

PUNCTATE BASOPHILIA AND LEAD ABSORPTION

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This record illustrates the use of punctate basophil counts over a period of 12 years on workers exposed to lead. Personal monitoring is essential. Analysis of lead in air is important, but has limitations. Factors have to be taken into account besides threshold limit values. Apart from variation in personal vulnerability, exposure alters with hours of work, posture, speed, depth of respiration or the way a job is engineered. Concentration of a toxic substance in the atmosphere may vary with draughts. With dust, particle size is all important and this can change with methods of machining. Dust can accumulate on clothes and, shaken off, produce a local concentration not detected by sampling six feet away. Danger can thus be taken home.

Methods of objective personal monitoring include measurement of excreted lead in urine and faeces, and urinary coproporphyrins and punctate basophilia or anaemia. All have some disadvantages for routine examination of workers in a factory.

Spot urine samples are an uncertain warning and 24 hours specimen impracticable. Urine must be fresh for coproporphyrins. Repeated veni puncture for blood lead estimation has objections, and micro methods are difficult. Since only a pin prick is required to check anaemia and punctate basophilia, it has advantages for screening.

The disadvantage is the great variation from day to day, so that frequent counts are needed for a reliable warning as far as an individual is concerned. Some cases of heavy absorption never show much punctate basophilia. On the other hand, the average count on a group of workers is a sensitive index of change in exposure. Standards have been suggested as to threshold levels of punctate basophilia, varying between a 1,000 to 10,000 stiple cells per million red blood cells. Different results will be obtained if different methods of staining and microscopy are used. What matters is that with a given technique a warning change is quickly noted.

In the department described, a man would be taken away from exposure if he had a count

of 5,000. Those with 1,000 to 5,000 were kept under more frequent observation and removed if this persisted, or there were extra indications.

The hazard occurs making motor car bodies of sheet steel panels. Manufacture falls into three phases. Firstly panels are stamped (Fig. 1). Next is assembly, by welding them together into subassemblies which are then joined together on a trolley and hitched to a conveyor line. (Fig. 2). Thirdly the body is prepared for painting by 'metal finishing' (Fig. 3). Fourthly this consists of knocking out small irregularities, smoothing the metal with files and by powered grinding tools (Fig. 4). Although limited by design, welded joint lines show in places.

These patches are covered over with solder, a tin and lead mixture (Fig. 5), and ground smooth where practicable by filing (Fig. 6), which does not produce any fine dust. In some awkward corners grinding machines have to be used (Fig. 7). These produce dust particles less than 5 microns in diameter, a respirable lead hazard. Solder application is not dangerous. Whereas the melting point of lead is 618°F with little fume until a higher temperature, solder is workable at 450°F.

A shop plan of the flow of production show two areas where solder machine grinding occurs (Fig. 8). While the car body moves down the conveyor lines, assembly and metal finishing are performed, and solder patches applied. Originally full time grinders worked behind screens at one end of the shop wearing filter respirators. Further down the line in the touch-up area, final metal finishing is done to the entire surface, including solder patches; minor defects may be removed by repair solderers.

Men from these two areas were examined periodically using punctate basophil and haemoglobin checks, so also were the men applying solder. A chart (Fig. 9), showing the latter's average basophil count over several years compared with the average of the shop is evidence of low lead absorption, although the few torch solderers on repair work in the touch-up area show a higher average.

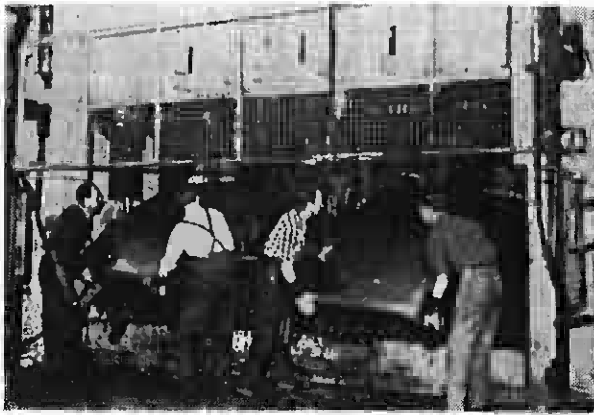


Figure 1.



Figure 4.



Figure 2.

