A Trial of Terylene Overalls for Lead-Acid Electric Accumulator Pastors

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A comparison of Terylene and cotton overalls has been made in the lead-acid electric accumulator industry. Six hand pastors wore personal lead-in-air samplers for two weeks. Three of the men wore cotton overalls the first week and Terylene overalls the second; the other three men wore Terylene overalls the first week and cotton overalls the second. The mean lead-in-air concentration in the breathing zone when the men wore Terylene overalls was slightly greater than when they wore cotton overalls but the difference was not statistically significant. Significant differences of lead-in-air concentrations were found between men and between the two weeks but not between days within the weeks. The lead-in-air concentration did not increase during the week. Neither a change to Terylene overalls nor more frequent laundering of overalls should be recommended for pastors in this factory on the basis of this study.

Bloor and Dinsdale (1962) studied dust concentrations in the breathing zones of operatives in the pottery industry both in a casting shop and making earthenware. When Terylene overalls were worn in place of cotton overalls the mean dust concentrations were reduced by 66% and 34% respectively.

In the manufacture of lead-acid electric accumulator plates, a paste containing lead oxide powder is pressed into the meshes of a lead grid. Lead oxide dust is produced during this process, especially if paste spillage is allowed to dry (Dreessen, Edwards, Reinhart, Page, Webster, Armstrong, and Sayers, 1941). As it has been suggested that Terylene overalls should be worn by lead workers, the lead-in-air concentrations of hand pastors wearing both Terylene and cotton overalls have been investigated.

Method

In an electric accumulator factory employing 15 hand pastors, six, selected by the foreman, wore personal samplers¹ (Williams, 1967) every working day (Monday to Friday) for two consecutive weeks (Fig. 1).

The personal sampler (Fig. 2) consists of a sampling head, worn on the lapel, connected by a plastic tube to the pump unit, worn on the belt. Contaminated air is

drawn through a glass-fibre filter-disc held in position by a plastic cap. A flow rate of 2 l./min. is indicated by a ball in an internally tapered transparent tube. The pump is driven by a governed motor from rechargeable batteries having sufficient capacity for an eight-hour run. A window in the case exposes an hour-meter. A socket and switch plug are used to start the motor, and the same socket is used for connecting the battery charger, which converts mains voltage A.C. to charging voltage D.C. The charger has an on-off switch and a switch marked 14 H for charging overnight and 64 H for charging over a weekend.

During the first week three of the men wore their usual cotton overalls; the other three men wore Terylene overalls weighing 4½ oz./sq. yard, made to the design of Bloor and Dinsdale (1962). All overalls were laundered at the weekend and reissued so that the men who wore cotton the first week wore Terylene the second week and *vice versa* (Table). A cotton cap, rubber apron, and rubber boots were also worn (The Electric Accumulator Regulations, 1925).

One man pasted two types of plate during the experiment, one of each type on alternate days of the week starting with the same type each Monday. Each of the other men pasted the same type of plate every day. The numbers of plates pasted each day by each man were recorded.

Six personal samplers and six pasting benches were used. During the first week each man was allocated at random a different personal sampler and a different bench each day. This allocation was repeated in the second week. The personal samplers were switched on whenever the men approached their work benches and

¹Cassella & Co. (1966).

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FIG. 1. Hand paster wearing personal sampler.

FIG. 2. The personal sampler on charge.

switched off whenever they left them. At the end of the day the personal sampler filter-discs were renewed, the hour meters read, the speeds timed, and the flows checked with a calibrating device and adjusted, where necessary, to lie within the range 2.0 ± 0.2 l./min.

(Williams, 1967). The samplers were recharged overnight. The amount of lead on each filter-disc was estimated polarographically and the mean concentration of lead-in-air was calculated from the hour meter readings for a flow of 2 l./minute.

