



# PEMPHIS



# MINISTERS Statement

The Maldives, a nation comprised of small islands nestled in vulnerable ecosystems, recognizes the gravity of the imminent threats posed by ozone depletion and climate change. Our very existence is intrinsically linked to the health of the ozone layer and the stability of our climate. The stark realities of rising sea levels, extreme weather events, and the acidification of our oceans serve as unyielding reminders of the dire consequences of inaction.

In our unwavering pursuit of a sustainable and resilient future, the Maldives has long been a firm advocate for international cooperation and the protection of the ozone layer. Our commitments to the Montreal Protocol, one of the most triumphant international agreements in human history, remains resolute. Through our efforts to phase out ozone-depleting substances, we have not only contributed to protecting the ozone layer but also made substantial strides in mitigating the impacts of climate change.

As we celebrate International Ozone Day, let us be conscious that the collective choices we make today determine the world we leave for future generations. The Maldives stands ready for collaborations with our global partners, both large and small nations, to confront these intricately linked challenges. Together, we can work towards the restoration of the ozone layer and the mitigation of climate change, thereby protecting the well-being of our planet and all its inhabitants.



Aminath Shauna

MINISTER OF ENVIRONMENT,  
CLIMATE CHANGE & TECHNOLOGY

# Ever wonder why the 'ozone hole' appeared in the Antarctica?

Global warming and climate change are quite frequently heard terms at the present day, as it's a huge global concern in the 21st century. Thanks to the advancing technology, scientists were able to uncover the underlying threats of global warming and climate change which if neglected could cause dramatic and devastating effects to humans and other living things on earth.

The discovery in 1970, which revealed that human-produced chemicals could lead to the depletion of the stratospheric ozone layer was what initially led scientists to follow the issue with additional researches, with an aim to better understand the threat to the ozone layer and the consequences of it to the agriculture as well as the terrestrial and oceanic ecosystems.

The stratosphere which extends from 4-12 miles above the earth's surface to around 31 miles, holds approximately 90% of the naturally occurring ozone. When chemicals containing the halogens, chlorine and bromine is emitted from sources such as refrigeration, air conditioning and foam blowing, they initially accumulate in the troposphere (lower layer of atmosphere) and are eventually transported to the stratosphere via natural air motions. Once in the stratosphere, they are chemically converted to reactive and reservoir gases by the absorption of the UV radiation, which in turn reacts to destroy the naturally occurring ozone molecules in the stratosphere. According to numerous findings, a single chlorine atom of these can destroy over 100,000 ozone molecules before it is removed from the stratosphere, hence leading to more ozone being destroyed way quickly than it is naturally created.

So, given this basic process of ozone depletion, ever wonder why the 'ozone hole' appeared in the Antarctica even though the naturally occurring ozone molecules and ozone-depleting substances are present throughout the stratosphere?

Well, this is due to the unique meteorological and chemical conditions that only exist in the Antarctic region and nowhere else over the globe. The extremely low winter temperatures in the Antarctic stratosphere causes Polar Stratospheric Clouds (PSC) to form. The specific chemical reactions that occur on these PSCs, together with the isolation of the polar stratospheric air inside the polar vortex, induces an increase in the abundance of chlorine monoxide (ClO), leading to initiation of chlorine and bromine reactions which destructs ozone and produces the ozone hole over Antarctica in the spring. This destruction of ozone in the Antarctic is quite severe in the late winter to early spring.

Global agreements such as the 'The Vienna Convention for the Protection of the Ozone Layer' have been extremely successful in addressing the threats to the ozone layer. The Montreal protocol under this convention which aims to protect the stratospheric ozone layer by phasing out the production and consumption of ozone-depleting substances (ODS) entered into force in 1988 and has now become a monumental achievement by being the first treaty to achieve universal ratification by all countries in the world.

Although it's presumed that the ozone layer may take quite a number of years to recover, the Scientific Assessment of Ozone Depletion on 05 November 2018 in Quito, has revealed a healing in the ozone layer (recovered at a rate of 1-3% per decade since 2000). Hence, the experts now speculate that it could return back to 1980 levels by 2040, if appropriate mitigation measures and ambitious climate actions are continuously practiced globally.

# OZONE & MALDIVES

**I**N 1985, the world came to the realization of ozone depletion and its impacts on human health and the environment. It was then that the Vienna Convention for the Protection of Ozone

Layer was created in response. Pursuant to the convention, the Montreal Protocol came into effect in 1987, requiring countries to take actions to protect the ozone layer. On May 16, 1989, Maldives signed the Montreal Protocol. Since then, significant milestones have been achieved in commitment to the cause, and has always been exemplary in fulfilling the obligations of the Montreal Protocol. Maldives was one of the first countries to phase-out CFC two years ahead of schedule, back in 2008.

