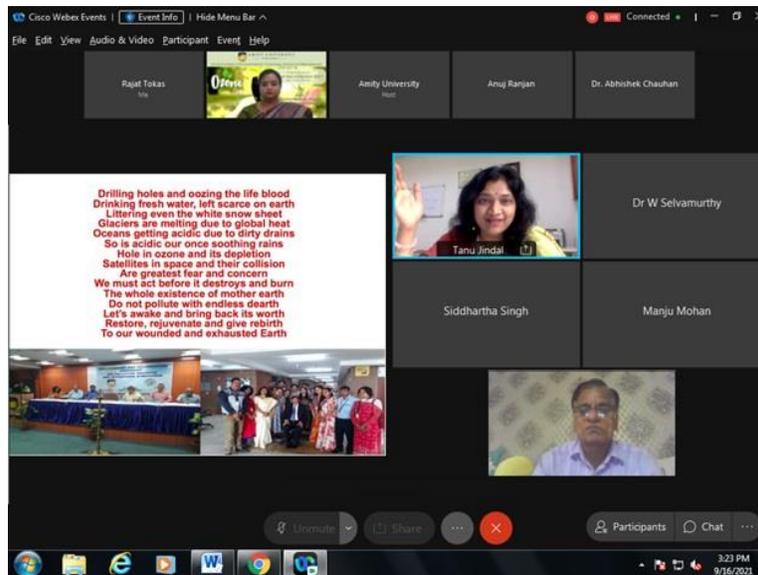


## Report on Ozone Day Celebration

16<sup>th</sup> September 2021

The program started at 3 pm. the co-hosted Dr. Smriti Shukla and Ms. Jayati. Dr. Smriti introduced Prof. Tanu Jindal and invited her to introduce the topic.

Prof. Tanu Jindal highlighted the importance of the Ozone Layer and briefed some of the related ongoing projects in the University. She also talked about the various ecotoxicological impacts of ozone layer depletion, such as its effects on our immunity, the adverse effects on terrestrial ecosystems.



Dr. D.K. Bandhyopadhyay welcomed the guests and eminent speakers. He mentioned that such celebrations help in creating awareness about major environmental issues. In case of ozone layer depletion, awareness and sensitization is of utmost importance. He also discussed about what is stratospheric ozone and what is tropospheric ozone. He also talked about how tropospheric ozone is formed. He also threw light on the importance of ozone layer and the adverse effects of ozone layer depletion. He also talked about the Montreal Protocol and the Kigali Amendment. In the end, he talked about the various mitigation measures needed to stop ozone layer depletion and climate change.



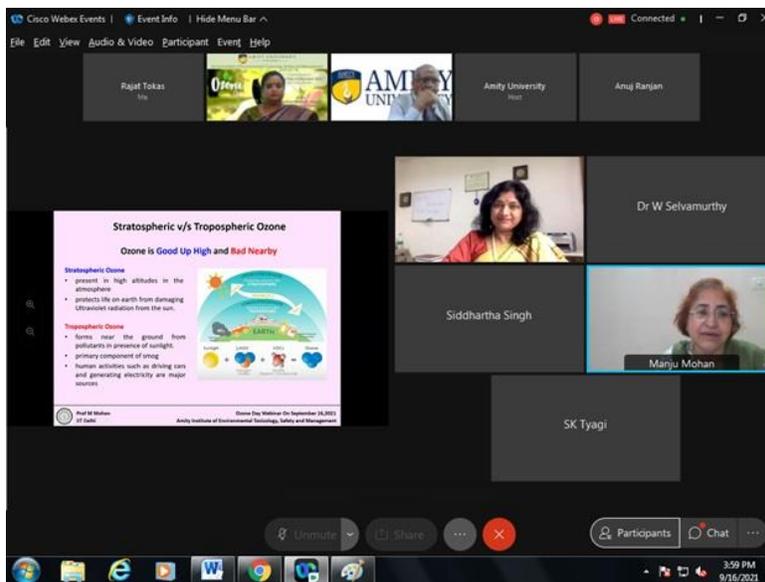
Dr. W Selvamurthy gave a very thought-provoking talk on the topic and highlighted the importance of action over the issue. He began his talk with the words ‘tackling climate change and ozone layer depletion are our most important priorities today’. He mentioned that nature has high resilience and can heal itself, provided with long periods of time. He also discussed about the causes of ozone hole and emphasized on the need to develop alternatives to ozone layer depleting substances. Amity University has also developed a new innovative method for zero energy cooling to cool fruits and vegetables.



