

Monitoring Employee Exposure to Hazardous Airborne Dusts

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The Occupational Safety and Health Administration initiated the Target Health Hazards Program in January 1972. Among the target pollutants were five hazardous airborne substances; asbestos, lead, silica, cotton dust and carbon monoxide. Asbestos, silica and cotton dusts are hazardous because microscopic particles can find their way into the lungs of workmen and cause various lung disorders.

Since microscopic particulates create the problem, special techniques and instrumentation are required for environmental control. Ambient monitors are not considered adequate because a fixed device cannot monitor the exposure of a particular worker as he moves about during the course of his duties. The alternative is personal monitoring.

Procedures have been set by the Department of Labor through its Occupational Safety and Health Administration (OSHA) in cooperation with the National Institute of Occupational Safety and Health (NIOSH) of the Department of Health, Education and Welfare. OSHA representatives, empowered by the Congressional Williams-Steiger Act of 1970, can enter a plant without warning, examine records, and

conduct tests according to prescribed procedures. Compliance officers, at their discretion, may order personal monitoring for all employees or a statistical sampling of some.

Standards have been published in the *Federal Register*, indicating in mg/m^3 the amount of dust to be tolerated. In general, the allowable concentration varies according to the composition of dust. OSHA has set safety standards for all dust hazards, since controls are not limited to those dusts in the Target Program. Virtually any form of dust in the microscopic range must be controlled, including those referred to collectively as nuisance dust.

Silica dust may be found in various manufacturing processes such as minerals, ceramics, abrasives, coal, glass, potteries, foundries, and in stone cutting and finishing operations. Cotton dust is found throughout the textile industry. Nuisance dusts are nearly everywhere. Most of the particulates listed in the *Federal Register* can be measured gravimetrically. This means that samples are collected on a suitable filter which can be weighed both before and after use on an extremely sensitive balance.

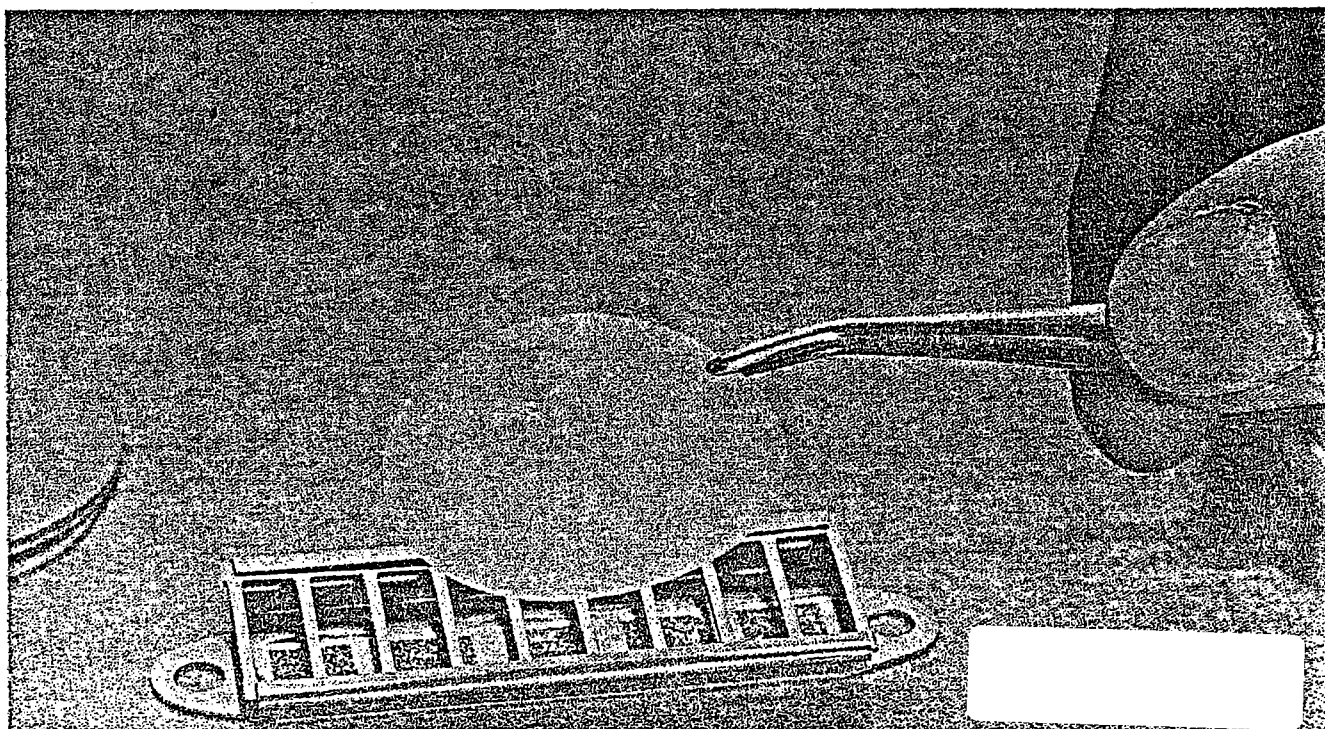


Fig. 1 Filter membrane exposed to ionizing radiation.

