South Africa has a serious silicosis problem with inadequate dust control and high disease rates in traditional ‘silica industries’. The strong association between silicosis and tuberculosis in southern Africa combined with the HIV epidemic make elimination of silicosis an important public health issue. Substantial activities to achieve this elimination have been initiated, including the National Programme for the Elimination of Silicosis, under the leadership of the Department of Labour, the Mine Health and Safety Council’s Elimination of Silicosis Programme and the Sida-sponsored regional Work and Health in Southern Africa initiative. These programmes are briefly described in this paper. The elimination of silicosis has raised a number of issues. Three are mentioned: an appropriate occupational exposure limit for quartz, the burden of disease in retired formerly exposed workers and prioritisation of industrial sectors for intervention.

A sustained and thoughtful effort over many years is required if South Africa is to eliminate silicosis and silica-related diseases.

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**Table 1. Estimates of occupational exposure to silica in South Africa.**

<table>
<thead>
<tr>
<th>Major industrial division</th>
<th>Number employed</th>
<th>Potential number of exposed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>Mining and quarrying</td>
<td>356 289</td>
<td>71 258</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>286 782</td>
<td>57 356</td>
</tr>
<tr>
<td>Construction</td>
<td>352 451</td>
<td>70 490</td>
</tr>
<tr>
<td>Total</td>
<td>995 522</td>
<td>199 104</td>
</tr>
</tbody>
</table>

20% = 20% of all employees in the division.
which the risk of tuberculosis is increased to a clinically important degree is not known, so theoretically communities heavily exposed environmentally may have increased rates of tuberculosis.

The relations between silica and tuberculosis are compounded by HIV. Corbett et al. have shown that the risks of silicosis and HIV infection combine multiplicatively for tuberculosis, so that tuberculosis remains as much a silica-related occupational disease in HIV-positive as in HIV-negative miners.

Combined with significant levels of migrant labour and among the highest HIV infection rates in the world, the interactions between inadequate silica dust control, high rates of silicosis, HIV infection and tuberculosis, including the multi-drug resistant forms, present major challenges for occupational and general public health in the region.

2. WHO IS AT RISK?

Describing the population at risk of silica-related diseases is a preliminary part of many elimination programmes; an example is the United States. South Africa’s National Institute for Occupational Health has tentative data based on the Statistics SA Census 2001 Database and an estimate of the proportions of workers potentially exposed in usual ‘silica industries’ (Sawry et al., in prep). Table 1 shows only a part of the NIOH data. It can be seen that the preliminary estimate is that between 199 000 to 796 000 workers are exposed in South Africa.

There are many uncertainties in these estimates, the most obvious being the proportion of workers exposed in a particular industrial sector, hence the 20%, 50% and 80% options. Another is which industries to exclude.

Agriculture is not included in Table 1 as the authors do not consider this industrial sector to present a real risk to the vast majority of farm workers, but a case could be made that at least some are at risk of silica-related diseases. Quartz percentages in the respirable fraction of some sandy-loam soils from farms in North Carolina, USA, have been shown to range from 9.1 to 21.3%. Also, surprisingly high levels of respirable silica were found on personal sampling of farm workers in North Carolina; by far the highest being a mean of 3.91 mg/m$^3$ for 5 sweet-potato transplanters. Case reports of silicosis in farm workers, particularly tractor drivers, are not unknown, albeit with unconvincing histories; some cases have been reported in South Africa. The NIOH Occupational Medicine Clinic has not seen a case of silicosis in an agricultural worker since its inception in 1975; nevertheless an evaluation of respirable quartz exposure in geologically ‘promising’ farming areas would be of value.

3. SUBSTANTIAL PROGRAMMES

Despite competing needs, infectious diseases and traumatic injury prominent examples, silicosis elimination is gaining momentum. Three large programmes make the point.

1. National Programme for the Elimination of Silicosis

This Programme, under the leadership of the Department of Labour, is a major development, but is described elsewhere in this publication by Motshelanoka.

1.2 Silicosis Elimination Programme, Mine Health and Safety Council

Planned for five years initially, there are three parts to what is probably the largest research-based effort to eliminate silicosis ever in South Africa. The Programme is for the mining industry but many products will be of general value. Part A is to improve exposure assessment and the measurement of dust and quartz; Part B to improve dust control methods and reduce exposure; and Part C to develop training methods and materials for miners, mine managers and health and safety representatives, and to communicate the importance of silica control and the elimination of silica-related diseases. The Safety in Mines Research Advisory Council (SIMRAC) website has details of the Programme: www.simrac.co.za.

