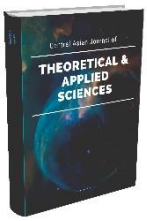

CENTRAL ASIAN JOURNAL OF THEORETICAL AND APPLIED SCIENCES

Volume: 03 Issue: 09 | Sep 2022 ISSN: 2660-5317
https://cajotas.centralasianstudies.org

A Scientific Study of the Pollutants of the Environment

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Received 17th Jul 2022, Accepted 18th Aug 2022, Online 24th Sep 2022

Abstract: *Environmental pollutants are chemicals that have ended up in the environment as a result of human activities and that are hazardous to health. Environmental pollutants are compounds introduced in the natural environment causing adverse changes, for example, adversely affecting health or causing other types of damage. Among these, the pesticides, herbicides, and fungicides are of considerable interest since they have a large-scale use in agriculture. A pollutant or novel entity is a substance or energy introduced into the environment that has undesired effects, or adversely affects the usefulness of a resource. These can be both naturally forming (i.e. minerals or extracted compounds like oil) or anthropogenic in origin (i.e. manufactured materials or byproducts from biodegradation). Pollutants result in environmental pollution or become public health concerns when they reach a concentration high enough to have significant negative impacts.A pollutant may cause long- or short-term damage by changing the growth rate of plant or animal species, or by interfering with human amenities, comfort, health, or property values. Some pollutants are biodegradable and therefore will not persist in the environment in the long term. However, the degradation products of some pollutants are themselves polluting such as the products DDE and DDD produced from the degradation of DDT.Pollution has widespread negative impacts on the environment.When analyzed from a planetary boundaries perspective, human society has released novel entities that well exceed safe levels.*

Keywords: *pollutants, environment, adverse, impacts, degradation, health, hazardous, human.*

Introduction.

Pollutants can be categorized in a variety of different ways. For example, it is sometimes useful to distinguish between stock pollutants and fund pollutants. Another way is to group them together according to more specific properties, such as organic, particulate, pharmaceutical, et cetera. The environment has some capacity to absorb many discharges without measurable harm, and this is called "assimilative capacity (or absorptive capacity); a pollutant actually causes pollution when the assimilative capacity is exceeded.[1,2]

Pollutants, towards which the environment has low absorptive capacity are called stock pollutants. Examples include persistent organic pollutants like PCBs, non-biodegradable plastics and heavy metals. Stock pollutants accumulate in the environment over time. The damage they cause increases as more pollutant is emitted, and persists as the pollutant accumulates. Stock pollutants can create a burden for the future generations, bypassing on the damage that persists well after the benefits received from incurring

that damage, have been forgotten. Scientists have officially deemed that the planetary boundaries safe chemical pollutant levels (novel entities) have been surpassed.

In contrast to stock pollutants, for which the environment has low absorptive capacity, fund pollutants are those for which the environment has a moderate absorptive capacity. Fund pollutants do not cause damage to the environment unless the emission rate exceeds the receiving environment's absorptive capacity (e.g. carbon dioxide, which is absorbed by plants and oceans). Fund pollutants are not destroyed, but rather converted into less harmful substances, or diluted/dispersed to non-harmful concentrations.

Many pollutants are within the following notable groups:

- Environmental Persistent Pharmaceutical Pollutants (EPPP)
- Greenhouse gases (GHG)
- Particulate matter (PM)
- Persistent organic pollutants (POPs)
- Polycyclic aromatic hydrocarbons (PAHs)
- Volatile organic compounds (VOCs)

The term environmental persistent pharmaceutical pollutants (EPPP) was first suggested in the nomination in 2010 of pharmaceuticals and environment as an emerging issue in a Strategic Approach to International Chemicals Management (SAICM) by the International Society of Doctors for the Environment (ISDE). The occurring problems from EPPPs are in parallel explained under environmental impact of pharmaceuticals and personal care products (PPCP). The European Union summarizes pharmaceutical residues with the potential of contamination of water and soil together with other micropollutants under "priority substances".[3,4]

Greenhouse gas emissions from human activities strengthen the greenhouse effect, contributing to climate change. Most is carbon dioxide from burning fossil fuels: coal, oil, and natural gas. The largest emitters include coal in China and large oil and gas companies, many state-owned by OPEC and Russia. Human-caused emissions have increased atmospheric carbon dioxide by about 50% over pre-industrial levels. The growing levels of emissions have varied, but it was consistent among all greenhouse gases. Emissions in the 2010s averaged 56 billion tons a year, higher than ever before.