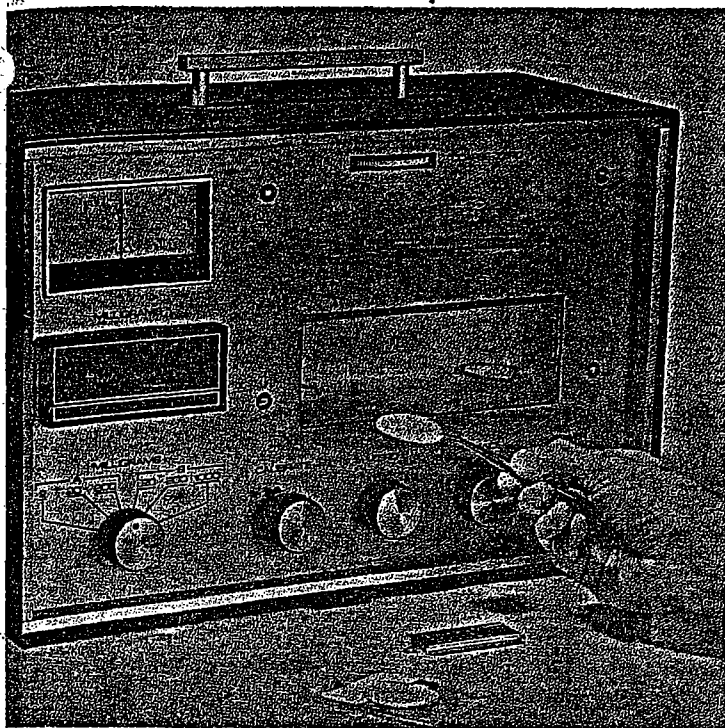


Fig. 2 Electrobalance



Fig. 3 Personal sampler as worn by workman.

The volume of air passed through the filter and the increase in the weight of the filter membrane allows the results to be reported as mg/m^3 .

Equipment required is an Electrobalance and a personal sampler for each worker to be monitored. The sampler consists of a portable sampling pump, filter discs, a two-piece filter cassette, and a 10-mm nylon cyclone. Filters are made of PVC, cellulose esters, or silver, depending on the composition of the contaminant to be collected. The filters are supported in the cassette by a porous cardboard filter pad or a perforated metal screen.

Loading the cassette takes only a few seconds but requires some care. The membrane filter is removed from its container and handled with unserrated non-magnetic metal forceps only, not with the fingers. The disc is then passed across a radioactive ionizing unit at a distance of less than one inch to remove static electricity, Fig. 1. Both surfaces are treated in this manner. The disc is placed carefully on the Loop A stirrup pan of the Electrobalance, Fig. 2. The weight is recorded. The disc is now placed on the filter pad or support screen already in the cassette. The assembled cassette is clipped to the employee's shirt or lapel at chest height, Fig 3, and connected to the portable pump attached to his belt.

When it is necessary to make a distinction between total dust and dust which actually gets into the lungs, the cyclone unit is used in conjunction with the filter holder. This device automatically eliminates all particles larger than about 10 microns in diameter, leaving the smaller ones to be deposited on the filter. The worker switches on the pump for the time specified in the appropriate OSHA data sheet. The pump has been preset and calibrated by the company industrial hygienist for the required sampling rate. A representative sample of the dust in the air breathed by the employee is collected on the filter.

At the end of the period, the filter is removed by disassembling the cassette and pushing a small rod or wire through the outlet hole below. The edge of the filter is then grasped with the forceps, exposed to the ionizing radiation, and reweighed. During the radiation exposure, the filter membrane should not be inverted since particles of dust might fall off. Instead the ionizing unit is passed over the membrane filter. The difference between the two weighings is noted. The time weighted average (TWA) is then calculated and compared with the threshold limit value (TLV) found in the latest edition of the *Federal Register*. ☉

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