



IEAGHG Information Paper; 2013-IP31; Drawing Down N₂O to Protect Climate and the Ozone Layer

A new report has been presented at COP19 today (21st November 2013) entitled "Drawing Down N₂O to Protect Climate and the Ozone Layer". The new report by the UN Environment Programme (UNEP), warns that:

- Nitrous oxide is now the most important ozone-depleting emission and the third most potent greenhouse gas released into the atmosphere.
- Emissions of nitrous oxide (N₂O), an often-overlooked yet potent gas, could nearly double by 2050 and thus potentially undermine gains in the ozone layer recovery and exacerbate climate change.
- While N₂O exists naturally in the atmosphere in trace amounts, human activities have increased its concentrations since the industrial revolution.

The UNEP report, produced in conjunction with scientists and experts from more than 35 organizations, points out that with determination and commitment to act it is possible to draw down nitrous oxide emissions.

Reducing N₂O emissions has major cost benefits since emissions are connected to diverse economic sectors from agriculture, chemical manufacturing and electricity production to waste management, transportation and fish production. Gains from emissions reduction will include increased crop and livestock productivity, poverty alleviation, improved human health and reduced environmental degradation. The report indicated that an across-the-board improvement in nitrogen use efficiency of 20 per cent would cost around US\$12 billion annually, but would save around US\$23 billion in annual fertilizer costs alone. Additional environmental, climate and human benefits could be worth an estimated US\$160 billion per annum.

"We need all hands on deck to combat the serious and significant increases in N₂O levels in the atmosphere", said UN Under-Secretary-General and UNEP Executive Director Achim Steiner. "Although not as prevalent in the atmosphere as CO₂ in terms of mass, N₂O - commonly known to many as 'laughing gas' - is far from a laughing matter in respect to climate and ozone damage as it has a disproportionate impact on global warming because of its radiative properties and long lifetime in the atmosphere, which is 120 years on average. Action on these emissions offer yet another opportunity to keep the world under a 2 degree C temperature rise," he added.

Most of the depletion of the stratospheric ozone layer up to now has been due to the infamous Chlorofluorocarbons (CFCs) and other halogenated (chlorine- and bromine-containing) chemicals. However, these chemicals - unlike N₂O - are now widely controlled by the Montreal Protocol, an international Treaty designed to protect the ozone layer.

Agriculture is by far the largest source of human-induced N₂O emissions, accounting for two-thirds of these emissions. Meanwhile, other important sources of N₂O include industry and fossil fuel combustion, biomass burning and wastewater.

The report lists specific, actionable measures that can be taken in the following areas:

Agricultural Emissions

Emissions can be reduced by boosting the overall nitrogen use efficiency of agriculture. This means improving the ability of crops and livestock to better utilize nitrogen, and minimizing the loss of nitrogen to the environment that occurs during crop cultivation and animal production. Other options for reducing agricultural emissions of N₂O include reducing excessive meat consumption - as the production of animal protein leads to higher N₂O emissions than plant protein - and reducing food waste and loss.



Controlling Emissions from the Industrial Sector

The report suggests that significant gains can be achieved by controlling emissions from just two chemical industries - adipic acid and nitric acid - which account for about 5 per cent of global N₂O emissions. Such reductions can be achieved by installing emissions control equipment in facilities producing such chemicals.

Reducing Emissions from Biomass Burning

In the area of biomass burning, the report notes that N₂O emissions from landscape fires can be achieved by reducing the use of fires for forest clearing and implementing prescribed burning to reduce the amount of burnable vegetation in natural fires. Improving the fuel and combustion efficiency of stoves can reduce emissions from biomass-burning in household stoves.

Wastewater and Aquaculture

Interventions in the collection and treatment of wastewater can reduce N₂O emissions to the atmosphere. These include, in particular, lowering the nitrogen content of discharge wastewater through improved wastewater treatment, reducing wastewater leakage from sewage piping, and recycling nutrients in wastewater as fertilizer. Emissions from aquaculture can be lowered by boosting overall nitrogen use efficiency, and by implementing fish farming systems that reduce the amount of waste generated, or by treating effluents from fish ponds.

