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# 1 Policy on Minimizing Occupational Health Hazards Associated with Nitrous 2 Oxide

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4 Review Council

5 Council on Clinical Affairs

6 Latest Revision

7 ~~2013~~ 2018

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## 9 Purpose

10 The American Academy of Pediatric Dentistry (AAPD) ~~recommends~~ recognizes that exposure to ambient  
11 nitrous oxide (N<sub>2</sub>O) ~~be minimized to reduce occupational~~ may be an occupational health hazards-hazard  
12 for dental personnel and encourages practitioners to take all precautions to minimize associated risks.

13

## 14 Methods

15 This policy was originally developed by the Clinical Affairs Committee and adopted in 1987. This  
16 document is a revision of the previous version, revised in ~~2008~~ 2013. ~~The policy is based on a systematic~~  
17 ~~literature search of the PubMed<sup>®</sup> electronic data base using the terms: nitrous oxide, occupational~~  
18 ~~exposure, AND dentistry; fields: all; limits: within the last 10 years, English. Sixteen articles met these~~  
19 ~~criteria; three additional papers from the previous policy statement were reviewed and added to the~~  
20 ~~references. Guidelines and recommendations from the National Institute for Occupational Safety and~~  
21 ~~Health (NIOSH) also were reviewed<sup>1,2</sup>. The update used electronic database and hand searches of the~~  
22 articles in the medical and the dental literature using the following parameters: Terms: nitrous oxide,  
23 occupational exposure, AND dentistry. Fields: all; Limits: within the last 10 years, English. Additionally,  
24 guidelines and recommendations from the National Institute for Occupational Safety and Health  
25 (NIOSH) were reviewed<sup>1,2</sup>. Expert opinions and best current practices were relied upon when sufficient  
26 scientific data were not available.

27

## 28 Background

29 Effects of occupational exposure to ambient N<sub>2</sub>O are uncertain, especially since the introduction of  
30 methods to scavenge N<sub>2</sub>O and ventilate operatories<sup>3</sup>. ~~Studies that linked increased general health~~  
31 ~~problems and reproductive difficulties among dental personnel to chronic exposure to significant levels of~~  
32 ~~ambient N<sub>2</sub>O have been challenged<sup>3</sup>. As of 2008, there were no definitive studies linking general health~~

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33 problems and reproductive difficulties among dental personnel to chronic exposure to scavenged ambient  
34 N<sub>2</sub>O<sup>3</sup>. A maximum safe level of ambient N<sub>2</sub>O in the dental environment has not been determined<sup>4,5,6</sup>.

35  
36 Reduction of ambient N<sub>2</sub>O through system maintenance, scavenging, ventilation, use of the minimal  
37 effective dose, and patient management is important to maintaining the lowest practical levels in the  
38 dental environment<sup>1,2,7</sup>. Frequent and regular inspection and maintenance of the N<sub>2</sub>O delivery system,  
39 together with the use of a scavenging system, can reduce ambient N<sub>2</sub>O significantly<sup>8</sup>. Using a well-fitted  
40 mask and an appropriate amount of suction via the scavenging system will minimize leakage, reducing  
41 ambient N<sub>2</sub>O levels<sup>8,9</sup>. The use of a double-mask patient delivery system has also been shown to be more  
42 effective than a single-mask system in the removal of waste nitrous oxide<sup>10,11</sup>. The combined use of the  
43 double mask system and scavenging systems with a high evacuation rate have been demonstrated to  
44 decrease occupational exposure to nitrous<sup>12</sup>. NIOSH has recommended that the exhaust ventilation of  
45 N<sub>2</sub>O from the patient's mask be maintained at an air flow rate of 45 L/min and vented outside the building  
46 away from fresh air intakes<sup>1-5</sup>. However, scavenging at this rate has been shown to reduce the level of  
47 psychosedation achieved with N<sub>2</sub>O inhalation<sup>13</sup>. Where possible, outdoor air should be used for dental  
48 operator ventilation<sup>11,14</sup>. Supply and exhaust vents should be well separated to allow good mixing and  
49 prevent short-circuiting<sup>1</sup>. Female dental staff frequently exposed to nitrous oxide (3 or more days a week)  
50 have been found to have no elevated risk of spontaneous abortion in offices using appropriate scavenging  
51 systems<sup>15,16</sup>.