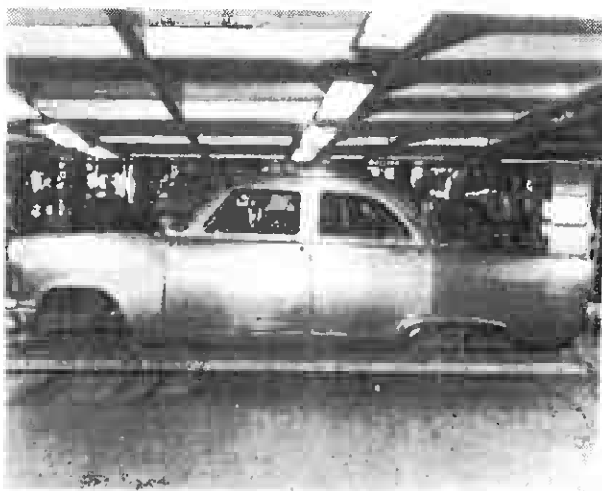


Figure 3.



Figure 5.



Figure 6.

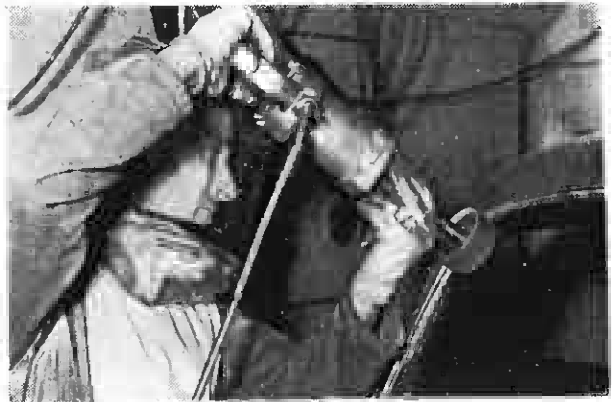


Figure 7.

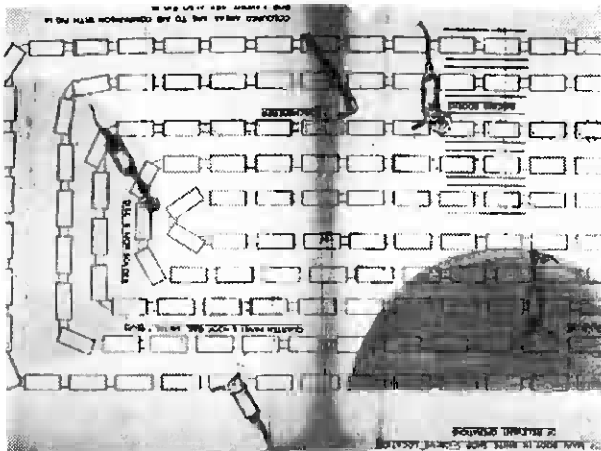


Figure 8.

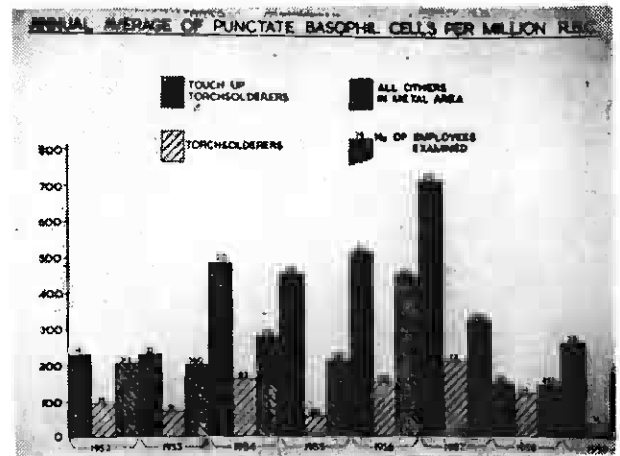


Figure 9.

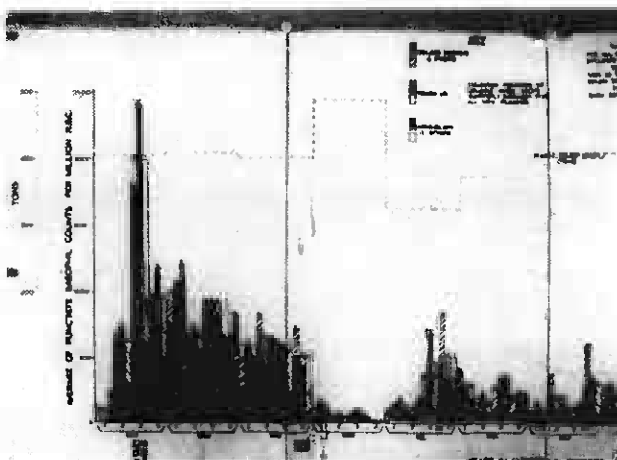


Figure 10.