The first speaker of the day, Prof. Manju Mohan, began her talk by mentioning that the Earth Overshoot Day for this year was reached on 29 July, 2021. She also talked about stratospheric ozone, which is also called good ozone and Tropospheric ozone which is also called bad ozone. Stratospheric ozone is the ozone found in the stratosphere, the layer of atmosphere which lies just above the troposphere. The ozone in the stratosphere protects all life on Earth from the harmful UV radiation from the Sun by absorbing the UV radiation.

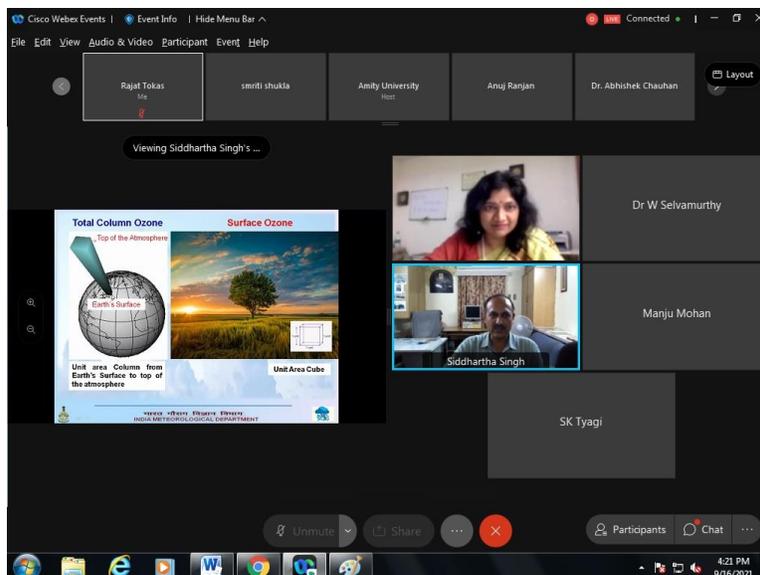
The ozone in the troposphere, however, is generated through reactions between primary pollutants in the atmosphere, namely nitrogen oxides and Volatile Organic Compounds (VOCs). The tropospheric ozone or ground level ozone causes a lot of harm to human health and the environment. She also talked about the Kigali Amendment. The Kigali Amendment is an important amendment to the Montreal Protocol which was formulated in 2016 in the Rwandan capital. It came into force from the beginning of 2019. Its aim is to ensure the gradual phase down of Hydrofluorocarbons (HFCs), which is used extensively in air conditioning, refrigerating and in the furnishing foam industry. The goals of this Amendment are: Reduction in the use of HFCs by 85 percent by the middle of this century. Different countries have different timelines to achieve this target. The developed countries have to achieve this target in 2036 and India has to achieve the target in 2047. Rich countries have to begin reducing their HFC emissions immediately while India and some other countries have to begin reducing their emissions from only 2031. Successful implementation of this Amendment will result in prevention of 0.5°C rise in temperature due to global warming by the end of this century. It can contribute significantly in achieving the Paris Agreement Targets. She also showed that tropospheric ozone was recorded in its highest concentrations at various monitoring stations in India. She also talked about some of the adverse effects of tropospheric ozone. These include negative impacts on human health and has caused many deaths. Tropospheric ozone has also caused a significant reduction in crop yield, which has caused a lot of economic damage in turn. The crops damaged due to ground-level ozone could have fed millions of poor people. She also talked about the Box-Whisker plot of surface ozone or tropospheric ozone. The northern and eastern parts of India showed high concentrations of tropospheric ozone as compared to the southern and western parts of India. She also said that the various monitoring stations of Delhi reported concentrations of tropospheric ozone well above the standards. Ground-level Ozone, also a powerful greenhouse gas, contributes to global warming as well. Dr. Manju Mohan also showed that during the Covid-19 lockdown, there was a significant decrease in the concentration of various air pollutants, including the precursors of tropospheric ozone. However, the concentrations of tropospheric ozone were found to be quite high during the lockdown, despite a reduction in the concentration of its precursors. Volatile Organic Compounds (VOCs) and nitrogen oxides are the main precursors of tropospheric ozone. It was also found that with an increase in the temperature of the troposphere, the concentration of tropospheric ozone also increased. She also talked about the Chemical Transport Model (CTM), which is a method of forecasting the tropospheric ozone levels. Dr. Manju Mohan also talked about the effects of urbanization on Ozone air pollution. She then presented a case study under this topic which was about using Chemical Transport Modelling (CTM) to measure the tropospheric ozone concentrations in the National Capital Region (NCR) in India. This case study

