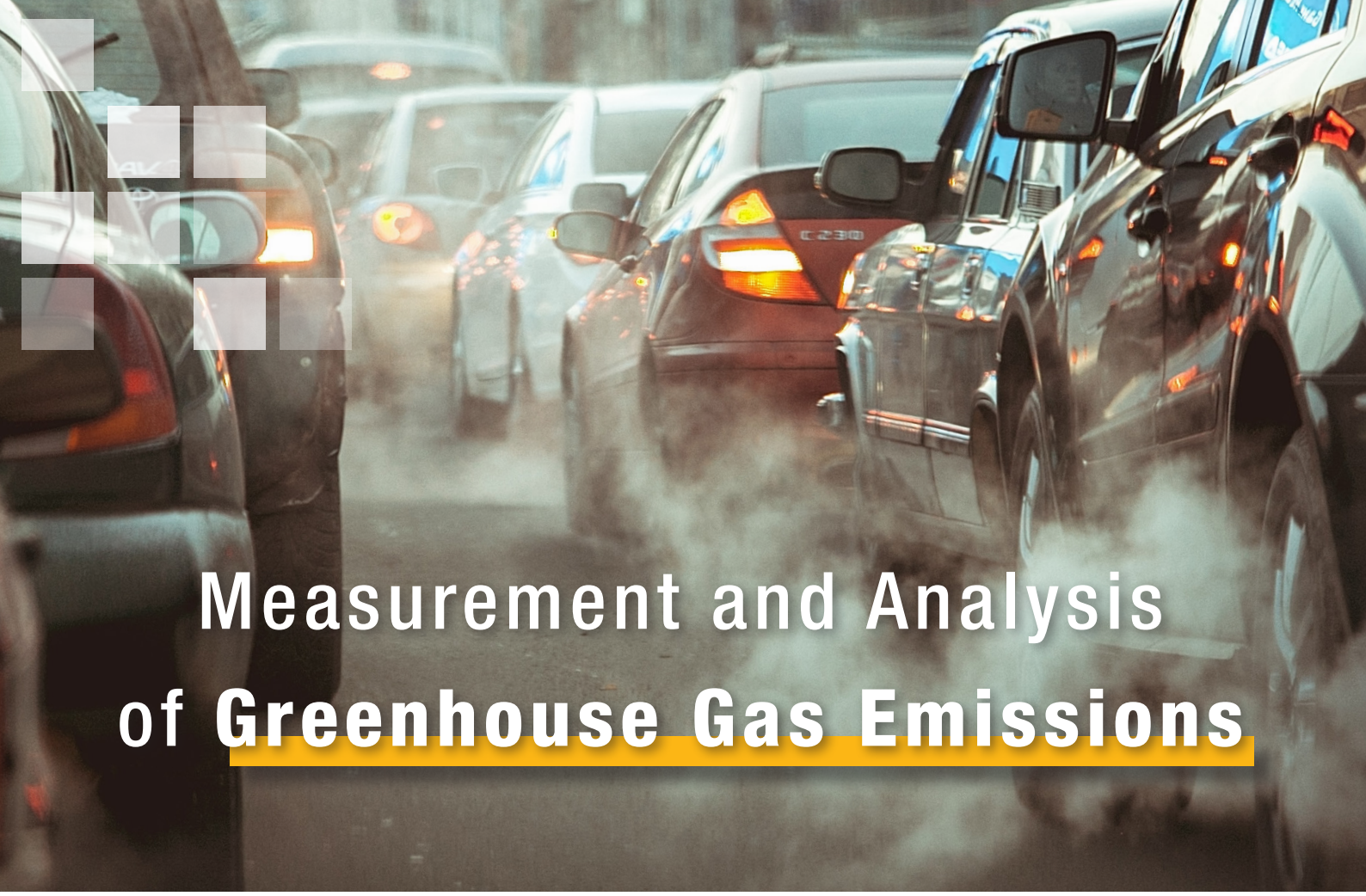

Measurement and Analysis of Greenhouse Gas Emissions

Greenhouse gases (GHG) trap heat in the Earth's atmosphere, causing the global average temperature to rise. Many countries lack the capacity to trace GHG emissions and to determine the source of emissions accurately. This limitation prevents countries from making evidence-based decisions to address reduced emission targets as required by international agreements, such as the Paris Agreement and the Kyoto Protocol.

Identifying the origin and measuring the extent of GHG emissions will allow countries to direct actions strategically towards the most significant sources of pollution and will contribute to the achievement of climate change goals.

Measuring and analysing GHG emissions is crucial for tracking progress toward international climate goals and reducing carbon footprints.

Nuclear techniques offer a precise way to assess and quantify GHG emissions from both industrial and agricultural activities; thus enabling the attribution of the source. The IAEA has also established standards to calibrate carbon isotope ratios, which ensures the consistency of data used in climate change monitoring.

Through the nuclear technique of 'isotopic fingerprinting', scientists can examine isotopes in GHG emissions in the air and determine their origin and concentration.

The IAEA is working in collaboration with the World Meteorological Organization (WMO) to support the tracking of GHG emissions in the framework of an international Technical Cooperation project. Many countries do not have the capacity to utilize isotopic tracing to monitor and analyze GHG emissions, necessitating regional and international cooperation. With IAEA support, Argentina is in the process of establishing the first regional training and analysis centre on the isotopic fingerprinting of GHG emissions. The laboratory space is being prepared by the new focal point and will receive necessary equipment, including an isotope laser analyser. In 2022, the IAEA trained an Argentinian expert on calibrating stable isotope measurements at the IAEA laboratories in Seibersdorf. This expert will now serve as the trainer for the new centre, allowing Argentina to become self-sufficient in its role.

This initiative is intended to strengthen countries'

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efforts to meet global commitments for reduced emissions by harmonizing data analysis and interpretation for the sake of comparability. The IAEA in cooperation with WMO aims to expand this initiative to additional regions in line with its global focus.

A practical guide addressing the sampling, analysis, and interpretation of isotopic data for methane has been developed and is in the process of being published. The document was produced in collaboration with WMO and experts from 4 global laboratories, namely the National Institute of Water and Atmospheric Research of New Zealand, the Swiss Federal Laboratories for Materials Science and Technology, the University of Heidelberg, and the institute of Arctic and Alpine Research. This guide will serve as a tool for technicians and scientists, offering a unified approach.

The Science

Elements are made up of protons, neutrons and electrons. Atoms of a particular chemical element have the same number of protons and electrons, but the number of neutrons can vary. Atoms of a chemical element with different numbers of neutrons are called isotopes.

An air sample will have its own ‘isotopic fingerprint’ as each compound of the sample will have a unique combination of different isotopes of different elements. A nuclear technique known as ‘isotopic fingerprinting’ is used by scientists to examine the different isotopes of greenhouse gases in air samples to determine their origin, history and sources.

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