International Journal Of Multidisciplinary Research In Science, Engineering and Technology (IJMRSET)

| ISSN: 2582-7219 | www.ijmrset.com | Monthly Peer Reviewed Journal |

| Volume 1, Issue 2, December 2018 |

Air Pollution and Its Control Measures

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ABSTRACT: Air pollution is the contamination of air due to the presence of substances in the atmosphere that are harmful to the health of humans and other living beings, or cause damage to the climate or to materials.[1] It is also the contamination of indoor or outdoor surrounding either by chemical activities, physical or biological agents that alters the natural features of the atmosphere.[2] There are many different types of air pollutants, such as gases (including ammonia, carbon monoxide, sulphur dioxide, nitrous oxides, methane and chlorofluorocarbons), particulates (both organic and inorganic), and biological molecules. Air pollution can cause diseases, allergies, and even death to humans; it can also cause harm to other living organisms such as animals and food crops, and may damage the natural environment (for example, climate change, ozone depletion or habitat degradation) or built environment (for example, acid rain).[3] Air pollution can be caused by both human activities[4] and natural phenomena.[5]

KEYWORDS: air pollution, atmosphere, control, climate change, ozone depletion, human activities, pollutants

I.INTRODUCTION

Air quality is closely related to the earth's climate and ecosystems globally. Many of the contributors of air pollution are also sources of greenhouse emission i.e., burning of fossil fuel.[2]

Air pollution is a significant risk factor for a number of pollution-related diseases, including respiratory infections, heart disease, COPD, stroke and lung cancer.[6] [Growing evidence suggests that air pollution exposure may be associated with reduced IQ scores, impaired cognition,[7] increased risk for psychiatric disorders such as depression[8] and detrimental perinatal health.][9] The human health effects of poor air quality are far reaching, but principally affect the body's respiratory system and the cardiovascular system. Individual reactions to air pollutants depend on the type of pollutant a person is exposed to,[10][11] the degree of exposure, and the individual's health status and genetics.[12]

Outdoor air pollution attributable to fossil fuel use alone causes ~3.61 million deaths annually, making it one of the top contributors to human death,[6][13] with anthropogenic ozone and $PM_{2.5}$ causing ~2.1 million.[14][15] Overall, air pollution causes the deaths of around 7 million people worldwide each year, or a global mean loss of life expectancy (LLE) of 2.9 years,[16] and is the world's largest single environmental health risk, which has not shown significant progress since at least 2015.[6][17][18][19] Indoor air pollution and poor urban air quality are listed as two of the world's worst toxic pollution problems in the 2008 Blacksmith Institute World's Worst Polluted Places report.[20] The scope of the air pollution crisis is large: 90% of the world's population breathes dirty air to some degree. Although the health consequences are extensive, the way the problem is handled is considered largely haphazard[21][22][23] or neglected.[19]

Productivity losses and degraded quality of life caused by air pollution are estimated to cost the world economy $5 trillion per year[24][25][26] but, along with health and mortality impacts, are an externality to the contemporary economic system and most human activity, albeit sometimes being moderately regulated and monitored.[27][28] Various pollution control technologies and strategies are available to reduce air pollution.[29][30] Several international and national legislation and regulation have been developed to limit the negative effects of air pollution.[31] Local rules, when properly executed, have resulted in significant advances in public health.[32] Some of these efforts have been successful at the international level, such as the Montreal Protocol,[33] which reduced the release of harmful ozone depleting chemicals, and the 1985 Helsinki Protocol,[34] which reduced sulphur emissions,[35] while others, such as international action on climate change,[36][37][38] have been less successful.

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Anthropogenic (human-made) sources

Demolition of the cooling towers of a power station, Athlone, Cape Town, South Africa, 2010

Controlled burning of a field outside of Statesboro, Georgia, in preparation for spring planting

Smoking of fish over an open fire in Ghana, 2017

These are mostly related to the burning of fuel.