focused more on the national capital, Delhi. It was found that the urbanization has increased by about seventeen times in the last 50 years. The increase in the urban built-up area in the NCR region has caused the levels of tropospheric ozone to increase in the NCR region. She also presented the “Nexus of Urban Dynamics on Air Quality”. Towards the end of the talk, Dr. Manju Mohan emphasized on the need to implement the mitigation measures to reduce the concentrations of ground-level ozone as soon as possible. She finally concluded by saying that the Montreal Protocol was a positive step towards protecting the stratospheric ozone.



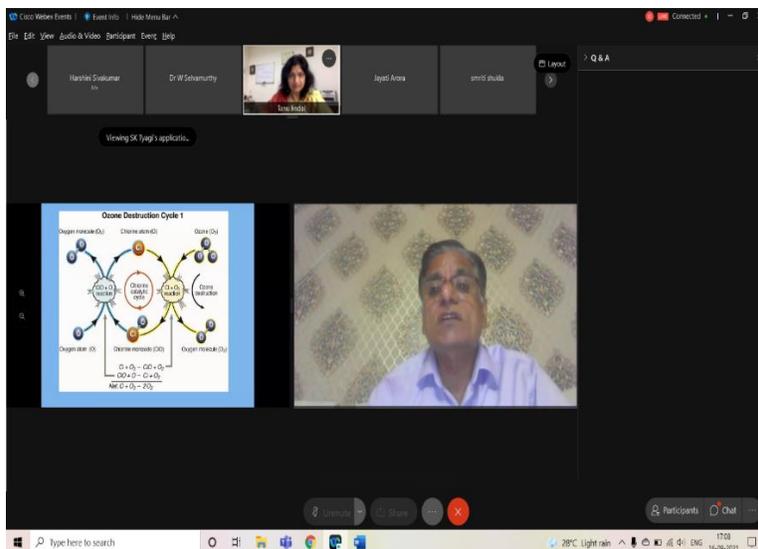
The next speaker was Dr. Siddhartha Singh. He gave a basic idea on ozone formation, tropospheric ozone, effects of ozone pollution on crops, etc. The Ozone is a gas naturally found in the stratosphere in order to protect all life on Earth from the harmful effects of UV radiation from the Sun by absorbing it. Thus, stratospheric ozone is also called as good ozone. He also talked about tropospheric ozone or the ground level ozone which is also called as bad ozone because tropospheric ozone is a secondary pollutant formed by reactions between the primary pollutants in the atmosphere, namely nitrogen oxides and Volatile Organic Compounds (VOCs). Tropospheric ozone also contributes to photochemical smog. He also talked about two types of ozone, namely Total Columnar Ozone and Surface Ozone. He also talked about the various adverse effects of UV radiation if it was able reach the earth’s surface by passing through the ozone hole. The negative effects of UV radiation include: Skin cancer, premature ageing, cataract in the eyes, damages materials such as rubber, wood and plastic. He also threw some light on the acute and chronic health effects of ground level ozone. These effects include: the respiratory system will be adversely affected, coughing, aggravation of asthma, reduced lung function. Ground-level ozone also damages crops, causing reduction in food production, which in

turn negatively affects the economy of a country. He also explained the chemical reactions in which ozone is continuously formed and destroyed. The formation and destruction of ozone should be in a state of equilibrium or balance in order for the ozone layer to remain intact. Ozone depletion occurs when this balance gets disturbed. Chemicals such as CFCs (Chloroflourocarbons), HCFCs, halons, Methyl bromide disturb this balance by releasing a chlorine free radical or bromine free radical into the atmosphere. Sources of Ozone depletion include refrigerants, fire extinguishers. He also defined an ozone hole as a region of the ozone layer where ozone concentration has dropped below 220 Dobson Units. He also mentioned some of the treaties formulated to reduce ozone depletion. One such treaty was the Vienna Convention, formulated by the United Nations (UN) in 1985. This was followed by the Montreal Protocol, which was formulated in 1987. As per the Phase-Out Schedule for India set by the Montreal Protocol, CFCs and Halons should be phased out by 2010 and HCFCs should be phased out by 2040. The Montreal Protocol was successful in reducing the ozone depletion to a great extent. He also explained the various chemical reactions responsible for ground level ozone formation. He gave a detailed explanation on how ozone levels are being monitored at Indian Meteorological Department and some of the trends observed in it. He also showed that during the Covid-19 lockdown, the concentration of various pollutants, including the precursors of ozone, decreased significantly but there was an increase in the tropospheric ozone concentrations. Towards the end, Dr. Singh talked about some measures to reduce the concentrations of tropospheric ozone such as proper maintenance and tuning of automobiles, the tyres of cars should be properly inflated, the containers of household cleaners and solvents should be properly sealed.



