ISSN 0976 – 1411

Available online at www.internationaleJournals.com

International eJournals

INTERNATIONAL eJOURNAL OF MATHEMATICS AND ENGINEERING

www.InternationaleJournals.com

International eJournal of Mathematics and Engineering 226 (2013) 2208 - 2215

THE SIGNIFICANCE OF ENVIRONMENTAL AWARENESS

[1]Satish Kumar Garg and [2]Arvind Dewangan

[1]Mechanical Engineering Department, Haryana college of Technology & Management, HCTM Technical Campus Kaithal-Haryana INDIA. Email: itsarungarg@gmail.com

[2]Civil Engineering Department, Haryana college of Technology & Management, HCTM Technical Campus Kaithal-Haryana INDIA. Email: arvinddewangan237@gmail.com

ABSTRACT

This paper comprises the effect and impact of Precipitation including all solid and liquid forms of water that are deposited on the Earth's surface from the atmosphere. It includes rain, snow, hail, dew and sleet. All forms of precipitation are acid in so far as they have a pH of less than 7; in general, precipitation unaffected by human activity has a pH of 5.6. This naturally acidic state of precipitation is caused by the combination of water and carbon dioxide in the atmosphere to produce carbonic acid. However, the term acid precipitation, or acid rain, is usually applied to precipitation characterized by a pH of less than 5.1 (Elsworth 1984) and that contains sulphurous and nitrous acids. The latter are derived from various sources, among which fossil fuels are the most important. Environmental issues that have developed in industrialized economies have led to an emerging multidisciplinary field of chemistry known as environmental chemistry, beginning in the late 1980s[1]. Primarily concerned with understanding how environmental processes function naturally and how humans impact that natural environmental flow, environmental chemistry includes the study of water, soil, and air chemistry. Atmospheric and environmental chemists compare the natural state of these resources and determine how they are affected by human activities[2].

Key Words: 1 Environmental Chemistry 2. Fossil 3. Air 4. Water 4.Soil 5. Carbon dioxide 6.Ecology

Sub Area : GEOCHEMISTRY

Broad Area : ENVIRONMENTAL ENGINEERING

INTRODUCTION

Clearly one of the most diverse fields of chemistry, environmental chemistry combines the fields of organic chemistry, inorganic chemistry, biochemistry, analytical chemistry, and toxicology as well as biology and ecology. Many industries require the use of environmental chemistry, including the petroleum, mining, pesticide, agricultural, marine and fishing, and food production industries. Environmental chemists must be able to understand the chemical reactions and interactions taking place in the environment as well as the biological impact of those reactions. Environmental chemists spend a large part of their time separating, isolating, and analyzing the components of the soil, water, and air. Environmental chemistry can be divided into several areas of focus, including the impact of human activity on the following: the atmospheric chemistry of the upper and lower atmosphere; the chemistry of water, including the oceans, lakes, rivers, streams, and drinking water; the study of weather and its impact on the planet; air pollution in cities and towns; and food production.

Causes of Pollution

The ultimate cause of pollution is human activity itself. Pollution is a human contribution to nature. Science has evolved technologies and technologies have helped the human welfare. In the process, the pollution has been a part of technology and therefore a part of human miseries.

Human activities mainly include:

- Industries for various human needs - directly and indirectly
- Agriculture for food production and industrial needs
- Health care for health of human beings and animals
- Transport for mobility of human beings
- Dwelling for settlement in city or villages
- Energy for various direct human needs and industrial needs.

All of them contribute to pollution in one way or other and therefore cause miseries. All of them are aimed to be part of human welfare programmes. Along with welfare, all of them have brought the maladies of pollution.

Each one is discussed in detail as below. The pollutant (a material causing pollution) may greatly differ and dimension of problem may also greatly differ in such causes.

Industries

A vast array of industries can cause pollution contrary to popular perception that only a chemical industry can cause pollution. The nature and intensity of pollution may be different in different industry. In some industries, the pollution is out rightly visible and substantial. In others, it may be invisible, indirect or negligible. In such a broad sense, no industry is free of pollution. Classified list of industries causing different types of pollution is presented in table.