TABLE
LEAD-IN-AIR CONCENTRATIONS (MG./M.³)

Man	First Week					Mean	Second Week					Mean	Grand Mean
	M	Tu	W	Th	F		M	Tu	W	Th	F		
	Cotton						Terylene						
1	0.265	0.228	0.183	0.171	0.244	0.218	0.157	0.127	0.190*	0.152	0.237	0.173	0.195
2	0.172	0.219	0.115	0.212	0.194	0.182	0.153†	0.121	0.112	0.111	0.163	0.132	0.157
3	0.348	0.258	0.186*	0.174	0.146	0.222	0.190	0.271	0.223	0.160*	0.116	0.192	0.207
	Terylene						Cotton						
4	0.144	0.329	0.097	0.152	0.123*	0.169	0.158	0.147	0.105	0.125	0.158	0.139	0.154
5	0.226	0.252	0.128	0.315	0.354	0.255	0.127	0.256	0.248	0.206	(0.201)	0.208	0.231
6	0.785	0.731	0.259	0.466*	0.644	0.577	0.393	0.352	0.347	0.122	0.263	0.295	0.436
Mean	0.323	0.336	0.161	0.248	0.284	0.271	0.196	0.212	0.204	0.146	0.190	0.190	0.230

*Sampler running fast.

†Based on mean daily time.

() Estimate of missing value.

Results

The Table shows the lead-in-air concentrations obtained. On five occasions the hour meter speeds and flow rates of two samplers were found to be high following the overnight charge, perhaps because the battery voltage was low during calibration the previous evening. For the purpose of the calculations it was assumed that the hour meter speed and flow rate were increased proportionately. One of these two samplers was replaced by a spare at the end of the first week. The other failed to operate on the last day and the readings on that day were lost. An estimate of the missing lead-in-air concentration was made by calculating the value that would minimize the error variance of the data.

One of the hour meter readings was rejected as the man had forgotten to switch off his sampler at dinner-break. The reading used was the mean of the other nine readings from the same man.

The number of plates pasted by each man was almost constant from day to day.

The mean lead-in-air concentration when the men wore Terylene overalls was 0.250 mg./m.³² compared with 0.211 mg./m.³ when they wore cotton overalls. An analysis of variance showed the difference (17% of the mean) was not statistically significant at the 0.05 level. The experimental

sensitivity was such that a difference in mean lead-in-air concentration between Terylene and cotton of 18% would have been significant at the 0.05 level. There were, however, statistically significant differences of lead-in-air concentrations between men and between the two weeks ($P < 0.001$) but not between days within the weeks.

Discussion

Applicants for employment as pasters in this factory were selected, both by personnel and medical officers, for smart appearance and personal cleanliness. Time is allowed for sluicing down rubber aprons at the bench, and supervisors maintain a high standard of cleanliness. This may account for the absence of any observed benefit from Terylene overalls.

Dinsdale (1963) found that replacing the dirty cotton overalls of pottery workers by clean ones reduced the dust concentration in the breathing zone by 50%. The lead pasters' overalls are laundered once a week. The absence in the present study of statistically significant differences between the days within each week, with no indication of an increase in lead-in-air during the week, suggests that no reduction of the lead exposure of these hand pasters would be obtained by laundering more frequently.

Large differences in lead-in-air concentrations between men doing similar jobs are of interest. Such differences have also been observed in another survey, to be published.

Reasons for the differences between weeks (every man had a lower mean reading during the second week) are also of interest but are not known.

²It may be noted that the T.L.V. of 0.20 mg./m.³ using static samplers is based on a 'normal workday' (American Conference of Governmental Industrial Hygienists, 1965). The mean daily hour meter time was about 5½ hours. If the 'normal workday' is taken as eight hours, and no other lead exposure occurred, the lead-in-air concentration obtained with personal samplers for Terylene overalls, adjusted to the 'normal workday', is 0.17 mg./m.³.

It was concluded that in this factory, where there is a high standard of cleanliness, no change to Terylene overalls should be recommended, and laundering overalls once a week is sufficiently frequent.

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