



FORM 6747-12

TECHNICAL REPORT SUMMARY

Date
February 12, 1982

TO: TECHNICAL COMMUNICATIONS CENTER - 201-2CN

(Important - If report is printed on both sides of paper, send two copies to TCC.)

Division OH & SP Lab		Dept. Number 1575
Project Diffusional Samplers		Project Number 2701000300
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To L. W. ANDERS		
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SECURITY ► ☒ Open (Company Confidential) ☐ Closed (Special Authorization)	3M CHEMICAL REGISTRY ► New Chemicals Reported ☐ Yes ☒ No	

KEYWORDS:

(Select terms from 3M
Thesaurus. Suggest other
applicable terms.)

OH & SP Division

CURRENT OBJECTIVE:

1. Support 3750 analysis/product effort.
2. Determine sampling rate and calibration data for the chlorine monitor.
3. Finalize the development of the sulfur dioxide monitor.
4. Continue performance evaluation of the 3500 and 3520 with highly volatile compounds and at ppb levels.

REPORT ABSTRACT: (200-250 words) This abstract information is distributed by the Technical Communications Center to alert 3M'ers to Company R&D. It is Company confidential material.

Development on chlorine-sensitive poroplastic proceeds using transmission densitometry as the analytical method.

Product documentation and competitive testing was done for the 3400, 3500 and 3520.

The 3900 sweatpatch assembly was transferred to the pilot plant.

Sampling at the ppb level for EPA applications was begun.

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February 12, 1982

CHLORINE (3760)

The chlorine-sensitive poroplastic film was used to sample a 4 ppm chlorine challenge in an OVM-type configuration. The film was removed from the body and analyzed by transmission optical densitometry. It exhibited a range of approximately 1 to 10 ppm-hours. This was in agreement with an extensive study done on this film by M. L. Langhorst showing a .4-10 ppm-hour range.

Feasibility studies were done using the chlorine-sensitive film in the transparent PVC and nylon cups. Unaided accurate visual detection of endpoint was limited by the transparency of the detector, even when used with a white background. A reflectance densitometer was used directly on the viewing window to quantify the degree of color change. A linear relationship between the change in reflectance optical density and concentration was observed between 1 and 8 ppm-hours.

The user needs for a TWA chlorine monitor can most readily be met by the transmission optical densitometry approach to analysis because the film has been well characterized using this method. The third party work has already measured performance as a function of concentration, temperature, relative humidity, air velocity and interferences. This configuration would require only the determination of the calibration curve for the film in the 3M sampler's geometry.

Investigation of cost and availability of transmission optical densitometers showed adequate instruments available for \$900 - \$1,000. 3M Micrographics Division private labels one such instrument.

Interaction with J. Kvikstad and M. Langhorst continues in an effort to supply information on availability and technical performance for presentation at the February meeting of the Chlorine Institute.

CARBON MONOXIDE (3400)

The MSA diffusional sampling tube performance was observed at constant and variable concentrations, high relative humidities, in the presence of probable contaminants and as a function of readability. The results, documented in a separate report, showed performance within NIOSH accuracy guidelines when the product is used within concentration ranges specified by the manufacturer.

The testing facility for the 3400 was transferred to building 552. Refired disks continue to be supplied by the lab until the furnace installation is complete.

SWEATPATCH (3900)

The assembly procedure and materials have been transferred to building 552 with substrate preparation being done in the laboratory.

The inventory for continued support of outside evaluation was increased this month to 1200.

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3M 009515

February 12, 1982

SWEATPATCH (Continued)

Validation of the method is being done by Dr. Michael Phillips and others. In addition to its demonstrated efficacy for measuring alcohol levels, they have recently shown feasibility for evaluating pesticide levels. Recently, Dr. Phillips had all the claims allowed on his patent for this device. L. W. Anders, E. Okubo and M. Phillips are discussing terms for licensing.

DIFFUSIONAL SAMPLING AT ppb LEVELS

The increasing interest in using diffusional samplers for evaluating concentrations less than a ppm has initiated work to technically assess the applicability of 3M monitoring products at these low levels. Initial spiking of organic vapor monitors with ethylene dibromide (PEL of 130 ppb) has shown detection with electron capture as low as 2 micrograms with a possible 100 fold more sensitivity possible. Performance under dynamic conditions are ongoing.