- Stationary sources include:
  - fossil-fuel power plants and biomass power plants both have smoke stacks (see for example environmental impact of the coal industry)[39]
    - Oil and gas sites that have methane leaks[40][41][42][43]
  - Burning of traditional biomass such as wood, crop waste and dung. (In developing and poor countries, traditional biomass burning is the major source of air pollutants.[44][45] It is also the main source of particulate pollution in many developed areas including the UK & New South Wales.[46][47] Its pollutants include PAHs.[48])
  - manufacturing facilities (factories)[49]
    - A 2014 study found that in China equipment-, machinery-, and devices-manufacturing and construction sectors contributed more than 50% of air pollutant emissions.[50] This high emission is due to high emission intensity and high emission factors in its industrial structure.[51]

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- waste incineration (incinerators as well as open and uncontrolled fires of mismanaged waste, making up about a fourth of municipal solid terrestrial waste)[52][53]
- furnaces and other types of fuel-burning heating devices[54]

- Mobile sources include motor vehicles, trains (particularly diesel locomotives and DMUs), marine vessels and aircraft[55] as well as rockets and re-entry of components and debris.[56] The air pollution externality of cars enters the air from the exhaust gas and car tires (including microplastics[57]). Vehicles were reported to be "producing about one-third of all U.S. air pollution"[58] and are a major driver of climate change.[59][60]
- Agriculture and forest management strategies using controlled burns. Practices like slash-and-burn in forests like the Amazon cause large air pollution with the deforestation.[61] Controlled or prescribed burning is a practice used in forest management, agriculture, prairie restoration, and greenhouse gas reduction.[62] Foresters can use controlled fire as a tool because fire is a natural feature of both forest and grassland ecology.[63][64] Controlled burning encourages the sprouting of some desirable forest trees, resulting in a forest renewal.[65]

There are also sources from processes other than combustion:

- Fumes from paint, hair spray, varnish, aerosol sprays and other solvents. These can be substantial; emissions from these sources was estimated to account for almost half of pollution from volatile organic compounds in the Los Angeles basin in the 2010s.[66]
- Waste deposition in landfills produces methane.[67]
- Nuclear weapons, toxic gases, germ warfare, and rocketry are examples of military resources.[68]
- Agricultural emissions and emissions from meat production or livestock contribute substantially to air pollution[69][70]
  - Fertilized farmland may be a major source of nitrogen oxides.[71]

II. DISCUSSION

Air pollutant emission factors are reported representative values that aim to link the quantity of a pollutant released into the ambient air to an activity connected with that pollutant's release.[3][77][78][79] The weight of the pollutant divided by a unit weight, volume, distance, or time of the activity generating the pollutant is how these factors are commonly stated (e.g., kilogrammes of particulate emitted per tonne of coal burned). These criteria make estimating emissions from diverse sources of pollution easier. Most of the time, these components are just averages of all available data of acceptable quality, and they are thought to be typical of long-term averages.

There are 12 compounds in the list of persistent organic pollutants. Dioxins and furans are two of them and intentionally created by combustion of organics, like open burning of plastics. These compounds are also endocrine disruptors and can mutate the human genes.

E-waste processing in Agbogbloshie, Ghana using open-burning of electronics to access valuable metals like copper. Open burning of plastics is common in many parts of the world without the capacity for processing. Especially without proper protections, heavy metals and other contaminates can seep into the soil, and create water pollution and air pollution.

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The United States Environmental Protection Agency has published a compilation of air pollutant emission factors for a wide range of industrial sources.[80] The United Kingdom, Australia, Canada and many other countries have published similar compilations, as well as the European Environment Agency.

An air pollutant is a material in the air that can have adverse effects on humans and the ecosystem.[85] The substance can be solid particles, liquid droplets, or gases, and often takes the form of an aerosol (solid particles or liquid droplets dispersed and carried by a gas).[86] A pollutant can be of natural origin or man-made. Pollutants are classified as primary or secondary. Primary pollutants are usually produced by processes such as ash from a volcanic eruption. Other examples include carbon monoxide gas from motor vehicle exhausts or sulfur dioxide released from factories. Secondary pollutants are not emitted directly. Rather, they form in the air when primary pollutants react or interact. Ground level ozone is a prominent example of a secondary pollutant. Some pollutants may be both primary and secondary: they are both emitted directly and formed from other primary pollutants. In Europe, Council Directive 96/62/EC on ambient air quality assessment and management provides a common strategy against which member states can "set objectives for ambient air quality in order to avoid, prevent or reduce harmful effects on human health and the environment ... and improve air quality where it is unsatisfactory".[

On 25 July 2008 in the case Dieter Janecek v Freistaat Bayern, the European Court of Justice ruled that under this directive citizens have the right to require national authorities to implement a short term action plan that aims to maintain or achieve compliance to air quality limit values.

This important case law appears to confirm the role of the EC as centralised regulator to European nation-states as regards air pollution control. It places a supranational legal obligation on the UK to protect its citizens from dangerous levels of air pollution, furthermore superseding national interests with those of the citizen.

