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AMBIENT AIR— PREPARATION OF REFERENCE TEST ATMOSPHERES CONTAINING SULPHUR DIOXIDE, USING PERMEATION TUBES



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Australian Chemical Industry Council
Australian Institute of Petroleum
Australian Mining Industry Council
Australian Timber Producers Council
Clean Air Society of Australia and New Zealand
Confederation of Australian Industry
CSIRO, Division of Fossil Fuels
Department of Home Affairs and the Environment
Department of the Environment, Tasmania
Electricity Supply Association of Australia
National Association of Testing Authorities, Australia
National Health and Medical Research Council
State Pollution Control Commission, N.S.W.
Technical Association of the Australian and New Zealand Pulp and Paper Industry

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PREFACE

This standard was prepared by the Association's Committee on Methods for Examination of Air. It is one of a series of methods of test for determining pollutants in ambient air.

During the preparation of this standard, the committee paid special attention to the work of ISO/TC 146, Air Quality, and of the Environmental Protection Agency, U.S.A., particularly in the areas where methodology is still developing.

This standard was derived from the United States Environmental Protection Agency Air Regulation Standard, Pollution Control Guide, Sub-chapter C—Air Programs—Part 50 National Primary and Secondary Air Quality Standards, Section 8031, Appendix A, Reference Method for the Determination of Sulphur Dioxide in the Atmosphere (Pararosaniline Method). Acknowledgement is made of the assistance obtained therefrom.

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STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

for

AMBIENT AIR—PREPARATION OF REFERENCE TEST ATMOSPHERES
CONTAINING SULPHUR DIOXIDE, USING PERMEATION TUBES

1 SCOPE. This standard sets out procedures for the preparation of reference test atmospheres containing known concentrations of sulphur dioxide, using permeation tubes, and for the preparation of a calibration curve therefrom.

NOTE: References on various aspects of the standard are provided.

2 APPLICATION. These procedures apply to the preparation of reference test atmospheres, containing sulphur dioxide levels from 25 $\mu\text{g}/\text{m}^3$ to 14 000 $\mu\text{g}/\text{m}^3$ (0.01 p.p.m. to 5.0 p.p.m. by volume), and for the calibration and validation of certain instrumental methods for determining sulphur dioxide in ambient air.

3 APPARATUS. The following apparatus is required:

- (a) *Sulphur dioxide permeation tubes.* Permeation tubes which emit sulphur dioxide gas at a known, low, constant rate.

NOTES:

1. Such tubes can be used to conveniently produce reference test atmospheres containing desired levels of sulphur dioxide, e.g. 25 $\mu\text{g}/\text{m}^3$ to 14 000 $\mu\text{g}/\text{m}^3$.
2. Permeation tubes with certified permeation rates are available from the National Bureau of Standards, U.S.A., and may be used as absolute standards. Other permeation tubes should be calibrated for use at a given temperature by passing dry, purified air or dry, purified nitrogen carrier gas at that temperature over the tube and weighing at regular intervals. Stabilization of the permeation tube is necessary and is established when the tube loses mass at a constant rate. Two weeks may be required before this condition is reached.
3. Detailed, explicit directions for permeation tube calibration are described in Reference 1.

- (b) *System for generating reference test atmospheres (see Fig. 1).* The system incorporates a permeation tube as specified in (a) above with the temperature held constant within 0.1°C of the calibration temperature. The sulphur dioxide permeating from the tube is carried by a flow of dry purified air or nitrogen* carrier gas to a mixing chamber where it may be accurately diluted to the appropriate concentration.

NOTE: The relevant factors in controlling production of a reference atmosphere from a permeation tube are temperature level and carrier gas flow.

4 PROCEDURE. The procedure shall be as follows:

- (a) Using the following equation, calculate the flow rate of dilutant gas required to give a series (usually six) of reference test atmospheres containing sulphur dioxide levels spaced over the expected range of measurements:

$$R_d = \frac{P \times 10^3}{c} - R_1$$

R_d = flow rate of dilutant gas, at reference conditions, in litres per minute.

P = permeation rate, in micrograms per minute.

R_1 = flow rate of carrier gas, at reference conditions, in litres per minute.

c = concentration of sulphur dioxide at reference conditions, in micrograms per cubic metre.

- (b) Using the system described in Clause 3(b), prepare, in turn, each of the reference test atmospheres.

NOTE: The initial period of stabilization may be several days, notwithstanding constant temperature and constant carrier gas flow. Stabilization is required at all temperature changes.

- (c) Sample each reference test atmosphere using similar apparatus and using identical flow rate and other conditions as for the ambient atmospheric sampling in the appropriate instrumental method.
- (d) Take measurements on each sample in the same manner as for the ambient atmospheric sample in the appropriate instrumental method.

*Purified nitrogen, if used as the dilutant gas rather than purified air, may cause problems with some types of instruments, e.g. pulsed fluorescence.