Safety In Mines Research Advisory Committee
Project Summary : OTH 409

Project Title:	The positive identification of asbestos or other fibres in the mining of kimberlite deposits and an evaluation of relevant threshold limit values

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Category:	Other	Applied Research	

Summary

Dry drilling is not permissible under South African mining regulations. However, due to the physical and chemical properties of kimberlite, water has been found to have undesirable effects on blue ground, causing swelling and disintegration. Consequently, no water is used in drilling operations within blue ground pipes. This research work was carried out in conjunction with another SIMRAC project, SIMOTH 410, which investigated pollutant levels and the practice of dry drilling during the mining of kimberlite deposits. The same sampling sites were used for both projects but the sampling equipment and techniques differed. In this investigation gravimetric samplers, thermal precipitators and konimeters were used to sample for the presence of airborne fibres, whereas gravimetric samplers, tyndallometers and real-time dust monitors were used for the dry-drilling investigation. In this project the gravimetric samplers were used in both continuous and intermittent mode.

Whereas the dust levels in pipe deposits were generally found to be different from those in fissure mines due to the differing mining methods and dust control measures used, fibre levels were found to be less dependent on these factors and more dependent on the geology of the deposit being mined. Nevertheless, high background dust levels tended to mask the presence of airborne fibres. Effective dust control measures and the use of water, reduce the background dust levels thus rendering the fibres more visible in the counting fields. This effect could easily lead to incorrect conclusions when sampling results from different workplaces or mines are compared.

Unlike the results obtained for the dry drilling study, no real differences in fibre levels were found between pipe deposit and fissure mines, or between dry mining and wet mining operations. It was consistently found that intermittent sampling, i.e. 10 minutes in each 60-minute period, yielded the highest fibre concentrations. This can be ascribed to the lower background dust levels collected during these short intervals when compared to the larger mass collected with continuous samples. Under these conditions, fibres would be more visible in the counting fields as stated before. The results from the thermal precipitator and konimeter sampling were, in general, an order of magnitude lower than those from gravimetric sampling.

Conclusions

It was also found that intermittent sampling, i.e. 10 minutes in each 60-minute period, yielded the highest fibre concentrations. This was felt to be due to the lower background dust levels on these samples making it easier to find the fibres during counting. The results from the thermal precipitators and konimeters were, in general, an order of magnitude lower than those from intermittent sampling. Considerable differences were found in the results for individual samples within paired samples. The necessity to collect samples in pairs is therefore apparent and is recommended.

It is important to note that no fibres were detected in the downcast shaft samples and only very low concentrations in the main intake airways (0,02 f/mP). Nevertheless, the fibre concentrations found in the main return airways were found to be 0,43 f/mP and in the upcast shaft 2,82 f/mP. These results tend to indicate a release of fibres into the workings due to mining operations. The results reported are for averages of pairs of samples and in several cases individual fibre concentrations exceeded 2 f/mP. The presence of airborne fibres was also detected at tipping and crushing operations.

It is significant that several types of asbestiform fibres, i.e. chrysotile, anthophyllite and actinolite/tremolite, were found in all the mines sampled, both in the country rock and in the kimberlite excavations. However, of greater significance was the fact that NAMF constituted between 53 and 78 per cent of the airborne fibres. In effect, this means that if a fibre level of 2 f/mP is encountered, the asbestos content is likely to be between 0,4 and 0,1 f/mP.

It was also concluded that discrimination between asbestos and many other fibres using optical microscopy, was a difficult if not an unreliable means of identifying fibres - even for experienced operators or technicians. According to the literature, even with phase-contrast microscopy only about 5 to 15 per cent of the fibres visible by transmission electron microscopy can be seen, i.e. those fibres more than 2 μm long and more than 0,2 μm in diameter.

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