasive blasting media and hearing protection during 2000 and can be found at www2.whs.qld.gov.au/blitzaudit/blitz/blitz06.pdf>

This blitz was conducted across a range of industries through Queensland and included many workplaces which would not normally have considered themselves as "abrasive blasters" such as automotive repair, construction or radiator repairs.

The following executive summary information is provided on the performance of the industry in its following of the 1999 Industry Code of Practice and the Hazardous Substances Regulation.

"*Generally 66% of workplaces involved knew of the Code, but only 23% had used it to the extent of undertaking any risk assessments associated with the blasting work. The use of MSDSs and labels as information sources was relatively poor. Most abrasive blasting operations are still done dry. Dry sand blasting was now found in only 2 (4%) of workplaces. Although the Code recommends a maximum level for lead of 0.1% in abrasive blasting media, 42% of slag samples averaged over two analyses showed lead exceedingly this level. All workplaces now use air supplied respiratory protection, with around 96% meeting the manufacturer's nominal specifications. Only two failed. Knowledge about the actual performance of respiratory protection is universally lacking, and most workplaces have not assessed the quality of breathing air. Training in the use of the respiratory protection had been given to only 64% of users, and respiratory fit testing was recorded by only 27% of users. The industry has not yet been involved in either air monitoring or health surveillance to any extent."*

No specific investigation was made into health outcomes (eg. respiratory disease), or the actual (measured) quartz exposures but the blitz identified a significant reduction in the use of high quartz sands:-

"It is not possible to compare the utilities of the Code of Practice, and specific regulation from this audit. The code looks promising, and in time, the code and its requirements should be more widely implemented. However, a continual enforcement overview will nonetheless be required."

Resume on Abrasive Blasting

While there will have been some unknown number of individuals from years prior to the introduction of the *Workplace Health and Safety Act of 1989* who will have been exposed to levels of silica considered now likely to have been excessive, Workplace Health and Safety Queensland believes that the move towards the Code of Practice under the umbrella of the Hazardous Substances Regulation has reduced the extent to which beach or river sand is employed in dry abrasive blasting and the respirable crystalline silica exposures of its workers. Nominal application of high performance respiratory protection is also high (96%) although the goal must be 100%.

Some early exposures (prior to 1995) are likely to have been excessive in modern day terms, though the compensation data do not reflect any cases of silicosis.

Silica exposure in the foundry industry

The foundry industry has traditionally been one which has contributed to cases of silicosis due to its use of silica sand for moulding. The incidence has been very low since the late 1940s. In 1948, Dr D Gordon surveyed 359 men in 76 foundries, and identified a prevalence of 11 cases of Category 1 (early) and 2 in the next stage. All were elderly men. A survey of 81 workers in a large regional foundry in 1961 identified only 1 case. No system of compulsory X-ray surveillance has been present for the foundry industry at any time, and the probable complete absence of silicosis has justified that position. The number of foundries has commensurately fallen from close to 80 in late 1940s to fewer than 20.

The industry had been subject to direct regulation under both the Foundry and Abrasive Blasting Rules of the Factories and Shops Act since at least the 1950s and then under the same named provisions of the Workplace Health and Safety Regulations from 1989, regulation was rescinded in 1998/99.

The abrasive blasting provisions with respect to use of any silica containing sands were effectively redundant by late 1970s because the industry moved to use of metal shotblasting because it was more economical. The removal of silica containing mould release parting powders also contributed to a significant reduction silica exposures. However, many objects being blasted still were contaminated with silica moulding sand. Silica exposures in foundries are now subject to the general provisions of the Hazardous Substances Regulations and the exposure standard for respirable free silica, and supported by the Foundry Industry Code of Practice 2004.

Silica exposures have continued with the moulding, fettling and sand plant and sand recovery operations. These have been infrequently monitored by the regulatory authority in foundries in Queensland. The following aggregated table provides an indication that most operations (72%) in foundries are compliant with respect to its obligations on silica. Sand plant and shake out operations are likely to require attention.

Operation	**Respirable dust mg/m^3**	**Respirable silica mg/m^3**
Fettling	2.1	0.07
Core Moulding	0.2, 0.3, 0.3, 0.6, 0.1	0.04, <0.03, <0.04, <0.05,<0.03
Floor Moulding	0.6, 0.9, 0.6	0.08, 0.3, <0.05
Shake out	1.6, 0.5, 2.4, 0.6	0.17, 0.07, 0.29, 0.03
Sand Plant	2.4, 3.0	0.26, 0.13
Shot Blaster	2.2	0.06
Furnace melter	0.2, 0.4	<0.04, <0.04

Generally, there is little indication that the foundry industry will be a significant contributor to cases of silicosis into the future if those operations which have recently been found non-compliant can be controlled.

Terms of reference

(c) The extent to which employers and employees are informed of the risk of workplace dust inhalation.

The Department of Industrial Relations or its predecessor Department, through the agency of Workplace Health and Safety Queensland, have developed longstanding arrangements of informing workplaces about the specific risks in many industries. When major new legislative initiatives are introduced, these are accompanied by public seminars held around the state to inform employers, workers and other obligation holders of their specific obligations in relation to that new legislation. Public information and education fall into several different categories. Examples provided here are from the **WHS Information** resource, and are not confined to silica issues but includes other dusts. This documentation has been accessible on, and slowly added to the Workplace Health and Safety website.