COMPETITIVE EVALUATION OF THE 3500 AND 3520, DuPONT AND MSA

The accuracy and precision of the 3M 3500 and 3520 organic vapor monitors, the DuPont badge with back up and the MSA Vapoguard sampler were determined when sampling challenges of toluene and methylene chloride. Table One shows that DuPont and 3M had sufficient accuracy and precision and MSA's performance was poor, but was evaluated only on methylene chloride. It was also found that the accuracy and precision of the 3M and DuPont samplers were found unaffected of a 9 day storage at room temperature after sampling methylene chloride. The 3M storage technique was clearly more convenient than the competitors.

3500/3520 PERFORMANCE WITH HIGHLY VOLATILE COMPOUNDS AND WITH TRANSIENT CONCENTRATIONS

Vinyl chloride and methylene chloride challenges are being sampled to document the organic vapor monitors' performance sufficiently to meet validation criteria acceptable to potentially large users of such devices for sampling highly volatile compounds. Simultaneously, DuPont and MSA samplers are being evaluated.

The data has been collected and calculations completed on a study of the response of diffusional sampling devices to short high concentration pulses (1.5 to 24 seconds). The final paper, now being written, concludes that diffusional samplers accurately evaluate even these concentration excursions. Heretofore, there has been frequent hypothesis that diffusional devices were inadequate under such conditions.

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TO PROTECTIVE ORDER

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February 12, 1982

SILICA GEL AS AN ABSORBENT

Webs of silica gel/teflon were successfully prepared. When used to sample a challenge of diethyl amine, isobutyl amine and tertiary butyl amine, an unacceptably low recovery coefficient (<70%) was observed for the grade 59 Grace silica gel. Simultaneous work by G. Johnson and D. Hakes of CRL Analytical with hydrazine showed the same poor desorption phenomenon with water or acidified water.

If this work is continued the behavior of grade 3 (smaller pores) and the percent teflon would be among the first parameters to be studied for their effects on desorption.

FIELD TEST APPARATUS

The plexiglass device designed by H. E. Mullins and P. Sullivan was shown to give uniform results throughout its length. When spiking was done through the injection sites the monitors reflected accurate sampling of such spikes in this apparatus.

Because of the large cross sectional area it was found that a flow of 200 lpm was required to avoid diffusional starvation.

PRODUCT RELATED INTERACTIONS

- Supplied G. Johnson with materials for a study of contamination potential of capped OVM's versus charcoal tubes sealed with their polyethylene caps. He dramatically illustrated the gas tight seal of 3M monitors which did not allow any of 12 contaminants at high concentrations to leak into the sampler. In contrast, the xylene, toluene, methylene chloride, acetone, MEK and seven other compounds went through the caps on the charcoal tubes and absorbed on the charcoal in large quantities.
- A review article on diffusional samplers was being written by J. Perkins of the U of Alabama for the National Academy of Sciences and the AIHA journal. Much technical information was supplied.
- T. Samson, corporate hygienist at Occidental Oil Shale contacted us as a result of the API presentation in June. Requested information was supplied.
- Product literature and technical papers were forwarded to Dr. H. Beauleu at U of Colorado for a short course he was teaching on diffusional sampling.
- An OVM seminar was given to 72 industrial hygienists at the Carolinas AIHA sectional meeting. A diffusional sampling seminar was given at the OSHA Training Center in Chicago.

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3M 009517

February 12, 1982

PRODUCT RELATED INTERATIONS (Continued)

- A comparison of monitor units shipped from 552 and units billed was done. AN AVERAGE OF 8% FEWER units were billed, than on record for shipped, for each month of 1981. This discrepancy is under investigation.
- Supported analytical services via proofreading and some sample log in.

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TABLE ONE

COMPARISON OF DIFFUSIONAL MONITORS

SAMPLING KNOWN LABORATORY CHALLENGES

COMPOUND	KNOWN CONCENTRATION (ppm)	MEASURED CONCENTRATION (ppm)		
		3M	DuPONT	MSA
Toluene	76.1	74.9 $\pm$ 1.9	75.6 $\pm$ 1.4	---
Toluene	24.2	23.6 $\pm$ 0.4	26.8 $\pm$ 0.9	---
Methylene Chloride	127	116 $\pm$ 4	106 $\pm$ 6	78.7 $\pm$ 14
Methylene Chloride (analyzed 9 days after exposure)	128	120 $\pm$ 4	106 $\pm$ 6	89 $\pm$ 5
Methylene Chloride	131	140 $\pm$ 7	132 $\pm$ 6	---

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