The last speaker of the event was Dr. SK Tyagi. He started his talk by throwing some light on the significance of World Ozone Day. This day, also as the International Day for the Preservation of Ozone Layer, is celebrated on the 16th of September every year. The main aim of this day is to make more and more people aware about the need to protect the ozone layer. He also said that ozone acts as a “vaccine” for all life on Earth as it absorbs the harmful UV radiation from reaching the Earth’s surface, thus preventing it from reaching the Earth’s surface. He also talked about the various treaties formulated to reduce ozone layer depletion, such as the Vienna Convention, formulated by the UN in 1985, followed by the Montreal Protocol, whose main aim is to phase-out ozone depleting substances. Another such treaty was the Kigali Amendment, which was the 8th amendment to the Montreal Protocol. If implemented successfully, the Kigali Amendment could reduce global warming by as much as 0.5 Degrees Celsius. It was observed that tropospheric ozone concentrations remained high even during the Covid-19 lockdown, despite a decrease in the concentrations of its precursors. He also talked about stratospheric ozone, also known as good ozone, as it protects all life on Earth from the harmful effects of UV radiation. Tropospheric ozone is also known as bad ozone as it negatively impacts human health and the environment and contributes to photochemical smog. He also explained the chemical reactions showing the formation and destruction of stratospheric ozone. Dr. SK Tyagi also focused upon the various Ozone Depleting Chemicals (ODCs) such as CFCs and HCFCs, both of which are emitted from use of aerosols and refrigerants. CFCs and HCFCs release chlorine free radicals once they reach the stratosphere, which in turn destroy several thousand ozone molecules, creating ozone hole. The level of stratospheric ozone over Antarctica has decreased by 40-60 %. The unit for measurement of ozone layer concentrations is Dobson Units. 1 Dobson Unit is equivalent to 1 ppb (parts per billion) of ozone. Ozone layer depletion has also caused the UV Index over the polar regions to increase. The ozone hole over Antarctica was found to be more prominent than the hole over the Arctic. He also talked about some natural causes of ozone depletion, such as Sunspots and stratospheric winds. Earlier, CFCs were widely used since they were stable, non-toxic, non-corrosive and unreactive compounds. Ozone Depleting Potential is a measure of a chemical’s capability to deplete the ozone layer. Halons are believed to have the highest Ozone Depleting Potential. He also showed that maximum depletion is caused by CFC-11, CFC-12, and Carbon Tetrachloride. Refrigerants are believed to cause 26 percent of the ozone layer depletion, whereas solvents are responsible for 16 percent of the ozone depletion. He also talked about the steps involved in the depletion of the ozone layer, which include emissions, accumulations, transportation, conversion and chemical reactions. He also talked about Chapman’s Theory of Ozone formation and destruction. It is believed that about 50 percent of the ozone layer has been destroyed. Towards the end of the talk, Dr. SK Tyagi also discussed about the various consequences of ozone layer depletion such as

increased exposure to UV radiation which has negative impacts on human health , reduces crop production and kills the marine phytoplankton and the need to strictly implement mitigation measures to reduce ozone layer depletion.



Some competition activities like poster making competition, article writing and poem writing were organized for the students. The students participated with great interest and enthusiasm. The names of the all the participants for poster making competition, article writing or poem writing competition were shared.



Then, some of the posters, articles and poems submitted for the competition were displayed on the panel.

A small panel-discussion about steps to reduce ozone depletion was also made, emphasizing on the need to encourage the use of herbal products to reduce ozone

depletion where different measures for prevention of ozone layer with mentioned. Prof. Tanu Jindal, Dr. W. Selvamurthy, Dr. Siddhartha Singh and Dr. SK Tyagi discussed in detail about the plan of action in this regard at individual levels.

Towards the end, a question-and-answer session for all the participants was arranged. The queries were answered by the panelists.

Finally, Dr. Abhishek Chauhan concluded the session with a vote of thanks.

