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re Thermal Precipitator

In considering the selection of the Thermal Precipitator as a standard instrument for dust collection and assessment, I am not detracting in any way from the Watson Victor Konimeter as a general dust sampler for normal field work.

Although the dust counting efficiency of any Konimeter is admittedly low and is selective with respect to size, it is easily recognisable as the most compact and simplest sampling device for quick assessment of dust concentrations in any working place. Similarly, such an instrument as the Thermal Precipitator, Midget Impinger, or the Cassella "Hexhlet", could hardly be considered suitable for normal underground dust sampling, as they are used mainly for sampling over varying periods of time.

Actually, in the majority of working places where high dust counts have been recorded, the fact that conditions were extremely dusty could easily have been assessed without the use of any dust sampling instrument, and I think that this is consistent with the opinion voiced by Drinker & Hatch P. 88.

It has been proved that different sampling instruments exhibit great variations in their behaviour with different kinds of dust and with particles of different size in the same dust. Therefore, it appears impossible to determine general conversion factors or to compare instruments on the basis of their absolute efficiencies unless the dust to be sampled is completely homogeneous.

To emphasise this point I would like to quote from the I.L.O. Publication "Guide to the Prevention and Suppression of Dust, 1965 (P. 306)

"In selecting a sampling system it is first necessary to decide whether it should be based on the weight of dust in the air or on the number of particles which are considered to be in the dangerous size range.

Allowance must, however, be made for the particular characteristics of different sampling instruments and procedures. Differences in these respects create difficulties in respect of comparability of results. Not only do the different instruments exhibit varying efficiencies in collection, but they also have different selectivities with regard to the particles being sampled. An example from one series of tests makes this clear. Side-by-side sampling with a thermal precipitator and a konimeter was performed on the dust created by a series of different underground operations.

The following results were obtained :

Operation	Dust concentration (number)	
	Thermal Precipitator	Konimeter
1	1,230	182
2	360	87
3	440	103
4	490	85
5	370	118
6	350	89
7	210	66
8	240	217
9	350	161

It will be seen that the health risks of operations 1 and 4 are the greatest according to the thermal precipitator, while the konimeter indicates that operation 8 presents the greatest hazard."

The ideal instrument is one which will collect a representative sample of the dust as it exists in the environment, that is without altering the particles or their distribution in any way, and will enable the result to be quickly and easily assessed.

It should sample only the respirable fraction of the dust with the same selectivity as the human respiratory system and provide information over an extended period of time with regard not only to the average concentrations, but also to ephemeral fluctuations.

It must be of simple and rugged construction for use under the conditions found in a mine, and automatic operation would be most desirable.

Although the above points illustrate the optimum requirements in any dust sampling instrument, there is however, no instrument at present available, capable of fulfilling all these requirements.

Most of them are selective in operation or break up aggregates and give an exaggerated reading of the number of fine particles present. Without doubt, the choice becomes quite restricted and it generally falls on an instrument which allows a large number of samples to be taken at different places in the shortest possible time, or else in a continuous sampling device.

As I stated before, the Konimeter is a suitable sampler for normal routine dust sampling underground, and it fulfills several of the previous mentioned requirements viz: rugged construction, large number of samples which can be sampled, the air volume sampled is fairly large, it is of a handy size and once loaded is always ready for sampling. In fact, I for one consider it the most practical instrument for routine dust sampling.

However, it also has great drawbacks, the most important being its unpredictable performance or efficiency under varying conditions. Similar instruments will give widely different results in the same environment.

It has a tendency to break up aggregates owing to the high impact velocity.

There is a difficulty in evaluating heavy concentrations.

Because of its rapid sampling rate - about 0.1 cents - the samples are only instantaneous values which may differ considerably from the average values.

Also, the quantity of dust collected in the sample depends to a large extent on the nature and thickness of the adhesive film.