Maldives was also the very first country to develop and start the implementation of a comprehensive HCFC Phase-out Management plan with commitments to phase out HCFCs. The decade long initiative was launched in 2010, with the target set out to quit the use of HCFC completely by 2020. When this work started back in 2010, Maldives' plan was to become carbon neutral by 2020, and therefore the idea was that we also phase-out HCFC by 2020. The goal of this was to align the dual goals of ozone layer protection and reduce the negative impacts of climate change.

In 2010 alone, 67 metric tons of HCFC was imported to the Maldives.

Fast forward 10 years, the number became zero, making Maldives the first of developing nations to completely phase out HCFC. This is a 10-year head start from the deadline by the Montreal protocol. The initiative was carried out supported by Multilateral Fund.

The Carbon Neutral Policy has today evolved into what we call Net Zero Policy. And in this regard, the commitment to address climate change is evident in the updated Nationally Determined Contribution (NDC). Maldives has declared the intention to reach net zero by 2030, provided that Maldives gets the immense support, both technological and financial, from the development partners. Building on the success of phasing out of CFC in 2008 and the phasing-out of HCFC in 2020, Maldives has plans to initiate the phase down of hydrofluorocarbons in 2024. The phasedown of HFC is scheduled to be completed by 2045. The targets for the HFC phasedown of Maldives is as follows:

- Reduce 10% of baseline by 2029
- Reduce 30% of baseline by 2035
- Reduce 50% of baseline by 2040
- Reduce 80% of baseline by 2045

Even though Maldives' contribution climate change is negligible, the geographical disparity of our country makes us extremely vulnerable to climate change and its negative impacts. As such Maldives will continue to be at the forefront in tackling climate change issues and being a leader for the world in our fight for the environment!





# OZONE TREATIES

When the advancements in science recognized that ozone depletion was a concern for human health and the environment, work towards a solution began. It was in 1985 world's governments adopted the Vienna Convention for the Protection of the Ozone Layer (Vienna Convention) in response to the prospect of increasing ozone depletion. Vienna Convention mandated the parties to adopt appropriate legislative or administrative measures and to limit, and prevent human activities under their jurisdiction which would have adverse effects resulting from modification or likely modification of the ozone layer.

This convention also provided a framework for nations to take appropriate measures on the depleting ozone and allowed cooperation on systematic observations, research and exchange of information. Vienna convention of any kind to be signed by every country involved, taking effect in 1988 and reaching universal ratification in 2009. The universal involvement showed the willingness of countries around the world to work together on healing the depleting ozone layer.

Considering the potential climatic effects of emissions of the Ozone Depleting Substances (ODS), parties of the Vienna Convention were committed to protecting the ozone layer by taking precautionary measures to control total global emissions of these substances. Therefore, keeping in mind the obligations of the Vienna Convention, the parties agreed on the Montreal Protocol on Substances that Deplete the Ozone Layer (the Montreal Protocol) in 1987. The protocol was signed to control the production and consumption of Chlorofluorocarbons (CFCs) and other Ozone Depleting Substances, which entered into force in 1989.

To replace the widely used Ozone Depleting Substance known as Chlorofluorocarbons, Hydrochlorofluorocarbons (HCFCs) were introduced as they cause considerably less damage to the ozone layer. Hydrofluorocarbons (HFCs), were introduced to replace HCFCs as it does not contribute to ozone depletion, which resulted in the stabilization of ozone depletion. Today, 16 September the day the Montreal Protocol was agreed upon is celebrated as the International Day for the Preservation of the Ozone Layer. At the 28th Meeting of the Parties of the Montreal Protocol held in Kigali, Rwanda, the Kigali Amendment on the Montreal Protocol was adopted. This Amendment phases down future global production and consumption of some HFCs, as they are known to be powerful greenhouse gases and contributors to climate change. Urgent action on HFCs is requisite to keep global temperature below 1.5 degrees.

The Montreal Protocol has successfully met its objectives ahead of schedule, winning the title of one of the most successful multilateral environmental treaties in UN History. This emphasizes the importance of multilateral cooperation to address the environmental challenges and global cooperation needed to tackle the triple planetary crisis.

# CLIMATE CHANGE AND OZONE PROTECTION

The ongoing climate crisis is hardly an unknown topic, especially for people living in a small island developing state. Almost every single day, extreme weather events happening across the world make headlines on the news. In the Maldives, many changes to our natural environment and ecosystems are becoming increasingly noticeable. This includes the loss of colour to our coral reefs as a result of coral bleaching events, changes to our island shorelines due to coastal erosion, and variations in the intensity and frequency of rainfall.

