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summary reports . . .

Field comparison of two methods for the determination of NO_2 concentration in air

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A field test of two sampling methods for the determination of NO_2 concentration in air is reported. All samples were collected in an underground salt mine in which diesel equipment is operated. Although each method has its own advantages, both appear to be suitable for most industrial hygiene applications.

introduction

Two personal sampling methods have recently been reported for the determination of NO_2 concentration in air.[1,2] One method involves the measurement of a quantity of a gas transferred through a tube to a triethanolamine absorbent by molecular diffusion. Since no pump is required for this method, the sampler is referred to as a passive dosimeter. The second method (TEA tube), uses a low flow pump to draw air through a glass tube containing two sections of triethanolamine - impregnated molecular sieve separated by an oxidizing section.

In both methods, the NO_2 is desorbed and the concentrations are determined spectrophotometrically. Each method has been laboratory tested by exposure to standard atmospheres. This report provides the comparative results of a field test of both methods.

methods

All samples were collected at or near the point where salt is hauled from the working face and dumped into primary crushers in an underground salt mine in which diesel equipment is operated. At each location, four samplers (two dosimeters and two TEA tubes) were taped together and suspended so that their open ends pointed downward. A flow rate of 10 cc/min was maintained through each TEA tube using a calibrated flow pump. Sampling was performed over a four day period with sample times ranging from 2.6 to 4.5 hours. Temperatures during the sampling period ranged from 16-18°C, and relative humidity ranged from 60-70%. All sample tubes identified by field number were sent to their respective laboratories for analysis. Quantities of NO_2 found were reported to senior author.

results and discussion

Concentrations of NO_2 for each sampling location are given in Table I. Analysis of variance was run in order to compare dosimeter readings with TEA tube values. The error and block by group interaction were combined to form the denominator for the F test. The F test for groups was significant reflecting a consistent pattern of the TEA tube method (average = 4.14 PPM) being slightly lower than the dosimeter method (average = 4.51 PPM). The pooled residual was .1072, and the overall average concentration for both methods was 4.33 PPM. The overall coefficient of variation was

$$\frac{\sqrt{.1072}}{4.33} = 7.6\%$$

Although the variances were assumed equal in the test of significance, the variance for the dosimeter readings was .069, while that for the TEA tube method was .131. The coefficients of variation were 5.8 and 8.7% respectively.

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TABLE I
Results of Field Comparison of Two Methods for the Determination of NO_2 Concentration in air

Sampling Location No.	Hours Exposed	Weighted Average NO_2 Concentration (PPM)			
		Dosimeter	Average	TEA Tube	Average
1	3.0	5.3 4.4	4.9	4.1 3.8	4.0
2	3.0	3.8 3.8	3.8	4.0 3.7	3.9
3	3.0	4.7 4.7	4.7	4.5 5.4	5.0
4	2.6	4.9 4.1	4.5	4.6 3.9	4.3
5	3.7	4.8 5.4	5.1	4.6 5.5	5.1
6	3.5	5.4 5.2	5.3	4.7 4.7	4.7
7	3.4	4.9 5.0	5.0	4.5 4.9	4.7
8	3.2	5.2 5.2	5.2	4.6 4.6	4.6
9	4.5	4.2 4.0	4.1	3.6 3.7	3.7
10	4.4	4.3 4.1	4.2	3.5 3.2	3.4
11	4.0	4.4 4.0	4.2	3.7 4.1	3.9
12	3.8	4.0 3.9	4.0	3.9 4.3	4.1
13	4.0	4.3 4.4	4.4	4.0 3.1	3.6
14	4.0	4.0 4.3	4.2	3.9 3.6	3.8
15	3.7	4.5 4.5	4.5	4.5 4.0	4.3
16	3.5	4.2 4.2	4.2	3.4 3.8	3.6

conclusions

Although the dosimeter method is somewhat more precise, it appears that both methods are suitable for most industrial hygiene applications. In addition to their obvious advantage of not requiring a sampling pump, the passive dosimeters are also light, easily constructed, and reusable. They are not, however, suitable for short term, e.g., 15 min. sampling times. While TEA tubes require a low flow pump, they have the capability of measuring NO as well as NO_2 in the same sample and they may be used for short-term sampling. The disadvantage of both methods is that fluctuations of concentration within the sampling period cannot be observed.

acknowledgments

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references

1. **Palmes, E.D., A.F. Gunnison, J. Dimattio and C. Tomczyk:** Personal Sampler for Nitrogen Dioxide. *Am. Ind. Hyg. Assoc. J. 37*:570-577 (1976).
2. **National Institute for Occupational Safety and Health:** Criteria For a Recommended Standard... Occupational Exposure to Oxides of Nitrogen (Nitrogen Dioxide and Nitric Oxide). HEW (NIOSH) Pub. No. 76-149. pp. 147-155 (1976).