Type of industries	Type of pollution
Manufacture of chemicals, pesticides, medicines	Water pollution, air pollution
Manufacture of gases	Air pollution
Cement, steel and other mine based industries	Air pollution and solid wastes, noise pollution
Textile industries and their ancillaries	Water pollution, air pollution, noise pollution

Transport vehicle manufacturing	Solid wastes, noise pollution, air pollution
Petroleum based industries	Water pollution, air pollution
Forest dependent industries	Air pollution, solid wastes and sound pollution
Food industries	Water pollution, air pollution, food pollution
Paper industries	Water pollution, air pollution, solid wastes, sound pollution
Sugar industry	Water pollution, air pollution, solid wastes
Brick industry	Air pollution, water pollution
Aircraft industry	Solid wastes, water pollution, air pollution
Electrical appliances and electric goods industries	Solid wastes, air pollution
IT based industries	Air pollution
Telecom industries	Solid wastes and air pollution

Although all these industries have potentiality to generate pollutants in the environment. Some of them cause serious pollution then others. They are

- Chemicals, pesticides, medicines manufacturing industries
- Cement, steel industries
- Textile manufacturing and processing industries
- Petroleum based industries
- Paper industries
- Sugar industries
- Food industries

All industries other than above cause relatively lesser pollution and are less dangerous than above industries.

Most of these industries are established as core industries for progress of human society. Hence, it is undisputable that they have to exist for human existence and development. The only disputable point is how they have to be managed to make them free of pollution. The cause of pollution - in many situations - is not the industry itself, but the technology adopted by such industry. As the scientific research progresses, new technologies for industries are added. New technologies to minimise the pollution are also generated in every industry. How far these technologies are adopted will decide the nature and extent of pollution.

EMISSIONS

Since the Industrial Revolution began in the midnineteenth century, factories using combustion to power machinery manufacturing products have released chemicals detrimental to the environment in their emissions. By the twentieth century, power plants generating energy through burning fuels such as coal and natural gas added to this pollution, and industrial greenhouse gases (GHGs) accelerated climate change. Motivated by economic, legislative, and environmental incentives, many industry operators sought ways to control industrial emissions. Engineers and scientists innovated and devised technology or methods to minimize, remove, convert, or store chemicals emitted during industrial combustion activities.

Turbines, boilers, generators, engines, and furnaces powered by burning fuels release GHGs produced during combustion. Emissions frequently associated with industries include nitrogen oxides, sulfur dioxide, carbon dioxide (CO2), and methane. The U.S. Environmental Protection Agency identified petrochemical, ammonia, aluminum, steel, iron, and cement manufacturers as emitters of large amounts of GHGs.

Political and social demands to reduce emissions resulted in many industry leaders evaluating how to alter production methods and technology in order to satisfy laws limiting emissions while not experiencing profit losses. Intergovernmental Panel on Climate Change (IPCC) reports discussed how to control industrial emissions, recommending industry managers seek control strategies and technology appropriate for manufacturing processes and fuels their factories utilized.

Industries have successfully controlled emissions with carbon-capture-and-storage (CCS) methods by securing carbons released during combustion and then compressing and sequestering them in remote areas, usually underground, distant from the Earth's atmosphere. CCS is especially effective for minimizing CO2 released in emissions from petroleum, iron, cement, and ammonia industrial processes and refineries[4].

Engineers designed scrubbers to meet specific industrial needs. Scientists identified chemical solutions, including chlorine dioxide, hydrogen peroxide, sodium chlorate, and sulfuric acid, effective as scrubbers to minimize sulfur oxides, nitrogen oxides, and heavy metals, such as mercury, in flue gas emissions.

Industrial emissions can be controlled by filtering contaminants produced during combustion. Filtration technology consists of an insulated metal chamber, usually made from stainless steel or an alloy, and mesh filters, mostly constructed with copper, silicon, or aluminum (Intergovernmental Panel on Climate Change, 2007). Tanks store water before and after filtration. Sprayers and pipes transport water during filtration[6].