In 2010, the European Commission (EC) threatened the UK with legal action against the successive breaching of PM10 limit values. The UK government has identified that if fines are imposed, they could cost the nation upwards of £300 million per year.[294]

In March 2011, the Greater London Built-up Area remained the only UK region in breach of the EC's limit values, and was given three months to implement an emergency action plan aimed at meeting the EU Air Quality Directive. The City of London has dangerous levels of PM10 concentrations, estimated to cause 3000 deaths per year within the city. As well as the threat of EU fines, in 2010 it was threatened with legal action for scrapping the western congestion charge zone, which is claimed to have led to an increase in air pollution levels.[

In response to these charges, Boris Johnson, Mayor of London, has criticised the current need for European cities to communicate with Europe through their nation state's central government, arguing that in future "A great city like London" should be permitted to bypass its government and deal directly with the European Commission regarding its air quality action plan.[295]

This can be interpreted as recognition that cities can transcend the traditional national government organisational hierarchy and develop solutions to air pollution using global governance networks, for example through transnational relations. Transnational relations include but are not exclusive to national governments and intergovernmental organizations allowing sub-national actors including cities and regions to partake in air pollution control as independent actors.

Global city partnerships can be built into networks, for example the C40 Cities Climate Leadership Group, of which London is a member. The C40 is a public 'non-state' network of the world's leading cities that aims to curb their greenhouse emissions. The C40 has been identified as 'governance from the middle' and is an alternative to intergovernmental policy.[It has the potential to improve urban air quality as participating cities "exchange information, learn from best practices and consequently mitigate carbon dioxide emissions independently from national government decisions".A criticism of the C40 network is that its exclusive nature limits influence to participating cities and risks drawing resources away from less powerful city and regional actors.

III. RESULTS

Emission standards are the legal requirements governing air pollutants released into the atmosphere. Emission standards set quantitative limits on the permissible amount of specific air pollutants that may be released from specific sources over specific timeframes. They are generally designed to achieve air quality standards and to protect human life. Different

| ISSN: 2582-7219 | www.ijmrset.com | Monthly Peer Reviewed Journal |

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regions and countries have different standards for vehicle emissions. Many emissions standards focus on regulating pollutants released by automobiles (motor cars) and other powered vehicles. Others regulate emissions from industry, power plants, small equipment such as lawn mowers and diesel generators, and other sources of air pollution.

The first automobile emissions standards were enacted in 1963 in the United States, mainly as a response to Los Angeles' smog problems. Three years later Japan enacted their first emissions rules, followed between 1970 and 1972 by Canada, Australia, and several European nations.[1] The early standards mainly concerned carbon monoxide (CO) and hydrocarbons (HC). Regulations on nitrogen oxide emissions (NO_x) were introduced in the United States, Japan, and Canada in 1973 and 1974, with Sweden following in 1976 and the European Economic Community in 1977. These standards gradually grew more and more stringent but have never been unified.[2]

There are largely three main sets of standards: United States, Japanese, and European, with various markets mostly using these as their base.[2] Sweden, Switzerland, and Australia had separate emissions standards for many years but have since adopted the European standards. India, China, and other newer markets have also begun enforcing vehicle emissions standards (derived from the European requirements) in the twenty-first century, as growing vehicle fleets have given rise to severe air quality problems there, too. An emission performance standard is a limit that sets thresholds above which a different type of vehicle emissions control technology might be needed. While emission performance standards have been used to dictate limits for conventional pollutants such as oxides of nitrogen and oxides of sulphur (NO_x and SO_x),[3] this regulatory technique may be used to regulate greenhouse gases, particularly carbon dioxide (CO_2). In the US, this is given in pounds of carbon dioxide per megawatt-hour (lbs. CO_2/MWhr), and kilograms CO_2/MWhr elsewhere

IV. CONCLUSIONS

Bharat stage emission standards are emission standards instituted by the Government of India to regulate the output of air pollutants from internal combustion engine equipment, including motor vehicles. The standards and the timeline for implementation are set by the Central Pollution Control Board under the Ministry of Environment & Forests.

The standards, based on European regulations were first introduced in 2000. Progressively stringent norms have been rolled out since then. All new vehicles manufactured after the implementation of the norms have to be compliant with the regulations. By 2014, the country was under a combination of Euro 3 and Euro 4-based norms, with Euro 4 standards partly implemented in 13 major cities. Till April 2017, the entire country was under BS IV norms, which is based on Euro 4.[45]

As of now manufacturing and registration of BS VI vehicles has started, from April 2015 all BS VI manufacturing is mandatory, respectively.[45][46]

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