“South Africa has isolated capacity to reliably measure quartz even at 0.1 mg/m$^3$, and many enterprises have yet to achieve this level of control.”
1.3 Work and Health Southern Africa (WAHSA)

This is a strategic 12-year programme to build sustainable capacity in southern Africa and to undertake key interventions to improve occupational health. It is supported by Sweden’s National Institutes for Working Life and Public Health, and has interventions on Silica, Silicosis and Tuberculosis. The major objectives are reduction of dust exposure in key industries and improved prevention of tuberculous in silica-exposed workers. Details of WAHSA are available from the NIOH in Johannesburg: www.nioh.ac.za.

4. SELECTED ISSUES

An appropriate occupational exposure limit (OEL) for quartz

A typical OEL for respirable quartz is 0.1 mg/m³. But there is increasing evidence that this limit is not protective against silicosis. South African gold mine data has been used to support this contention7. Also, OELs should be protective against all the major health effects of an agent. Tuberculosis is a major concern following silica exposure and a South African standard that does not address this health outcome will be partially satisfactory at best. But, although a case can be made for lowering the respirable quartz OEL, South Africa has isolated capacity to reliably measure quartz even at 0.1 mg/m³, and many enterprises have yet to achieve this level of control. What will be gained by introducing an OEL that cannot be assessed? It might be sensible to vigorously and widely enforce the 0.1 mg/m³ limit while capacity to measure quartz is further developed and the tuberculosis issue is considered.

Sectoral prioritisation

South Africa has limited resources, so focus on the key industrial sectors is necessary to use these efficiently. There is sufficient data to conclude that gold mining tops the list, but what of the others? We cannot decide with available information. Exposure while working clay deposits illustrates the difficulty. It is well known that some South African clay deposits have high quartz concentrations, although these vary by location and through profiles. Quartz percentages of 30% are not unusual and can reach 60% in the Grahamstown area clay deposits20, but the risk to workers has not been determined reliably, and it has been suggested that other minerals in clay may alter quartz surface characteristics21. A good argument can be made for simple dust measuring and case-finding surveys in sectors with a poorly defined risk, but the disease rates in former workers may need to be established to assess the importance of the sector.

Silica-related disease in former workers

Silicosis and silica related diseases may manifest many years after exposure has stopped6. This latency has many implications: cross-sectional surveys are likely to underestimate disease burdens, substantially if there is heavy exposure and high staff turnover; many former workers will present to general health services, rather than workplace services, and so awareness of the conditions needs to be created among health care professionals; and new cases will continue to be diagnosed years after dust control is adequate.

5. CONCLUSION

Silicosis elimination is gaining momentum in South Africa, and large programmes are being implemented. Activity is uneven across industrial sectors, however, and while the mining industry has publicly-stated targets, industry-specific programmes with substantial funding and numerous enterprise level interventions, the non-mining industries’ response has been desultory. Possible explanations for this disappointing response have been published elsewhere22, but it shows clearly that a sustained and thoughtful effort over many years is required if South Africa is to eliminate silicosis and silica-related diseases.

6. REFERENCES

17. Stopford, C.M. & Stopford, W. Potential for respirable quartz exposure from North Carolina farm soils. Scand J Work Environ
The fashion for artificially worn-in jeans is taking its toll on health, researchers have found. Jet sandblasting, used by manufacturers to distress the fabric, is leading to fatal lung diseases. Cases of silicosis, disabling lung scarring caused by inhaling crystalline silica, has been diagnosed in denim sandblasters in Turkey. Researchers raising the alarm recently, called for urgent measures in the textile industry to protect workers. Findings presented at the 2005 Annual Congress of the European Respiratory Society (ERS) highlighted the dangers. A team led by Metin Akgun, of Ataturk University in Erzurum, identified the condition in two young non-smoking male denim sandblasters aged 18 and 19. They had been just 13 and 14 years old respectively when they started in the job, working eleven-hour days in the same small, enclosed, poorly ventilated workshop with only simple facial masks to protect them. One month after diagnosis the younger patient died. The researchers say denim sandblasters’ silicosis seems to be a particularly acute form of the disease, developing in less than five years, rather than the 10 to 30-year period typical of silicosis in miners. “This rapid progression is the consequence of intensive exposure to large amounts of dust with a high silica content,” Akgun told the congress. A further case presented by Nur Dilek Bakan, of the Yedikule Teaching Hospital for Chest Disease and Thoracic Surgery in Istanbul, concerned a 30-year-old male subject whose lung function began to decline abruptly after just two years in the job. Similar cases of fast-developing silicosis were seen in stone cleaners working on Elgin Cathedral, Scotland.

Alert – Garment workers face silicosis danger

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20. Jacob, R.E. Department of Geology, Rhodes University, Grahamstown, South Africa, 2005. (Personal communication).

LUNG FUNCTION TEST

The lung function test (spirometry) measures the volume and/or flow rate of gas breathed in and out of the lungs under specific conditions of maximal effort using a spirometer.

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- progression of lung disease
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