Electricity generation and transport are major emitters, the largest single source being coal-fired power stations with 20% of GHG. Deforestation and other changes in land use also emit carbon dioxide and methane. The largest source of anthropogenic methane emissions is agriculture, closely followed by gas venting and fugitive emissions from the fossil-fuel industry. The largest agricultural methane source is livestock. Agricultural soils emit nitrous oxide partly due to fertilizers. Similarly, fluorinated gases from refrigerants play an outsized role in total human emissions.[5,6]

At current emission rates averaging six and a half tonnes per person per year, before 2030 temperatures may have increased by 1.5 °C (2.7 °F) over pre-industrial levels, which is the limit for the G7 countries and aspirational limit of the Paris Agreement.

Particulates – also known as atmospheric aerosol particles, atmospheric particulate matter, particulate matter (PM) or suspended particulate matter (SPM) – are microscopic particles of solid or liquid matter suspended in the air. The term aerosol commonly refers to the particulate/air mixture, as opposed to the particulate matter alone. Sources of particulate matter can be natural or anthropogenic. They have impacts on climate and precipitation that adversely affect human health, in ways additional to direct inhalation.

Types of atmospheric particles include suspended particulate matter; thoracic and respirable particles; inhalable coarse particles, designated PM10, which are coarse particles with a diameter of 10 micrometers (μm) or less; fine particles, designated PM2.5, with a diameter of 2.5 μm or less; ultrafine particles, with a diameter of 100 nm or less; and soot.[7,8]

The IARC and WHO designate airborne particulates as a Group 1 carcinogen.Particulates are the most harmful form (other than ultra-fines) of air pollution due to their ability to penetrate deep into the lungs, blood streams and brain, causing health problems including heart attacks, respiratory disease, and premature death. In 2013, a study involving 312,944 people in nine European countries revealed that there was no safe level of particulates and that for every increase of 10 μg/m3 in PM10, the lung cancer rate rose 22% (95% CI [1.03–1.45]). The smaller PM2.5, which can penetrate deeper into the lungs, were associated with an 18% increase in lung cancer per 5 μg/m3; however, this study did not show statistical significance for this association (95% CI [0.96–1.46]) Worldwide exposure to PM2.5 contributed to 4.1 million deaths from heart disease and stroke, lung cancer, chronic lung disease, and respiratory infections in 2016.Overall, ambient particulate matter ranks as the sixth leading risk factor for premature death globally.

Persistent organic pollutants (POPs), sometimes known as "forever chemicals", are organic compounds that are resistant to environmental degradation through chemical, biological, and photolytic processes. They are toxic chemicals that adversely affect human health and the environment around the world. Because they can be transported by wind and water, most POPs generated in one country can and do affect people and wildlife far from where they are used and released.

The effect of POPs on human and environmental health was discussed, with intention to eliminate or severely restrict their production, by the international community at the Stockholm Convention on Persistent Organic Pollutants in 2001.[9,10]

Most POPs are pesticides or insecticides, and some are also solvents, pharmaceuticals, and industrial chemicals. Although some POPs arise naturally (e.g. from volcanoes), most are man-made. The "dirty dozen" POPs identified by the Stockholm Convention include aldrin, chlordane, dieldrin, endrin, heptachlor, HCB, mirex, toxaphene, PCBs, DDT, dioxins, and polychlorinated dibenzofurans.

The United States has taken strong domestic action to reduce emissions of POPs. For example, none of the original POPs pesticides listed in the Stockholm Convention are registered for sale and distribution in the United States today. In 1978, Congress prohibited the manufacture of polychlorinated biphenyl (PCB) and severely restricted the use of remaining PCB stocks. Since 1987, the Environmental Protection Agency and states have effectively reduced environmental releases of dioxins and furans to land, air, and water from U.S. sources.