Water and temperatures control industrial emissions during filtration. Inside the chamber, sprayers coat water that has been cooled to 2° Celsius in an adjacent refrigerator tank on one or more mesh filters near the top of the chamber prior to hot emissions rising beneath the filter in the chamber. The dripping water hits the emissions, cooling them, and capturing particulates or liquefying such gases as sulfur dioxide and CO2 when they reach the filter. The water containing particulates and gases is expelled into a dump tank[7].

Some industrial emissions are managed by neutralizing them. Researchers innovated methods to extract toxic chemicals prior to combustion. Engineers developed technology to impede nitrogen oxidization during combustion. In selective catalytic reduction (SCR), the reaction of ammonia with flue gases, aided by use of a catalyst such as tungsten oxide, breaks nitrogen oxides into nitrogen molecules and water. SCR effectively reduces emissions by 80 to 90 percent but is costly due to catalyst expenses.

Fluidized bed combustion (FBC) keeps nitrogen oxides from being produced because chamber temperatures are lowered to 750° to 950° Celsius by water tubes in the bed absorbing heat. FBC control methods used when burning coal achieve 80 to 90 percent reduction of sulfur oxides[8]. Various flue gas desulfurization (FGD) methods utilize chemicals or minerals such as limestone that absorb emission contaminants, particularly sulfur dioxide.

Images of smoke rising from industrial parks often are used to symbolize global warming. Endeavors to control industrial emissions exemplify international focus on enhancing and promoting the use of clean technology, particularly due to the expansion of industry because of economic incentives to produce more goods and energy to support expanding populations. Legislation such as the U.S. Clean Air Acts (1963-1990) outlined requirements for industries to control emissions. The Kyoto Protocol addressed industrial emissions control and suggested reductions. As global warming worsened into the twenty-first century, governments worldwide, such as the European Union, revised limits previously set for GHGs produced by industries. Many industrial leaders recognized their environmental responsibilities and willingly limited emissions from factories and acquired updated equipment, trained operators, and enforced stricter procedures to minimize the impact of industrial emissions on climate change. Other industries, however, continued to release excessive GHGs because of apathy, ignorance, or inability to afford or attain access to emissions control technologies.

Air pollution is almost impossible to contain because of its ability to spread rapidly over a large area. There are many different pollutants in the air, and their effects range from environmental damage to health issues. The effect of pollution on the ozone layer is one example of environmental damage. The ozone layer is a part of the atmosphere that helps absorb radiation from the sun and a portion of ultraviolet light that is responsible for causing, among other things, various types of skin cancer and cataracts. Because substances such as carbon dioxide, chlorofluorocarbons, and sulfur dioxide (the chief cause of air pollution) are being released into the air, the ozone layer is being reduced and could possibly be destroyed. These pollutants are by-products of industrialization, such as the combustion of fossil fuels and exhaust from automobiles and factories.

INTERNATIONAL ISSUES:

The U.S. Environmental Protection Agency (EPA) has taken steps to prevent and reduce several sources of air pollution, such as supporting the passage of legislation to ban the use of lead in gasoline in the United States. Furthermore, the Clean Air Amendment of 1990 mandated a 50 percent reduction in pollutants such as sulfur dioxide by the year 2000 in an attempt to reduce future occurrences of acid rain. Despite action taken, a common problem that the EPA encounters is that many strategies used to reduce one type of pollution can lead to the introduction of a different pollutant into the environment[9].

The danger of air pollution is not only how rapidly it spreads but also how it affects other parts of the planet, such as the ozone layer. The atmosphere is such a critical part of the environment that experts now view it as a resource in the same way as land, forests, and water.

Fossil Fuel Emissions

With the exception of CO2, the effluents of fossil fuel combustion devices such as automobile engines and thermoelectric power plants do not seem to have a direct effect on climate change. These pollutants are important, however, because of their deleterious effects upon the environment and human health.

Fossil fuels are combustible geologic deposits of carbon created from plant and animal remains subjected to high temperatures and pressures in the Earth over hundreds of millions of years. Coal, oil, and natural gas are the primary fossil fuels. When any carbon-based fuel is burned, the carbon unites with oxygen in the atmosphere to produce carbon dioxide (CO2), the main culprit responsible for anthropogenic global warming. In addition, sulfur dioxide, nitrogen oxides, ozone, and particulate matter are often by-products of fossil fuel combustion. These pollutants detrimentally affect plants, aquatic life, and human respiratory health.

