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OCT 18 1982

Arthur D. Little, Inc.

October 12, 1982

Mr. James Kuikstad
3M Center
Building 220 - 7W
St. Paul, MN 55144

Dear Mr. Kuikstad:

Enclosed is a copy of the slides for my presentation of "Acceptance of Diffusion Dosimeters Among Industrial Hygienists", at the Cincinnati AIHA meeting in June.

If you have any questions regarding this material please don't hesitate to contact me.

Sincerely,

E. R. Hoyle

E. Robinson Hoyle

ERH:w

Enc.

DIFFUSION DOSIMETER USER SURVEY

Presented by

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3M 105966

PRINCIPLE OF PASSIVE DOSIMETERS

1. Contaminant enters dosimeter by diffusion and/or permeation. The diffusional sampling rate is defined by Fick's First Law of Diffusion or:

$W = DA/L\ (C-C_o)t$ if $C_o = 0$

w = Weight of contaminant
c = Concentration
t = Sampling time
D = Diffusional coefficient
A = Geometric area of chamber
L = Geometric length of chamber

PRINCIPLE OF PASSIVE DOSIMETERS

2. Adsorbed onto activated charcoal

3. Solvent desorbed and analyzed

4. Exposure time and concentration determined amount adsorbed

TYPES OF AVAILABLE DIFFUSION DOSIMETERS

Organic Vapors	3M, DuPont, MSA, NMS
Nitrogen Dioxide	DuPont, MDA, Leak-Tec
Formaldehyde	DuPont, 3M
Carbon Monoxide	3M, Leak-Tec
Chlorine	Span, Leak-Tec

ADVANTAGES OF PASSIVE DOSIMETERS

1. Small and lightweight (e.g., improved wearer acceptance)
2. No calibration or maintenance (e.g., recharging batteries, etc.)
3. Little training necessary for sampling personnel
4. Easy for I.H. to sample large population for exposures

Stricoff, R.S. and C. Summers, *An Evaluation of Organic Vapor Passive Dosimeters Under Field Use Conditions*, 1980.

- 3M-OVM and Abcor differed slightly from charcoal tubes at low contaminant concentrate loadings and for short durations.

Hickey, J.S. and C.C. Bishop, *Field Comparison of Charcoal Tubes and Passive Vapor Monitors with Mixed Organic Vapors*, 1981.

- "...reliably assayed low concentrations of mixed vapors of 20 of the chemicals mentioned equally as well as charcoal tubes, under the conditions encountered."

Jeannot, P.M., B.G. Ward, and D.M. Quick, *A Laboratory and Field Study of Commercially Available Passive Dosimeters for Organic Vapors*, 1981.

- Found a 10-17% variation between their field and laboratory data and a manufacturer's laboratory data.

- "...that there remains an unexplained bias in the performance of these devices."

CONCLUSIONS FROM CURRENT LITERATURE

- The existing field and laboratory data are incomplete (e.g., experimental derivation of diffusion coefficients).

- Very little negative data to discourage potential dosimeter users.

OBJECTIVES OF USER SURVEY

Evaluate diffusion dosimeters' usage patterns in industry.

Diffusion dosimeters' significance with respect to the industrial hygienist's routine air sampling protocol.

SURVEY POPULATION — INDUSTRIAL HYGIENISTS

- Certified by the American Board of Industrial Hygiene.
- Employed in fields other than government, consulting, academic and insurance.

Survey Population	640
Survey Response	211 (33%)

JOB DESCRIPTION

Corporate level I.H.	51%
Division level I.H.	28%
Location level I.H.	16%
Other	5%

INDUSTRY CLASSIFICATION

Chemical	32.7%
Primary Metal	10.4%
Electrical/Electronic	9.4%
Fabricated Metal	6.2%
Petroleum	5.2%
Rubber/Plastic	5.2%

LOCATIONS RESPONDENTS PROVIDED I.H. SERVICE

< 10	44%
10-24	20%
25-49	13%
50-99	9%
100 +	14%

DOSIMETER USE

Organic (charcoal based)	75.8%
Inorganic (non-charcoal based)	39.8%

ORGANIC DOSIMETER USE (75.8%)
BY NUMBER OF EMPLOYEES

< 100	1.3%
100-799	4.4%
800-1,999	11.9%
2,000-3,999	15.6%
4,000-7,999	18.1%
8,000-14,999	11.9%
15,000 +	36.9%

Have you tested organic dosimeters in the laboratory?

YES	68.8%	70.0%	Acceptable
NO	31.2%	30.0%	Inadequate

Indicate your experience with field tests of organic vapor diffusion dosimeters.

Adequate	56.2%
Inadequate or Inconclusive	33.0%

LABORATORY TESTS VS FIELD TESTS

		Field Test Results		
		Acceptable	Inadequate	
Laboratory Test Results	Acceptable	42 (70.0)	0 (0.0)	42
	Worth Field Test	15 (25.0)	3 (5.0)	18
		57	3	60

Do you routinely use organic vapor diffusion dosimeters for sampling?

Benzene	37%
Acrylonitrile	11%
Chlorinated Hydrocarbon (solvents)	54%
Aromatic Hydrocoolant	64%

Do you follow-up high levels measured on organic vapor diffusion badges with charcoal tube and sampling pump?

Always	23.7%
Usually	19.4%
Sometimes	25.0%
Rarely	8.7%
Never	10.0%

Which one of the following statements best expresses your opinion of the value of organic vapor diffusion dosimeters?

Reliable and useful	46.9%
Reliable, but reluctant to use until OSHA/NIOSH approval	25.6%
Undecided	18.7%
Unreliable	6.9%

Which one of the following statements best expresses your opinion of the value of inorganic vapor diffusion dosimeters?

Some unreliable, some reliable	33.3%
Reliable and useful	26.1%
Undecided	25.0%
Reliable, but reluctant to use until OSHA/NIOSH approval	8.3%
Unreliable	3.6%

Do you follow-up high levels measured on inorganic vapor diffusion samples with confirmatory sampling by another method?

Always	11.9%
Usually	20.2%
Sometimes	21.4%
Rarely	14.3%
Never	15.9%

CONCLUSIONS

Diffusion dosimeters have been widely tested by certified industrial hygienists.

Diffusion dosimeters are generally accepted to evaluate the work environment.

- However, the respondents did not rely exclusively upon diffusion dosimeters, with the majority using other methods to confirm exceptional dosimeter results.