Samples are often crowded out with background count due to bubbles in foreign matter in the adhesive film. This phenomena has increased since the use of dark-field illumination, and from our own experience, we found it necessary to switch from using Konimeter jelly to the Xylol-Petroleum Jelly solution. Even so, we have received reports on the difficulty caused by excessive background counts in this solution (Department of Mines N.S.W. has requested us on three occasions in the last two years, to forward samples of our Xylol-Petroleum Jelly solution as they were experiencing difficulty in overcoming background intrusion).

According to the International Labour Office's "Guide to the Prevention and Suppression of Dust in Mining, Tunnelling and Quarrying, 1965", the Konimeter is not so suitable for precise dust measurements, but it is of value when used in conjunction with other instruments which give more precise information about the nature of the dust concentration.

The need for a more precise instrument, such as the Thermal Precipitator, is becoming increasingly self-evident each year. We have a highly technical and qualified staff whose responsibility lies in the control of dust suppression in all mines, quarries, reduction and crushing plants throughout the State. It is our duty to convince Mine and Company officials of the need for increased dust control. This is not always easy when our sole method of dust sampling is per medium of the Konimeter. Dust counts tendered by our Department have, on several occasions, been queried by some of these Companies on their reliability. Water-vapour and foggy atmospheres have sometimes been the cause of discussion on high results. Breaking-up of aggregate concentrations have been other causes. Until we convinced the Mines to standardise on Dark-Field Illumination for particle countings, differences of opinion arose on whose dust count was correct - dark field illumination invariably gave higher readings.

Various methods for sampling the asbestos dust at Wittenoom and Marble Bar have been tried in conjunction with Konimeter Sampling (e.g. Tyndallascope and Midget Impinger) with no effective results.

The Thermal Precipitator, if acquired, would not be used for routine dust sampling. Its main requirements would be to provide a standard for comparison with other instruments, which would be universally accepted.

To Provide a precise instrument for carrying out special investigations into any facit of the industry whether surface plant or underground. Results from such an instrument would be more acceptable whenever there was any variance of opinion.

(3) When any place is in doubt due to changing environment, e.g. Primary Crushing operations, ore pass control operations, areas affected by secondary blasting operations, multi-operations in close proximity (Mineral Sands Treatment Plants), the need for a continuous sampler is multiplied.

It has been necessary on numerous occasions in the past, when investigating anomalous conditions, to determine the dust concentrations over a period of time due to changing environment throughout the shift. This has applied both surface and underground. To carry out such a survey, there are a number of points to be determined e.g. the quantities and characteristics of the dust liberated; the dustiest operations, places and equipment; and the variations in dust concentrations in the course of a shift or between shifts.

The information obtained is necessary to plan effective measures for prevention and suppression of dust in the most efficient manner. To carry out such a survey it is necessary to obtain some form of continuous sampler. In the past we have obtained the use of a Midget Impinger, or a Thermal Precipitator, from the School of Mines. However, this is not always convenient for us or the School.

Although it is agreed that the necessity for obtaining 100% efficiency in dust particle concentrations is not very great, and that the main characteristic to be determined is whether or not an industrial hazard exists in certain working places. I would like to add that the need for a world-wide use of a standard method of dust determination, to serve as a basis of comparison of conditions in different countries and different industries, was emphasized at the Silicosis Conference in South Africa as far back as 1930 (Drinker & Hatch P.151).

There is no doubt that the Thermal Precipitator is fast becoming that recognised standard.

It is also quoted in Drinker & Hatch's publication "Industrial Dust" P.130 that, at the time of publication of this book, the Thermal Precipitator had not been used to any extent in industry, and that its merits had not been fully explored. However, it is now regarded as one of the most reliable dust sampling instruments, and may be used for sampling all kinds of airborne particles, both organic and inorganic, at high or low concentrations - I.L.O. "Guide to the Prevention and Suppression of Dust, 1965 P.326.

This concludes my views on the subject, and although they may appear lengthy in detail, I consider that as it is the responsibility of our Department to improve and maintain the standard of ventilation and dust suppression in this State, we should use the best means available in this regard.

DISTRICT INSPECTOR OF MINES (Vent.)