Climate change is often described as the long-term shifts in the global average temperature and weather patterns. Since the Industrial Revolution, human actions have been the primary driver of climate change, mainly due to burning fossil fuels like coal, oil and gas. These fossil fuels generate green house gases when they are burned, which accumulate in the Earth's atmosphere. As the amount of these gases increase, they absorb more heat from the sun and raise temperatures. This is known as global warming and has various impacts on the planet, including sea level rise. Rising temperatures do not only result in hotter weather, as climate change has a multiplier effect and exacerbates underlying environmental and geographical vulnerabilities. Global warming threatens food systems and availability of nutritious food, the survival of biodiversity and ecosystems across the planet, the access to potable water resources as well as various other impacts on human health and wellbeing.

To combat climate change and to minimise the adverse impacts on the planet, countries have been working to address climate change, especially after 1990 which was when the first Intergovernmental Panel on Climate Change's (IPCC) report indicated that the world has been warming and will likely continue to do so. Since then, many pledges and commitments have been made by countries on the mitigation or reduction of climate change. However, recent analysis from the IPCC shows that the actions of major emitters are not in line with the climate change mitigation target of reducing temperature increase to 1.5°C. Countries are encouraged to show ambition in their Nationally Determined Contribution

(NDCs), which is a plan each country prepares under the Paris Agreement to show their greenhouse gas reduction targets and submits to the UN Framework Convention on Climate Change (UNFCCC).

Despite having almost negligible global emissions, the Maldives has pledged to achieve net-zero emissions by 2030 with adequate international support, and this target is highlighted in the updated NDC. This climate ambition follows the Maldives' leadership in the international environmental space and builds on previous achievements, especially considering the phase-outs of ozone depleting substances at accelerated timelines.

While ozone depletion is not a major cause of climate change, the two issues are interlinked in many ways. Historically, most refrigerant gases that were discovered to have caused ozone depletion, did not significantly contribute to climate change. Newer refrigerants that are used in the cooling sector do not have ozone depleting potentials, but have high global warming potentials which contributes to heating the Earth's surface. To this extent, the most commonly imported refrigerant gas in the Maldives, hydrofluorocarbons (HFCs), does not deplete the ozone layer despite being a greenhouse gas.

As global temperatures continue to rise as a result of climate change, the demand for cooling is likely to also rise proportionately. This means it is critical to ensure cooling appliances and equipment are environmentally-friendly and that innovation takes place to find alternate refrigerants that are safe to use and reduce climate change. Opportunities will arise to pursue approaches that build on the synergies of ozone layer protection and climate action. For developing countries, especially small island developing states, who do not contribute major emissions, the Ozone Secretariat and the UNFCCC will play vital roles in enabling global convergence and mobilising support and technical assistance for the most vulnerable countries.

# THE OZONE LAYER AND OUR ECOSYSTEMS



Ecosystems support all life on Earth, by providing us with food, water and medicine required for survival. These ecosystems are identified as areas, where animals, plants and other organisms along with the landscape of the area work together to form a bubble of life. The functioning of the ecosystem depends on the biotic or living, as well as abiotic or non living parts of it. The biotic factors would include, the animals, plants and other organisms, while abiotic factors include, the temperature, humidity and rocks. Therefore, the survival and functioning of an ecosystem are interlinked and every factor depends on another factor, either directly or indirectly. Ecosystems also have keystone species which are crucial for the balance and survival of the ecosystem. The linkages between the species and its functions makes an ecosystem more resilient and negative impacts to any of these features leave the ecosystem vulnerable to collapse through natural and anthropogenic impacts.

The biodiversity in these ecosystems require several factors for their survival, the most important factors being the amount of sunlight and water received. In recent years, the release of harmful gases into the atmosphere have altered how much ultraviolet radiation is being received, particularly through the depletion of the ozone layer and the formation of the ozone hole. While organisms require sunlight for their growth, exposure to increased levels of solar UV-B radiation has negative impacts to their orientation mechanisms and motility as seen in marine phytoplankton. Our ocean ecosystems provide us with 30% of the worlds animal protein food security. Marine phytoplankton are essential for a healthy ocean ecosystem, and acts as a major sink for atmospheric carbon dioxide and also can be used for predicting future trends in carbon dioxide. The productivity of these phytoplankton are limited to the upper layer of the water column, or the euphotic zone of the oceans. This is because phytoplankton also require sunlight for photosynthesis and for orientation. However, when UV-B radiation increases, through ozone depletion, it impairs their enzyme activity, affects the photosynthesis process and inhibits their mobility and orientation. Solar UV-B radiation has also been found to cause damage to early development of other marine organisms such as fish, shrimp, crab and amphibians through decreased reproductive capacity and impaired larval development.

