CASE STUDIES

DENTAL LABORATORY – CAPTURING POLLUTANTS AT SOURCE

1. Organisations involved

Primary health insurance fund (CPAM) laboratory in Lyon — Regional health insurance fund (CRAM) Rhone-Alpes.

2. Description of the case

2.1. Introduction

Certain dusts, silica in particular, can cause serious diseases in dental laboratory technicians. By equipping all its workstations with appropriate capture systems, the dental prosthesis laboratory of the Lyons Primary Health Insurance Fund (CPAM) now provides each member of its team with the best possible protection.

Dental laboratory technicians are exposed to numerous pollutants that could cause occupational diseases in the medium or long term, such as bronchitis, asthma, silicosis and other respiratory complaints.

Silicosis is a serious lung complaint caused by the inhalation of silica dusts. Silicosis and pulmonary fibrosis, diseases affecting the miners of old, can affect dental laboratory technicians. Exposure occurs chiefly during the preparation of moulds (refractory coatings), during the sanding of parts and when performing finishing operations (scraping).

Dusts of non-precious alloys (cobalt, chromium, nickel, etc.) and methyl methacrylate vapours (methacrylic resins) can be added to the silica. However, the CPAM laboratory has not used nickel-chromium alloys containing beryllium for some time. This metal, used even today in some laboratories for its high resistance to deformation, is extremely toxic. It is likely to cause allergic symptoms but also respiratory complaints. Each stage in the production of a dental prosthesis can entail the inhalation of a number of harmful substances. At present, the most effective means of combating the risk of inhalation of noxious substances is to capture pollutants at source. For this purpose the CPAM laboratory in Lyons has installed an exemplary ventilation system. All polluting workstations have been equipped with collecting systems connected to one of the two centrally controlled exhaust units via collection networks.

2.2. Aims

The objective of the CPAM laboratory in Lyons was to eliminate the health risks for dental laboratory technicians by capturing the pollutants at source.

2.3. What was done, and how?

The dental prosthesis laboratory of the CPAM in Lyons has 34 laboratory technicians and the dental team has 29 dentists. In 2001 the laboratory initiated a programme to equip polluting workstations with an effective system for capture at source. The main difficulty faced was deciding which type of ventilation system to install. The choice was between a central exhaust ventilation system installed with the discharge outside the laboratory, or exhaust devices with a filter at each workstation but with discharge inside the laboratory. The chemistry laboratory of CRAM Rhone-Alpes advised the dental laboratory to equip all polluting workstations with a collecting system connected to one of the two centrally controlled exhaust units via collection networks. The chemistry laboratory not only took part at the project design stage, but also during validation of the systems, based on measurement of the capture rates defined beforehand as result targets. Accordingly, each assembly and bench finishing station was equipped with a capture system incorporated in the anchor.

The scraping stations for ‘skeleton’ prostheses (prostheses with a metallic base), where the presence of cobalt increases the toxic risk, were placed in ventilated enclosures (scraping

boxes). Preparation of the coatings, which involves handling highly silicogenic products for short periods, is performed under exhaust ventilation, using a swivelling collector for ceramic work and by working under a fume cupboard (suction hood with a raisable screen) when handling dental prostheses.

Figure 1. Preparation of coatings and de-moulding of cylinders now takes place under a suction hood to reduce dust emission

In the same way, the operation of filling bronze moulds with resin and compressing it, which causes the emission of noxious, flammable methyl methacrylate vapours, is now performed under a ventilated hood.

Some equipment, such as polishing and sanding machines, has been altered to allow it to be connected to the exhaust ventilation network. The equipment previously used had a filtration system incorporated in the polishing and sanding machines which filtered the dust and kept it in a bag, and then discharged the filtered air straight into the laboratory. This system was subject to numerous leaks and there was a risk that the air discharged into the laboratory could still contain some dust. The new filtration system comprises two units that remove dust by a wet path and then discharge the polluted air outside the building. The ventilation system also includes two units to allow fresh air to be introduced into the building. This air is warmed in winter by an electric heating unit located in the suspended ceiling in the stairwell, and cooled in summer by a refrigeration unit placed on a terrace.

The fresh air is distributed in each room by circular vents in ducts positioned in the suspended ceiling. Each ventilation unit is controlled by a programmable logic controller which constantly determines the exhaust ventilation delivery needs (operating startup of one to five turbines) and adjusts the inflows of fresh air accordingly. This permits optimum exhaust ventilation operation without excessive energy expenditure.

2.4. What was achieved?

When the CPAM in Lyons set up this system, it was considered very innovative to connect all the workstations to two centrally controlled collector networks leading into two exhaust ventilation units in a plant room, and with the air discharged outside the building after purification. This system therefore helps eliminate pollutants at source. The whole system meets the requirements of the Labour Inspectorate, the occupational medicine department, the occupational safety and health (OSH) organisations, management and the personnel. The system was installed as part of a larger renovation of the laboratory and required a total investment of about EUR 300 000.

The new ventilation system has changed certain habits, but everyone in the firm is now convinced of the health benefits. The CPAM dental prosthesis laboratory in Lyons has also shown that it was possible to comply with occupational health and safety requirements, despite the constraints due to its location in an old building in the heart of the city centre. The dental prosthesis laboratory is today a benchmark for all the laboratories in the Rhone-Alpes region.

Problems faced

The CPAM dental laboratory is located in an old building in the centre of Lyons, which complicated the task of installing the new exhaust ventilation system. For example, it was a challenge to find a room in this old building to install the exhaust ventilation units so as to protect the staff from the noise generated by the equipment.

Also, to be able to discharge air outside but not via the front of the building, a duct and a chimney running along the building were created to remove the treated air via the roof — no mean task considering that the laboratory is on the second floor of a seven storey building. Finally, to allow fresh air to enter, air intakes were created and two air production units were installed: one in a suspended ceiling and the other on the terrace. There was also some difficulty in getting the laboratory staff to adapt to the new work methods required by the new exhaust ventilation system. For example, there was some reluctance on the part of staff to work in enclosed boxes. On other finishing stations, the exhaust ventilation system incorporated in the anchor is fitted with a small cover allowing channelling of the exhaust ventilation. Initially, staff members preferred to remove the cover in some cases, which greatly reduces the quality of exhaust ventilation. However, these reservations disappeared over time, and all staff are now convinced of the value of all these improvements made to their working conditions.

2.5. Success factors

The success of this initiative is largely due to the commitment of the management of the CPAM laboratory. Indeed, management was a strong driving force in planning and implementing this system for exhaust ventilation of pollutants at source, and it has also subsequently equipped another smaller laboratory with the same system.

2.6. Further information

Contact information:
CRAM Rhone-Alpes
Jean-Claude Osternaud
Technicien conseil
35, rue Maurice Flandin
69436 Lyon Cedex 03
FRANCE
Tel. +33 478432243
E-mail: jcosternaud@cramra.fr
Internet: http://www.cramra.fr

2.7. Transferability

This action can be transferred to other laboratories taking into account all the constraints of each building and workplaces.

3. References, resources:

- http://osha.europa.eu/en/publications/reports/TEWE09001ENC