Proceedings of International Conference on Modern Science and Scientific Studies
Hosted online from Paris, France.
Date: 19th May, 2023
ISSN: 2835-3730 **Website:** econferenceseries.com

AIR POLLUTION AND CONTROL ENGINEERING AND TECHNOLOGY

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Air pollution refers to the release of pollutants into the air—pollutants which are detrimental to human health and the planet as a whole. According to the World Health Organization (WHO), each year air pollution is responsible for nearly seven million deaths around the globe. Nine out of ten human beings currently breathe air that exceeds the WHO's guideline limits for pollutants, with those living in low- and middle-income countries suffering the most. In the United States, the Clean Air Act, established in 1970, authorizes the U.S. Environmental Protection Agency (EPA) to safeguard public health by regulating the emissions of these harmful air pollutants.

"Most air pollution comes from energy use and production," says John Walke, director of the Clean Air Project, part of the Climate and Clean Energy program at NRDC. "Burning fossil fuels releases gases and chemicals into the air." And in an especially destructive feedback loop, air pollution not only contributes to climate change but is also exacerbated by it. "Air pollution in the form of carbon dioxide and methane raises the earth's temperature," Walke says. "Another type of air pollution, smog, is then worsened by that increased heat, forming when the weather is warmer and there's more ultraviolet radiation." Climate change also increases the production of allergenic air pollutants, including mold (thanks to damp conditions caused by extreme weather and increased flooding) and pollen (due to a longer pollen season).

"We've made progress over the last 50 years improving air quality in the United States thanks to the Clean Air Act," says Kim Knowlton, senior scientist and deputy director of the NRDC Science Center. "But climate change will make it harder in the future to meet pollution standards, which are designed to protect health."

The effects of air pollution on the human body vary depending on the type of pollutant and the length and level of exposure—as well as other factors, including a person's individual health risks and the cumulative impacts of multiple pollutants or stressors.

ISSN: 2835-3730 Website: econferenceseries.com

These are the two most prevalent types of air pollution. Smog (sometimes referred to as ground-level ozone) occurs when emissions from combusting fossil fuels react with sunlight. Soot (also known as particulate matter) is made up of tiny particles of chemicals, soil, smoke, dust, or allergens—in the form of either gas or solids—that are carried in the air. The sources of smog and soot are similar. "Both come from cars and trucks, factories, power plants, incinerators, engines, generally anything that combusts fossil fuels such as coal, gas, or natural gas," Walke says.

Smog can irritate the eyes and throat and also damage the lungs, especially those of children, senior citizens, and people who work or exercise outdoors. It's even worse for people who have asthma or allergies: these extra pollutants can intensify their symptoms and trigger asthma attacks. The tiniest airborne particles in soot, whether gaseous or solid, are especially dangerous because they can penetrate the lungs and bloodstream and worsen bronchitis, lead to heart attacks, and even hasten death. In 2020 a report from Harvard's T. H. Chan School of Public Health showed COVID-19 mortality rates in areas with more soot pollution were higher than in areas with even slightly less, showing a correlation between the virus's deadliness and long-term exposure to fine particulate matter and illuminating an environmental justice issue.

Because highways and polluting facilities have historically been sited in or next to low-income neighborhoods and communities of color, the negative effects of this pollution have been disproportionately experienced by the people who live in these communities. In 2019 the Union of Concerned Scientists found that soot exposure was 34 percent higher for Asian Americans, on average, than for other Americans. For Black people, the exposure rate was 24 percent higher; for Latinos, 23 percent higher.

A number of air pollutants pose severe health risks and can sometimes be fatal even in small amounts. Almost 200 of them are regulated by law; some of the most common are mercury, lead, dioxins, and benzene. "These are also most often emitted during gas or coal combustion, incinerating, or—in the case of benzene—found in gasoline," Walke says. Benzene, classified as a carcinogen by the EPA, can cause eye, skin, and lung irritation in the short term and blood disorders in the long term. Dioxins, more typically found in food but also present in small amounts in the air, can affect the liver in the short term and harm the immune, nervous, and endocrine systems as well as reproductive functions. Mercury attacks the central nervous system. In large amounts, lead can damage children's brains and kidneys, and even minimal exposure can affect children's IQ and ability to learn.

Another category of toxic compounds, polycyclic aromatic hydrocarbons (PAHs), are by-products of traffic exhaust and wildfire smoke. In large amounts they have been linked to eye and lung irritation, blood and liver issues, and even cancer. In one study, the children of mothers exposed to PAHs during pregnancy showed slower brain-processing speeds and more pronounced symptoms of ADHD.

Control engineering (or control system engineering) is the process of designing, analyzing, and optimizing a control system. A control system is a set of devices that regulates the behavior of other devices or systems. It can comprise mechanical devices like machinery, electronics such as computers, or a combination of the two. There are many different types of control systems, but each one serves the same purpose: to control outputs.

An air conditioner is one example of a control system you might encounter regularly. It controls the output of hot or cold air depending on the temperature setting you input. This process often involves the control of several different devices. For example, most air conditioning systems involve an air handler, a condenser, and a thermostat.

An Engineering Technology degree emphasizes the application of specific engineering techniques. Graduates with an Engineering Technology degree often seek employment in fields such as production, design, manufacturing and operations. Some examples of real-world challenges graduates with an Engineering Technology degree may explore include:

Consulting development for electronic designs for commercial purposes

Research capabilities and implementation for current technologies

Exploring tracking technology in space exploration, consumer electronics and defense

The degrees of Engineering Technology and Bachelor of Science in Engineering contain some overlap, but they also have important characteristics that make them unique.

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