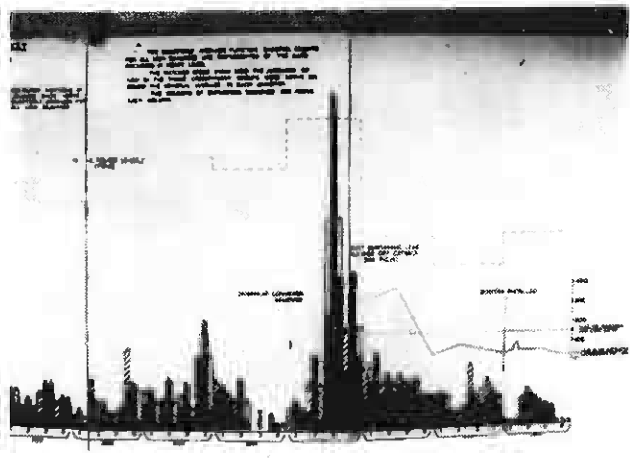


Figure 11.

Another chart (Fig. 10) shows the average for all the workers in the shop over a period of 12 years, recorded for each quarter. Within the broad column showing this, are three narrow columns which show the average of the men in the two danger areas, and all others in the shop.

The hazard had been known pre-war but on resuming peace time manufacture, rules had been forgotten. A case of lead poisoning occurred, and it was found that the average punctate basophil count was high. Discipline was tightened up and for some years there were no further cases, the average count remaining low.

Suddenly, in the third quarter of 1956 it rose (Fig. 11). There was no increase in overtime, neither the number of solder patches nor the speed of the line had increased, nor the working position of operators changed.

The high counts were around the touch-up area: the average had been above general shop level here on previous occasions, men had temporarily been removed from this area, when repair work had increased with the introduction of a new model. This time there was no such reason for an increase far greater than before.

Air analyses were done for lead in particles less than 5 microns, which showed atmospheric contamination corresponding to the area of high counts (Fig. 12). A thick deposit of fine dust was found on some roof trusses and catwalks. Analysis revealed lead content of 11%. Some months before there had been a reorganisation of cleaning responsibility. No one had cleaned this small area. Footprints showed much dust had been kicked off by men

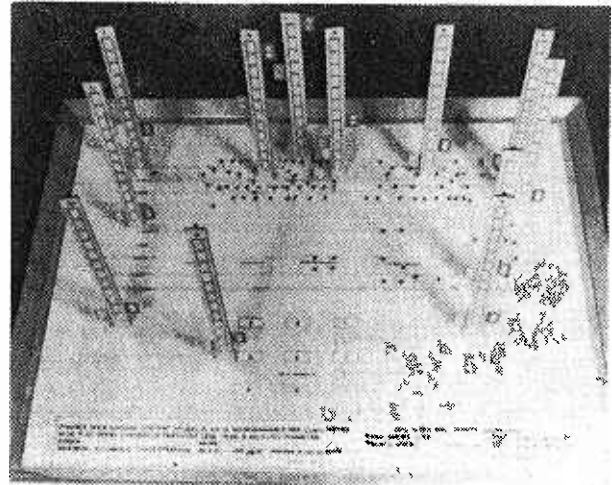


Figure 12.

working near the roof shortly before. After many months accumulation it had fallen down on the touch-up men who had sporadically produced it.

Due to a minor breakdown in housekeeping a dangerous situation had occurred after several uneventful years. The danger was spotted in time to prevent cases of frank lead poisoning. However, efforts were made to confine future discing inside booths where exhaust ventilation would stop any further drifting dust. Periodic sampling was done outside booth openings to make sure the system was working.

A postscript must be added. Some months after the period under review, punctate basophil counts again increased. It was found that shortly before, part of the roof had been raised, and a gap had been left between it and the top of the extractor trunking of one booth. Continued personal monitoring had been justified again.