52  
53 Patient selection is an important consideration in reducing ambient N<sub>2</sub>O levels<sup>7</sup>. Patients who are  
54 unwilling or unable to tolerate the nasal hood and those with medical conditions (e.g., obstructive  
55 respiratory diseases, emotional disturbances, drug dependencies) that contraindicate the use of N<sub>2</sub>O  
56 should be managed by other behavior guidance techniques<sup>7</sup>. In the dental environment, patient behaviors  
57 such as talking, crying, and moving have been shown to result in significant increases in baseline ambient  
58 N<sub>2</sub>O levels despite the use of the mask-type scavenging systems<sup>17,18</sup>. Utilization of appropriate nitrous  
59 concentration levels should also be considered in relation to procedure difficulty. Nitrous can be  
60 discontinued once adequate anesthesia is achieved<sup>19</sup>, or decreased levels can be maintained during easier  
61 procedures and increased for stimulating procedures<sup>5</sup>. Furthermore, the use of scavenging systems alone  
62 cannot lower the ambient N<sub>2</sub>O levels to the recommended standards<sup>8,17,20</sup>. Use of supplemental measures,  
63 such as a high-volume dental aspirator suction placed in proximity to the dental operative site, has been  
64 shown to reduce ambient N<sub>2</sub>O levels significantly<sup>17,21</sup>. During the first three to five minutes after  
65 terminating N<sub>2</sub>O administration, a significant amount of the gas is exhaled by the patient. Once N<sub>2</sub>O

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66 administration is discontinued, administering 100 percent oxygen to the patient for at least five minutes  
67 allows oxygen to replace the N<sub>2</sub>O in the gas delivery system<sup>2-3</sup>. This post-procedural oxygenation also  
68 decreases the risk of diffusion hypoxia to the patient. Diligent use of the above practices in the pediatric  
69 dental environment has allowed for the reduction of ambient N<sub>2</sub>O to the levels recommended by  
70 NIOSH<sup>21,22</sup>. Measurement of N<sub>2</sub>O levels in the dental operatory can be helpful in determining the type and  
71 extent of remediation necessary to decrease occupational exposure.

72

### 73 Policy statement

74 The AAPD encourages dentists and dental auxiliaries to maintain the lowest practical levels of N<sub>2</sub>O in the  
75 dental environment while using N<sub>2</sub>O. Adherence to the recommendations below can help minimize  
76 occupational exposure to N<sub>2</sub>O.

- 77 • Educate dental personnel on minimizing occupational exposure to and potential abuse of nitrous  
78 oxide.
- 79 • Use scavenging systems that remove N<sub>2</sub>O during patient's exhalation.
- 80 • Ensure that exhaust systems adequately vent scavenged air and gases to the outside of the  
81 building and away from fresh air intake vents.
- 82 • Use, where possible, outdoor air for dental operatory ventilation.
- 83 • Implement careful, regular inspection, and maintenance of the nitrous oxide/oxygen delivery  
84 equipment.
- 85 • Carefully consider patient selection criteria (i.e., indications and contraindications) prior to  
86 administering N<sub>2</sub>O.
- 87 • Select a properly-fitted mask size for each patient.
- 88 • During administration, visually monitor the patient and titrate the flow/percentage to the minimal  
89 effective dose of N<sub>2</sub>O.
- 90 • Encourage patients to minimize talking and mouth breathing during N<sub>2</sub>O administration.
- 91 • Use ~~rubber dam and~~ high volume dental ~~evacuator~~ suction when possible during N<sub>2</sub>O  
92 administration.
- 93 • ~~Administer 100 percent oxygen to the patient for at least five minutes after terminating nitrous-~~  
94 ~~oxide use to replace the N<sub>2</sub>O in the gas delivery system.~~

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