A polycyclic aromatic hydrocarbon (PAH) is a hydrocarbon—a chemical compound containing only carbon and hydrogen—that is composed of multiple aromatic rings. The group is a major subset of the aromatic hydrocarbons. The simplest of such chemicals is naphthalene, having two aromatic rings, and the three-ring compounds are anthracene and phenanthrene. The terms polyaromatic hydrocarbon or polynuclear aromatic hydrocarbon are also used for this concept.

PAHs are uncharged, non-polar molecules, with distinctive properties due in part to the delocalized electrons in their aromatic rings. Many of them are found in coal and in oil deposits, and are also produced by the combustion of organic matter—for example, in engines and incinerators or when biomass burns in forest fires.[11,12]

Polycyclic aromatic hydrocarbons are discussed as possible starting materials for abiotic syntheses of materials required by the earliest forms of life

Volatile organic compounds (VOCs) are organic chemicals that have a high vapour pressure at room temperature. High vapor pressure correlates with a low boiling point, which relates to the number of the sample's molecules in the surrounding air, a trait known as volatility.

VOCs are responsible for the odor of scents and perfumes as well as pollutants. VOCs play an important role in communication between animals and plants, e.g. attractants for pollinators, protection from predation, and even inter-plant interactions. Some VOCs are dangerous to human health or cause harm to the environment. Anthropogenic VOCs are regulated by law, especially indoors, where concentrations are the highest. Most VOCs are not acutely toxic, but may have long-term chronic health effects.

Discussion

Light pollution is the impact that anthropogenic light has on the visibility of the night sky. It also encompasses ecological light pollution which describes the effect of artificial light on individual organisms and on the structure of ecosystems as a whole. Pollutants can also be defined by their zones of influence, both horizontally and vertically

The horizontal zone refers to the area that is damaged by a pollutant. Local pollutants cause damage near the emission source. Regional pollutants cause damage further from the emission source.[13,14]

The vertical zone refers to whether the damage is ground-level or atmospheric. Surface pollutants cause damage by accumulating near the Earth's surface. Global pollutants cause damage by concentrating on the atmosphere.

Measures of pollutant concentration are used to determine risk assessment in public health.

Industry is continually synthesizing new chemicals, the regulation of which requires evaluation of the potential danger for human health and the environment. Risk assessment is nowadays considered essential for making these decisions on a scientifically sound basis.

Measures or defined limits include:

- No effect concentration (NEC), No Observed Effect Concentration (NOEC), No-observed-adverse-effect level (NOAEL)
- Lowest-observed-adverse-effect level (LOAEL)
- Acceptable Operator Exposure Level (AOEL)
- ECx (in percent)

Pollutants can cross international borders and therefore international regulations are needed for their control. The Stockholm Convention on Persistent Organic Pollutants, which entered into force in 2004, is an international legally binding agreement for the control of persistent organic pollutants. Pollutant Release and Transfer Registers (PRTR) are systems to collect and disseminate information on environmental releases and transfers of toxic chemicals from industrial and other facilities.

The European Pollutant Emission Register is a type of PRTR providing access to information on the annual emissions of industrial facilities in the Member States of the European Union, as well as Norway.

Clean Air Act standards. Under the Clean Air Act, the National Ambient Air Quality Standards (NAAQS) are developed by the Environmental Protection Agency (EPA) for six common air pollutants, also called "criteria pollutants": particulates; smog and ground-level ozone; carbon monoxide; sulfur oxides; nitrogen oxides; and lead. The National Emissions Standards for Hazardous Air Pollutants are additional emission standards that are set by EPA for toxic air pollutants. [15,16]

Clean Water Act standards. Under the Clean Water Act, EPA promulgated national standards for municipal sewage treatment plants, also called publicly owned treatment works, in the Secondary Treatment Regulation. National standards for industrial dischargers are called Effluent guidelines (for existing sources) and New Source Performance Standards, and currently cover over 50 industrial categories. In addition, the Act requires states to publish water quality standards for individual water bodies to provide additional protection where the national standards are insufficient. he Resource Conservation and Recovery Act (RCRA) regulates the management, transport and disposal of municipal solid waste, hazardous waste and underground storage tanks