The report assesses four different sets of scenarios that correspond to different levels of potential N₂O mitigation:

- Under the business-as-usual scenarios, with little or no mitigation, levels of N₂O could increase on average by 83 per cent between 2005 and 2050;
- The moderate mitigation scenarios have emissions that increase but more slowly than business-as-usual. Under these scenarios, levels of N₂O could increase on the average by 26 per cent between 2005 and 2050;
- Under the concerted mitigation scenarios, N₂O emission levels could be 22 per cent lower in 2050 than in 2005.

The report stresses that a reduction in N₂O levels, as seen in the concerted mitigation scenarios, will not only help to protect the ozone layer and bring climate benefits, but also have many other co-benefits.

Rising levels of N₂O may undermine the gains in ozone layer recovery achieved by drawing down CFC and other ozone depleting substances. Reducing emissions will help avoid the continued depletion of the ozone layer and secure the gains made by the Montreal Protocol.

Emissions to be avoided by the concerted mitigation scenarios between 2013 and 2050 are of comparable magnitude to the 1550 to 2350 Kt's of ozone depletion potential of CFC's estimated to be locked up in the stocks of old refrigerators, air conditioners, insulation foams, and other units that have already been manufactured and used, but not yet released to the atmosphere.

According to the UNEP Emissions Gap Report 2013¹, there will be an "emissions gap" of around 8 to 12 Gt's of CO₂ equivalent (GtCO₂eq) in 2020. Drawing down N₂O can make a significant contribution to narrowing this gap. The potential to reduce N₂O emissions in 2020 is around 1.8 TNG N₂O-N/yr. In units of equivalent CO₂ emissions, this is about 0.8 GtCO₂eq/y, which is around 8 per cent of the emissions gap.

Moreover, continued N₂O emissions will worsen anthropogenic climate change and the effects will persist for a century or longer even when emissions are reduced in the future.

¹ <http://www.unep.org/publications/ebooks/emissionsgapreport2013/>



Cost, capacity building, technology transfer, and the lack of know-how are among the barriers to implementing N₂O reduction strategies at a global scale. Possible actions to overcome such barriers involve a combination of regulatory, financial and voluntary approaches. These include:

- Removing subsidies that encourage the overuse or misuse of nitrogen fertilizer and other products, while providing incentives for adopting best management practices that would improve nitrogen use efficiency;
- Putting a price tag on nitrogen pollution through appropriate levies, incentives and tradable permits;
- Encouraging research and development geared towards the development of innovative techniques to enhance nitrogen use efficiency as well as increased crop and animal productivity in agriculture and other sectors;
- Increasing support for good nutrient management practices in crop and livestock operations through education, extension and outreach, especially to farmers in developing countries;
- Setting clear targets for N₂O emission reductions and for improving nitrogen use efficiency, and putting in place strategies for tracking progress.

The full report can be downloaded at <http://www.unep.org/publications/ebooks/UNEPN2Oreport/>

The report also points to opportunities for embedding needed N₂O mitigation policies into existing international treaties and institutions. Such opportunities include:

- **United Nations Framework Convention on Climate Change** - N₂O emissions from nitric and adipic acid production are already being addressed under the Clean Development Mechanism of the Convention, but attention could be given to agriculture and other sectors responsible for the vast majority of N₂O emissions;
- **United Nations Vienna Convention for the Protection of the Ozone Layer** - The Montreal Protocol of the Convention could be expanded to include the control of processes leading to N₂O emissions;
- **United Nations Convention on Biological Diversity** - Targets for reducing N₂O emissions could be linked to the Convention's Aichi Biodiversity Target 8 on nutrient pollution;
- **UNECE Convention on the Long Range Transport of Air Pollution** - This UNECE Convention could be expanded to cover controls of N₂O and to include new countries that are a major source of N₂O emissions;
- **Global Program of Action on the Protection of the Marine Environment from Land-based Activities (GPA)** - This intergovernmental process could play a key advisory role in implementing N₂O emission reduction measures building on its existing remit for nutrient management.

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November 2013