Ground level or tropospheric ozone, also known as the bad ozone is a global, secondary air pollutant that has impacts to human health and ecosystems and its biodiversity. One of the largest ecosystems on earth is our land ecosystems of native and agricultural forests and mangrove forests, which provides us with food security, coastal protection and acts as a major carbon sink. However, tropospheric ozone is toxic to plants and damages their ability to sequester carbon. Furthermore, the tropospheric ozone taken up by plants, alters the ecosystem balance directly through effects to photosynthesis, reduces respiratory capacity and stomatal conductance and reduces overall plant growth. These effects are observed in mangrove species, such as red mangroves, along with necrosis in some zones when exposed to tropospheric ozone. Reduction in photosynthesis slows down plant growth and increases risk of diseases, and which is a direct threat to areas which depend on agricultural crops for livelihoods and food security.

Therefore, our forest and ocean ecosystems need to be protected and restored for the beneficial services received from the biodiversity present in these ecosystems. The more diverse an ecosystem is, the more denser and resilient it becomes and less vulnerable to collapse.

# Embracing Ozone Protection

In the quest for a sustainable future, every individual wields the power to affect positive change. While the preservation of our planet's ozone layer may seem like a daunting task, there are numerous simple but effective steps that each of us can take to contribute to its preservation. Here are some simple yet impactful lifestyle changes and actions that individuals can adopt in their daily lives.



**Conscious Consumption of Products:** Being mindful of the products that we consume can be an effective way to contribute. Opting for products with “Ozone friendly” label when buying products such as air fresheners, and aerosol sprays ensures the use of environmentally safe propellants.

**Energy Efficiency at Home:** Simple things such as replacing old light fixtures with LED bulbs, disconnect electronics when not in use and opting for energy-star-rated or “Hakathari” rated appliances such as refrigerators and air conditioners. By using energy more efficiently, we take part in decrease the production and release of ozone-depleting substances.

**Try and Embrace Eco-Friendly Transportation:** Whenever possible, choosing to take public transportation, to cycle, or to walk and if you must drive, consider a fuel-efficient or electric vehicle. Taking these steps not only reduces emissions but also contributes to the overall reduction of harmful substances in the atmosphere.

**Minimize Air Travel:** While air travel is sometimes unavoidable, try to limit it when feasible. Airplanes emit pollutants, including greenhouse gases, at high altitudes, which can contribute to ozone layer depletion. Consider exploring local destinations such as biosphere reserves, unique ecosystems and historical sites.

**Support local and Sustainable Agriculture:** Choose locally sourced and organic foods whenever possible. Conventional farming practices, especially those involving synthetic fertilizers can release nitrous oxide, a potent ozone-depleting substance. By supporting sustainable agriculture, we actively promote local farmers who utilise environmentally-friendly farming methods.

**The 3 R's:** Adopt a zero-waste mindset by reducing single-use items, reusing what you can, and recycling materials whenever possible. By minimizing waste, you help decrease the demand for resource-intensive production processes such as plastic manufacturing that may contribute to ozone layer depletion.

**Proper Disposal of Hazardous Waste:** Make sure that hazardous household materials, such as paints, solvents, and batteries, are segregated and disposed of correctly. Improper disposal of such waste can lead to the release of harmful chemicals into the environment, potentially impacting the ozone layer.

**Advocate for Ozone-Friendly Policies:** Staying informed about local and national environmental policies and advocating for regulations that support ozone protection, such as restrictions on the use of ozone-depleting substances and incentives for clean energy initiatives has the potential to bring about greater change long term.

**Educate and Spread Awareness:** Share information about ozone layer protection with your family, friends, and community. Encourage others to adopt environmentally-conscious practices and participate in initiatives aimed at preserving the ozone layer.

In conclusion, individual actions are integral to the collective effort in safeguarding the ozone layer. By incorporating these practical tips and lifestyle changes into our daily routines, we contribute to a healthier and more sustainable planet. Together, we can make a substantial difference in the fight against ozone layer depletion, leaving a legacy of environmental stewardship for generations to come.





# MINISTRY OF ENVIRONMENT, CLIMATE CHANGE AND TECHNOLOGY

LAYOUT:

IBRAHIM FAUZAAN FATHUHULLA

CONTRIBUTORS:

FATHIMATH HAIFA

IBRAHIM FAUZAAN FATHUHULLA

FATHMATH USRA

THIBYAN IBRAHIM

HAWWA NABAHA NASHID

MOHAMED NAIF

PROOF READ BY:

HASSAN UMAIL ADAM

RAYYA HUSSAIN

AISHATH REESHA SUHAIL