Results

A conventional pollutant is a term used in the USA to describe a water pollutant that is amenable to treatment by a municipal sewage treatment plant. A basic list of conventional pollutants is defined in the U.S. Clean Water Act.The list has been amended in regulations issued by the Environmental Protection Agency:

- biochemical oxygen demand (BOD)
- fecal coliform bacteria
- oil and grease
- pH (exceeding regulatory limits)
- total suspended solids (TSS).

The Secondary Treatment Regulation contains national discharge standards for BOD, pH and TSS, applicable to sewage treatment plants in the U.S. [23,24]

The Pollutant Standards Index (PSI) is a type of air quality index, which is a number used to indicate the level of pollutants in air.

Initially PSI was based on five air pollutants, but since 1 April 2014 it has also included fine particulate matter ($PM_{2.5}$).

In addition to the PSI derived by averaging data collected for the past 24 hours, Singapore also publishes 1-hr $PM_{2.5}$ concentrations are also published every hour.

Besides Singapore, some other countries also use air quality indices. However, the calculations used to derive their air quality indices may differ. Different countries also use different names for their indices such as Air Quality Health Index, Air Pollution Index and Pollutant Standards Index.[17,18]

The PSI is reported as a number on a scale of 0 to 500. The index figures enable the public to determine whether the air pollution levels in a particular location are good, unhealthy, hazardous or worse. The following PSI table is grouped by index values and descriptors, explaining the effects of the levels:

PSI	Descriptor	General Health Effects
0–50	Good	None
51–100	Moderate	Few or none for the general population
101–200	Unhealthy	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects. To stay indoors.
201–300	Very unhealthy	Health warnings of emergency conditions. The entire population is more likely to be affected.
301+	Hazardous	Health alert: everyone may experience more serious health effects

A toxicant is any toxic substance or pollutant. Toxicants can be poisonous and they may be man-made or naturally occurring. The different types of toxicants/pollutants can be found in the air, soil, water, or food. Cigarette smoke contains toxicants.E-cigarette aerosol also contains toxicants.[9] The emissions of a heat-not-burn tobacco product contains toxicants.[10] Most heavy metals are toxicants. Diesel exhaust contains toxicants. Pesticides, benzene, and asbestos-like fibers such as carbon nanotubes are toxicants/pollutants.Possible developmental toxicants include phthalates, phenols, sunscreens, pesticides, halogenated flame retardants, perfluoroalkyl coatings, nanoparticles, e-cigarettes, and dietary polyphenols.[19,20]

Conclusions

There are many waste/pollutant types defined by modern systems of waste management, notably including:

- Municipal waste includes household waste, commercial waste, and demolition waste
- Hazardous waste includes industrial waste
- Biomedical waste includes clinical waste
- Special hazardous waste includes radioactive waste, explosive waste, and electronic waste (e-waste)

Waste/pollutant management is a significant environmental justice issue. Many of the environmental burdens cited above are more often borne by marginalized groups, such as racial minorities, women, and residents of developing nations. NIMBY (not in my back yard) is the opposition of residents to a proposal for a new development because it is close to them. However, the need for expansion and siting of waste treatment and disposal facilities is increasing worldwide. There is now a growing market in the transboundary movement of waste, and although most waste that flows between countries goes between developed nations, a significant amount of waste is moved from developed to developing nations.[21,22]

Education and awareness in the area of waste and waste/pollutant management is increasingly important from a global perspective of resource management. The Talloires Declaration is a declaration for sustainability concerned about the unprecedented scale and speed of environmental pollution and degradation, and the depletion of natural resources. Local, regional, and global air pollution; accumulation and distribution of toxic wastes; destruction and depletion of forests, soil, and water; depletion of the ozone layer and emission of "green house" gases threaten the survival of humans and thousands of other living species, the integrity of the earth and its biodiversity, the security of nations, and the heritage of future generations.[25]

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