

# Exposure to nitrous oxide is no laughing matter

*Environmental monitoring of nitrous oxide during dental anaesthesia* K. A. Henderson, and I. P. Matthews  
*Br Dent J* 2000; 188: 617-619

## Aim

The study was carried out to see if levels of nitrous oxide in dental theatres and community dental clinics were being controlled in accordance with the Control of Substances Hazardous to Health Regulations.

## Setting

A multi-centre study looked at exposure levels in a dental teaching hospital and two community dental clinics in the South Wales area between 1997 and 1998.

## Methods

A MIRAN infra-red spectrophotometer was used to measure static levels of nitrous oxide during general anaesthesia and conscious sedation. NIOSH method 6600 was used to collect personal samples of the individual administering the anaesthetic.

## Results

The results showed compliance with the regulations when averaged out over an 8 hour time weighted average. However, over short periods of time peak concentrations of up to 1190 ppm were observed through static sampling, and up to 734 ppm through personal sampling.

## Conclusions

The results highlighted the need to provide adequate control measures such as anaesthetic gas scavenging, to reduce

occupational exposure to dental staff in dental operating theatres and community dental clinics, therefore providing a safe working environment.

## In Brief

- A community dental clinic outside of the hospital environment without gas scavenging was found to have unacceptably high exposure levels, underlining the importance of scavenging.
- The importance of patient throughput upon environmental levels was highlighted by measurements in a community dental clinic, within a hospital, where exposure levels during a general anaesthetic list were unacceptably high, despite gas scavenging.
- The sessions we observed did not last in excess of about 3 hours. However, approximately half of the sessions monitored had associated exposures grossly in excess of the exposure limit for 8 hours exposure. Thus, any individual working in theatres in excess of 3.4 hours could exceed standards even in a scavenged theatre.
- The General Dental Council and the Royal College of Anaesthetists through recent reports on the administration of Anaesthetics, have emphasised the need to comply with the Control Of Substances Hazardous to Health (COSHH) Regulations 1999.

## Comment

The principal occupational health hazards associated with nitrous oxide exposure of healthcare workers are the potential for effects upon the bone marrow caused by the depression of the function of vitamin B12, diminished reproductive health, and abusive self administration.<sup>1</sup> Boivin recently conducted a meta-analysis of the risk of spontaneous abortion associated with occupational exposure to anaesthetic gases concluding that the relative risk was 1.48 (95% CI 1.4 to 1.58) from the 19 reports reviewed, or as high as 1.9 (95% CI 1.72 to 2.09) when restricted to the six studies considered to have the highest validity.<sup>2</sup> Boivin discusses that these associations may be due as much to biases from confounding variables and response rates, but that the concordance with animal data suggest a real risk may be present. These studies of reproductive effects have not included quantitative exposure data and were in settings before gas scavenging was in widespread use. Bone marrow toxicity has been demonstrated in male dentists exposed to nitrous oxide in high concentration, greater than 1800 parts per million.<sup>3</sup> Nitrogen oxides are also of interest in relation to their

wider environmental effects and interaction with ozone.<sup>4</sup>

Henderson and Matthews present the results of an environmental hygiene survey of nitrous oxide exposure of healthcare staff in hospital and community dental practice. While it is reassuring to note that in theatres with gas scavenging the personal exposures were within the recommended exposure standards, it is of some concern that this was not the case in the community setting. The rising levels of nitrous oxide during the treatment of three patients suggest that the room used may remain contaminated with high levels of the gas for some time after the session. It may then be the case that clinic staff are exposed above the occupational exposure standard, also the dental or anaesthetic practitioner may be going on to perform another session in the same or a different clinic with consequent further exposure. It is regrettable that costs seem to have constrained a more full evaluation of exposures in the community clinics. In the future the development of convenient, reliable, and inexpensive bio-monitoring techniques such as urine<sup>5</sup> or breath samples would help confirm the ade-

quacy of any control measures instituted. The techniques to control exposures are readily available and should be implemented as necessary. This latter statement assumes that the relevant measurements have been made which is perhaps unlikely in many community and private clinics.

## A Adishes

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- 2 Boivin I F. Risk of spontaneous abortion in women occupationally exposed to anaesthetic gases: a meta-analysis. *Occup Env Med* 1997; 54: 541-548.
- 3 Sweeney B, Bingham R M, Amos R J, Petty A C, Cole P V. Toxicity of bone marrow in dentists exposed to nitrous oxide. *Br Med J* 1985; 291: 567-569.
- 4 Environmental and occupational risks of healthcare. British Medical Association, 1994.
- 5 Imbriani M, Ghittori S, Pezzagno G, Capodaglio E. Nitrous oxide (N<sub>2</sub>O) in urine as biological index of exposure in operating room personnel. *Appl Ind Hyg* 1988; 3: 223-227.