

Occupational exposure to metallic dusts and noise in factory producing metal alloys

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Introduction

A factory producing notches for circular metal blades used for cutting cement and asphalt was examined for metal dusts in air and, noise levels. Concentrations of metals in the urine of the workers were also determined.

The notches were produced from various mixtures of metal powders and diamond grits. The basic steps for the production of the notches are as follows:

1. Weighing raw materials (metal powders, diamond grits)
2. Mixing raw materials
3. Drying
4. Powder preparation prior to pressing
5. Pressing
6. Firing of the notches
7. Cleansing
8. Attachments of notches to circular blade

It was observed that the most serious problems due to metal dust were in the “Alloy Room” (section A) where weighing, mixing and drying of metal powders occur and in the “Granulation Room”(section Z) where powder preparation prior to pressing occurs. Weighing of diamond grits occurs in section B. In section C, pressing, firing and cleansing occur, while in section D attachment of the notches occurs.

Of the many metal powders used, those that are of concern were **cobalt** and **nickel**.

In addition, **noise** as a source of irritation was especially pronounced in section E where flattening of the metal disks occurs.

Methods for the measurement of metal concentrations in air and in urine

Air samples (about 200lt) were collected on 0,8 µm cellulose-ester filters. The filters were extracted with aqua regia in close vessels and the diluted extract was analysed for cobalt and nickel using Graphite Furnace Atomic Absorption Spectroscopy. Urine samples were collected at the end of shift at end of workweek. The samples were acidified with acetic acid and diluted prior to analysis for cobalt and nickel using Graphite Furnace Atomic Absorption Spectroscopy.

Methods for the measurement of noise

For the measurements of noise level, integrating echometers were used according to ISO R-1999. The calibrated echometers were placed 160 cm above floor level before measurements were made in different sections of the plant.

Results and Conclusions

1. Noise

Noise levels (L_{eq} dBA) by sound level meters and noise dose meters measured in:

- section A ranged from 80,4 to 89,5 dB
- section B from 78,2 to 86,4 dB
- section C from 76,5 to 85,0 dB
- section D from 90,7 to 95,9 dB
- section E from 93,6 to 96,6 dB

(See diagrams (1) and (2) for sections D and E respectively)

Audiometric tests were performed on 26 production workers. Of these, 17 (65,8%) exhibited a loss of hearing ability at 4000Hz in both ears. This represents, according to Merluzzi, an average hearing loss of 51 dB.

2. Air

- Initial measurements of Co and Ni in air in section A show elevated concentrations, especially for Co, but also a large difference between two portable measurements. Following corrective measures (local exhaust systems, strict adherence to work guidelines) a decrease in the concentration of these elements in the air was observed. In addition, the smaller difference in the concentration between the measurements was attributed to the better control of the process.
- The same downward trends are observed for Co and Ni in sections B and Z.
- In the case of Co it was observed that (despite the decreasing trend) the concentrations still remain above the TLV-TWA value of 0.02 mg/m^3 (2003-ACGIH).