Release of new Regulations or Advisory Standards

- Hazardous Substances Regulation public seminars given to more than 3000
- Advisory Standard for Hazardous Substances
- Risk Management Advisory Standard 2000 public seminars to around 2500
- Asbestos Advisory Standard 2004 (and its predecessor standards)

Development of Industry Codes of Practice

- Foundry industry Code of Practice
- Abrasive Blasting Industry Code of Practice
- Glass and Rockwool Industry Code of Practice

Publication of Blitz Reports and Audits

- Results of a blitz on abrasive blasting operations throughout Queensland (2000)
- Bakery Audit Report

Brochures

- Cabinet making – Dealing with Risks in Cabinet-making (October 1998)
- Silica Dust in Building and Construction (January 2001)
- Sawmilling Industry Health and Safety Guide (March 2001)
- Lead – Removal of Lead Based Paint (January 2001)
- Lead at Work (January 2001)
- Personal Protective Equipment – Information for Employers (October 1997)
- Personal Protective Equipment – Information for Workers (October 1997)

Guides

- Asthma – Occupational Asthma – A Guide for Employers
- Concrete Cutting and Drilling Industry (March 2001

Safety Links

- Asbestos Wall and Roof Sheets
- Bagassosis- Research into Queensland Sugar Mills
- Chrysotile Asbestos to be banned

Compliance Audits or Investigations directly in workplaces

- Lead in the radiator industry

Website accessible information

- Variations of some of the above topics dealing with dusts are available on the WHS website

External information sessions

- Workplace Health and Safety Queensland carries out external information in topics such as lead and asbestos for industry groups and local governments
- Presentations are given at conferences hosted by industry sectors into specific dust issues eg. asbestos, abrasive blasting, lead

Terms of Reference

(d) the availability of accurate diagnoses and medical services for those affected and the financial and social burden of such conditions

(e) the availability of accurate records on the nature and extent of the illness, disability and death, diagnosis, morbidity and treatment

(f) access to compensation, limitations in seeking legal redress an alternative models of financial support for affected individuals and their families

Workplace Health and Safety Queensland has no submission to make on these Terms of Reference as they are not matters over which it has, or has ever had, any legislative authority or responsibility.

Terms of Reference

(g) the potential of emerging technologies, including the nanoparticles, to result in workplace related harm.

Workplace Health and Safety Queensland has so far not been involved in any issues with new nanoparticle technologies but will be keeping a watching brief when industrial processes involving their use emerge in Queensland. Some nanoparticles exposures already occur from aerosols in existing Queensland industries such as pharmaceutical manufacturing, aluminium smelting, welding processes, soldering and metal grinding, thermal coating. However, Workplace Health and Safety Queensland possesses no capacity to assess accurately the health impacts from particle sizes specifically in the nanometre range or the possible preponderating influence of their massive numbers.

CONCLUSION

Methodology for assessing the risk traditionally thought to be associated with silica exposure, silicosis, is now adequate and has been almost so for at least two decades. Australia now uses sampling techniques which are internationally standardised. The new NOHSC dust standard of 0.1 mg/m^3 will not be able to be fully evaluated against silicosis, lung cancer and airways disease for a few decades. The extent to which general industry (other than mining) complies, and can be shown to comply, will remain a significant undertaking for employers and the regulatory authorities over those same two to three decades. Measurement of the other exposure parameters (i.e. upper airways and very fine particles) is a new challenge for the scientific, regulatory and employer communities.

One of the clear findings from the research carried out for this submission has been the paucity of information of significance held in a readily accessible form by any organization, including the State regulator. Proper investigation of the adverse impacts on health of abrasive or "sand" blasters from the 1960s through to the 1980s and beyond requires a reasonable knowledge of their historical exposures. Although fully reliable technology (respirable dust measurement and respirable silica determinations) for this purpose did emerge in the mid to late 1970s, there have been no identifiable programs for routine collection of exposure data of the kind which will bring great substance to these discussions. Perhaps it is that it is considered better not to know; there is no indication that it is particularly valued. Industry, probably for reasons related to competition, has not been motivated or sufficiently organised to fund and set up any scheme for either data collection or shared data management. This situation applies not only to those in dusty industries, but to almost all fields where exposure occurs to hazardous substances with both short and long term health consequences, but particularly long term exposures with chronic diseases. Only in mining has there been a long standing arrangement of routinely collecting dust exposure data by government bodies. By default, it is likely that only government can command the ability to collect and analyse data for such purposes. Efforts to establish such collections of data in Australia on a national basis through either the National Institute for Occupational Health and Safety or the NOHSC have come to nought, because of their lack of continuity. Impartiality and independence in the national arena are now new considerations. In the case of exposures to respirable crystalline silica, the time frame must be many decades long. The Health and Safety Executive in the UK has operated a mechanism into which such critical data from across the nation can be collected and analysed.

The small amount of recoverable data from records on abrasive blasting in the 1980s does not paint a very favourable picture of either the performance of the industry or of its control of exposure to respirable crystalline silica. There is no reason to believe that other industry operators using beach or river sands and gravel and the same standard types of respiratory protection would have fared any differently. Numbers of exposed during that period are not known, though fortunately, the number with compensable and confirmed silicosis appears to be negligible . Nonetheless the confirmation of quartz as an occupational carcinogen by the International Agency for Research on Cancer (IARC, 1997) and the previously mentioned recent epidemiological studies identifying excess lung cancer amongst some of the silica exposed will leave some unanswered questions for all those exposed in abrasive blasting for whom there have been no records of exposure. At least from now into the future, and armed with the best available medical and scientific knowledge, employers or their insurers will want to know exactly the long term exposure of their workers to dusts so that liabilities from silica and lung cancer can be separated from those of smoking and lung cancer.

Data relating to silica exposures in foundries from the late 1990s and early 2000 shows that this industry which was traditionally a source of silicotics in the community is now likely to be reasonably well controlled. Information on silica exposure in the construction industry is not available in this submission.

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