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**Soil Quality — Guidance on methods  
for measuring greenhouse gases (CO<sub>2</sub>,  
N<sub>2</sub>O, CH<sub>4</sub>) and ammonia (NH<sub>3</sub>) fluxes  
between soils and the atmosphere**

*Qualité du sol — Recommandations sur les méthodes de mesure des  
gaz à effet de serre (CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>) et des flux d'ammoniac (NH<sub>3</sub>)  
entre les sols et l'atmosphère*

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# Contents

	Page
<b>Foreword</b> .....	<b>iv</b>
<b>Introduction</b> .....	<b>v</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>1</b>
<b>4 Methods for measuring GHGs and ammonia fluxes between soil and the atmosphere</b> .....	<b>2</b>
<b>5 Concentration measurements and air sampling</b> .....	<b>5</b>
5.1 General.....	5
5.2 Concentration measurement methods.....	5
5.3 Air sampling.....	7
<b>6 Selection of the appropriate methods</b> .....	<b>9</b>
<b>7 Minimum requirement for reporting</b> .....	<b>10</b>
<b>Annex A (informative) Description of the flux measurement methods</b> .....	<b>11</b>
<b>Annex B (informative) Description of the concentration measurement methods</b> .....	<b>24</b>
<b>Annex C (informative) Description of the air sampling methods</b> .....	<b>29</b>
<b>Bibliography</b> .....	<b>33</b>

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## Foreword

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This document was prepared by Technical Committee ISO/190, *Soil quality*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

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## Introduction

Greenhouse gas (GHG) emissions from soils have become a major environmental concern. Global and national emission inventories have identified soils, in particular agricultural soils, as being a major contributor to these emissions, in particular nitrous oxide (N<sub>2</sub>O), methane (CH<sub>4</sub>) and carbon dioxide (CO<sub>2</sub>) related to loss of soil organic matter. Agricultural soils are also major emitters of ammonia (NH<sub>3</sub>), which is a precursor of N<sub>2</sub>O. Changes in soil management should take account of these emissions as part of efforts to mitigate climate change.

GHGs and ammonia fluxes from soil are complex to measure. They are variable and heterogeneous as they are governed by weather/meteorological conditions (e.g. temperature and moisture regimes), soil characteristics (e.g. soil parental material, pH, clay content, cation exchange capacity) and for managed soils by the agricultural or forestry practices (e.g. crop and wood residues management, soil tillage or no-tillage, inputs of soil conditioner and fertilizers, irrigation). These factors generally interact and their effects on GHG emissions are still poorly quantified. It results in large uncertainties for the inventories of national and global agricultural emissions. For example, Freibauer (2008)<sup>[1]</sup> has estimated an uncertainty at 80 % for European (EU27) agricultural N<sub>2</sub>O emissions. With the reinforcement of international and regional climate policies, comparable and reliable information is needed to report on GHG emissions but also to adopt and verify mitigation options.

No standard covers the measurement of GHGs and ammonia emissions from soils. However, several measurement methods have been developed. This document provides guidance on the main methods available to quantify the exchanges of greenhouse gases (CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>) and ammonia (NH<sub>3</sub>) between soils and the atmosphere. It is intended to help users to select the measurement method or methods most suited to their purposes by setting out information on the application domain and the main advantages and limitations of each methods.

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