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DUST STANDARDS

Summary of the contribution (published in the April, 1969, M.V.S. Journal, page 89) to a paper on "Dust" by D. G. Beadle, published in February, 1969

By R. S. J. du TOIT

The Afrikaans article may be summarized as follows:

Decisions on specific dust standards and the relevant factors that should be taken into account, in the application of a standard, are still veiled in uncertainty. The effect on man of the true long-term true mean dust concentration constitutes the fundamental basis of a dust standard.

Two other concentrations, viz., the short-term true mean and the short-term instrumental mean are dealt with in practice for any one dust-sampling instrument. These three values are illustrated in the published diagram with time as the independent variable and with dust concentration as the dependent variable.

It is for various reasons impossible in practice to classify places as being either "satisfactory" or "unsatisfactory" on the basis of long-term standards. The most important controlling factors are the limitations of manpower resources and time.

The effects on the long-term true mean dust concentration of a dust standard decided on, depend on the following factors:

(a) The reliability of the method of dust evaluation which includes the instrument and the assessment technique.
(b) The limits between which the dust concentration varies from one instant to another during the same shift.
(c) The limits between which the average dust concentration per shift varies from one shift to the next.

On the large gold mines, where 4 konimeter samples are taken with the same instrument by Inspectors of Mines, the overall coefficient of variation comes to 80 per cent. in respect of the three factors mentioned.

More specifically, the coefficient of variation is estimated to be approximately 70 per cent. between sampling periods while the coefficient of variation within the sampling period, including instrumental errors, approximates about 40 per cent.

A dust concentration of 200 ppcc (by konimeter) is accepted in some circles as a dust standard, but as a short-term dust standard, on account of practical difficulties related to the application of a long-term standard.

The consequences of certain approaches were then examined, the outcome of which could be summarized as follows:

(a) The figure of 200 ppcc should only be applicable to a long period;

(b) This figure should therefore not apply to the true value at the time of dust sampling;

(c) This figure should not include the reliability of the instrument nor the reliability of the method of evaluation. It is pointed out that the system of judging a working place after a single visit is an inefficient way of screening " unsatisfactory " places from the rest of the places. This inefficiency arises due to the high coefficient of variation of dust concentrations on account of which a place which maintains a true dust concentration of 100 ppcc could, once out of every 20 occasions, have a 4-spot mean as high as 250 ppcc. In other words, for about 5 per cent. of the time, the recorded dust concentration of a working place approximates, under current run-of-mine conditions, to 2½ times the mean dust concentration.

The only efficient method of judging a working plan is by repeated visits, during different shifts, and then in accordance with the cumulative mean value as given in a sequential control chart. According to such a chart, a place is judged " unsatisfactory " at smaller and smaller differences between fixed standard and the observed results as the number of visits increase.

It would therefore be advantageous for mine officials to evaluate dust records according to the above-mentioned sequential method that has been repeatedly recommended by Mr. Beadle.

It is pointed out that an increase in the number of samples during the same visit to a working place reduces only slightly the gap between the standard and the observed result at which a decision may be taken.

My impression is that Mr. Beadle did not accentuate this aspect sufficiently:

I would prefer that control charts refer to the number of visits made to a working place (during which, samples are taken) rather than to the number of samples taken.

A sequential control chart is submitted below, which gives the observed 4-spot mean by konimeter to the nearest 10, on which a judgment of " unsatisfactory " is made after " n " visits to a working place, as the number of visits increase from 1 to 10.

Number of visits (n)	Mean count of 4 samples taken with one konimeter after " n " visits. (ppcc)		
	Standard 100	Standard 150	Standard 200
1	260	400	500
2	160	250	300
4	130	200	250
7	115	170	230
10	110	165	220

The following procedure is recommended for the guidance of officials:

(a) Any working place with a dust count of 400 or more (ppcc) during the first visit is labelled " unsatisfactory " without further ado.

(b) Places with dust counts of less than 400 but more than 200 ppcc during the first visits are revisited,

OR

the dust records of the working places are judged in the light of the centre column of the given sequential control chart and the place is labelled " unsatisfactory " if the mean of the observed results exceeds the figure on the chart.

(c) Places with a dust count of 400 or more ppcc are after actual improvements had been effected, revisited, and the results compared with those in the centre column of the table to ensure that the working place is no longer " unsatisfactory ".

It is pointed out in this connection that the reverse judgment is not valid. In other words, places which are not labelled " unsatisfactory " may NOT be labelled " satisfactory ". For a working place to be labelled " satisfactory " the 4-spot mean count after " n " visits should be **lower** than those given in the following table:

Number of visits (n)	4-spot mean count after " n " visits		
	Standard 100 ppcc	Standard 150 ppcc	Standard 200 ppcc
1	20	40	50
2	50	70	100
4	70	100	140
7	80	120	160
10	90	130	170

The mean dust count of all working places at large gold mines is approximately 230 ppcc.

A material improvement would result at most working places at large gold mines if the recommended method were applied consistently.

A material improvement would be achieved even if the working places were judged according to the last column of the given table because if no working place has a long-term mean dust count as high as 200 ppcc, the long-term mean of all places would be far below 200 ppcc.

DR. JOHN SCOTT HALDANE AND METALLIFEROUS MINING

By J. P. REES

To the present generation the name of J. S. Haldane will not be familiar. A few will have heard of Lord Haldane (brother of J. S. Haldane) and of J. B. S. Haldane (son of J. S. Haldane), but neither of these eminent people are due for any special remembrance by mining men. Dr. J. S. Haldane, however, should be remembered. He was a medical man whose work should not be forgotten.

My first recollection of him was before the First World War when, as a student in London, I went to a demonstration that he gave on mine gases and their detection. He was demonstrating a very simple apparatus he had devised for testing and determining the quantity of CO_2 in naked lamp mines, which meant metalliferous mines. He appeared to be very earnest about something which, to my inexperienced mind, seemed rather trivial and unimportant. However, our lecturers at the Royal School of Mines said he was a great man, and I was forced to conclude that greatness is not always apparent and may abide in a simple exterior.

Many years later I went to a lecture in which he demonstrated that a mixture of oxygen and carbon dioxide, in suitable proportions, was more effective in reviving a half-asphyxiated mouse which he had on show on the demonstration table in a glass jar, than oxygen alone. This was altogether a charming and satisfactory experiment.

So then, Dr. J. S. Haldane was interested in mine gases and was an original and successful investigator and experimenter. This work of his started in connection with coal mining, and he was always more closely connected with the great coal mining industry than with metalliferous mining. Nevertheless, all miners have reason to remember him, and I propose to show what were his direct interests in the ventilation of metal mines.

Before proceeding I will diverge to quote from " The New Look ", by Harry Hopkins. Speaking of the introduction of the British Medical Service, for which Beveridge was largely responsible, he says: " Yet in the deeper sense the doctors failed dismally to respond to the challenge of Beveridgism. They could not respond to what they did not feel. The high cost of qualifying and establishing oneself in practice before the war had ensured that almost all England's doctors came from a small social class. Blinkered by prep and public school, their horizons had been further shuttered by a long and intensive technical education which took little account, even, of the social and psychological background of diseases. Nor were their social sympathies enlarged by an induction into a professional guild whose