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AMBIENT AIR—DETERMINATION OF OXIDES OF NITROGEN—CHEMILUMINESCENT METHOD

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THE FOLLOWING SCIENTIFIC, INDUSTRIAL AND GOVERNMENTAL ORGANIZATIONS were officially represented on the committee entrusted with the preparation of this standard:

Australian Chemical Industry Council

Australian Mining Industry Council

Australian Timber Producers Council

Clean Air Society of Australia and New Zealand

Confederation of Australian Industry

CSIRO, Division of Mineral Chemistry

Department of Science 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

Australian Institute of Petroleum Limited

State Pollution Control Commission, N.S.W.

Australian and New Zealand Pulp and Paper Industry Technical Association

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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 works of ISO/TC 146, Air Quality, and of the Environment Protection Agency, U.S.A. particularly in the areas where methodology is still developing.

CONTENTS

STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

for

AMBIENT AIR—DETERMINATION OF OXIDES OF NITROGEN—CHEMILUMINESCENT METHOD

1 SCOPE. This standard sets out a method for the determination of the concentration of oxides of nitrogen in ambient air.

2 DEFINITION. For the purpose of this standard, the following definition applies:

Oxides of nitrogen—nitric oxide (NO) and nitrogen dioxide (NO_2), collectively known as NO_x.

3 APPLICATION. The method is applicable to the analysis of ambient air having a concentration of oxides of nitrogen generally less than 1 mL/m^3.

The method is specific for nitric oxide (NO) but total oxides of nitrogen (NO_x) may be measured by first passing the air sample over a catalyst to convert nitrogen dioxide (NO_2) to nitric oxide (NO). NO_2 may then be calculated as the difference between NO_x and NO.

NOTE: Other substances which may be converted to nitric oxide include ammonia, particulates containing ammonia, organic amines and organic nitrates.

4 PRINCIPLE AND REACTIONS. Sampled air containing the oxides of nitrogen is fed into a chamber where it reacts with ozone (O_3) according to the following reaction:

$$NO + O_3 \rightarrow NO_2^* + O_2$$

Excited molecules of nitrogen dioxide return immediately to the ground state with the emission of photons:

$$NO_2^* \rightarrow NO_2 + h\upsilon$$

The intensity of the emission is proportional to the mass flow rate of nitric oxide (NO) into the reaction chamber. The photon emission is converted to an electrical output by means of a photomultiplier tube and associated electronic equipment and measured.

5 APPARATUS. An instrument capable of measuring the chemiluminescence, with performance requirements conforming to the values shown in Table 1. The catalytic convertor shall have a conversion efficiency of nitrogen dioxide to nitric oxide of not less than 98 percent.

6 CALIBRATION.

6.1 Initial Calibration. The calibration procedure shall be as follows:

(a) Set up the instrument in accordance with the manufacturer's instructions and allow a sufficient stabilizing period, ensuring that the instrument ozone generator is on.

(b) Set the instrument to zero in each of the nitric oxide and total oxides of nitrogen channels using zero air produced by passing ambient air through an external ozone generator and a column of activated charcoal. Adjust the nitrogen dioxide channel readout to zero.

NOTE: If a significant zero difference is observed with the instrument ozone generator on and off, rectification is indicated.

(c) Set the span on the nitric oxide measuring circuit using a calibration gas mixture of nitric oxide in air prepared from a standard gas containing a known amount of nitric oxide in nitrogen diluted by zero air as required. Use three concentrations corresponding to three points appropriately spread over the measuring range. Steady, indicated values shall agree within 2 percent of the calculated values.

(d) Set the span on the total oxides of nitrogen measuring circuit using a calibration mixture of nitrogen dioxide in air prepared from the nitric oxide in nitrogen gas calibration mixtures (step (c)) which have been passed through an external ozone generator ensuring complete conversion to nitrogen dioxide.