In the contemporary United States, 86 percent of all energy consumed is derived from fossil fuels, primarily oil (39 percent), natural gas (24 percent), and coal (23 percent). Some 8 percent comes from nuclear power, with the remaining 6 percent equally divided between wood and hydroelectric plants.

The energy consumed by each U.S. economic sector is as follows: residential and commercial, 35 percent; industry, 23 percent; direct transportation, 27 percent; and transportation-related uses, such as highways and other infrastructure construction, 15 percent. Some 69 percent of the petroleum consumed is for transportation, with another 9 percent for transportation-related uses. Industry accounts for 16 percent of U.S. petroleum consumption, while the residential and commercial sectors account for only 6 percent. Of the 9 percent used for transportation, automobiles consume 40 percent, trucks 33 percent, railroads and buses 3 percent, aircaft 9 percent, water craft 6 percent, and all others 9 percent[10].

Fossil fuels provide energy when carbon, the backbone of all fossil fuels, unites with oxygen in the air to produce that energy, as well as CO2--a combustion by-product. Other elements occurring with fossil fuels, most notably sulfur, are also combusted, releasing emissions toxic to plants and animals. Non-negligible environmental impacts also result from the extraction, processing, transportation, and waste disposal involved with fossil fuels. The two most important ecological impacts of combusting fossil fuels are the effects on climate of CO2 emissions and the effects on health of particulate matter and the gaseous by-products of combustion.

Coal mining is accomplished through either strip mining or deep mining. Strip mining renders scores of hectares of land unusable unless they are later reclaimed and has led to mudslides when the removed overburdens are piled too high. Deep mining is prone to cave-ins and fires, and virtually all career deep miners eventually succumb to pneumoconiosis (black lung disease). Abandoned mines often leach acidic effluents into local streams, decimating the local ecology and ruining scenic vistas.

Drilling for oil leads to environmental degradation at the drill site, but even more problematic are the minor leaks and major oil spills that occur during transportation of the oil. These accidents have contaminated shorelines and estuaries, fouling beaches and killing waterfowl and aquatic life. Natural gas is prone to drilling accidents as well and is also subject to pipeline leaks during gas transportation.

All fossil fuels emit CO2, which is a greenhouse gas but not a direct health hazard. In addition, coal typically contains from 1 to 10 percent sulfur and many other trace elements, some of which are radioactive. When sulfur is burned with the coal, it produces sulfur dioxide, which converts to sulfuric acid in the atmosphere. Rain containing the dissolved acid (known as acid rain) will adversely affect forests, and when the acid contaminates bodies of water, fish and aquatic plants are likely to die.

Whenever a carbon-containing fuel is burned, nitrogen oxides are also created; these chemicals react with atmospheric water vapor to create nitric acid, another component of acid rain. In addition, atmospheric nitrogen oxides, as well as sulfur oxides, raise mortality rates and morbidity, particularly among those with respiratory problems. Another gaseous pollutant associated with combusting fossil fuels is ozone, a highly reactive form of oxygen, formed when nitrogen oxides combine with volatile organic compounds in automotive exhaust. Ozone, in addition to increasing morbidity in those with respiratory problems, detrimentally affects forests and reduces crop yields.

Particulate matter released when fossil fuels are burned causes respiratory illness when particles between 0.2 and 3 microns in size coat the lining deep inside the lungs. For those already burdened by respiratory ailments, increased morbidity is a likely result[10].

In the past 150 years, the U.S. population has increased by a factor of ten, and the per capita consumption of energy has increased by a factor of five. The United States is thus consuming fifty times the energy it consumed in 1860. Over this time period, the use of wood for fuel has remained relatively constant at about 3 exojoules annually. Water was not harnessed for energy until about 1906, when Niagara Falls became the site of the first hydroelectric power plant. After World War II, the available energy from new hydroelectric plants increased to about 3 exojoules, where it has remained.

The use of coal began around 1840 and grew exponentially until 1920, when it reached 15 exojoules per year. Although the rate of increase has slowed, total annual coal use continues to increase; it is about 22 exojoules today. The use of oil, relatively minimal in the nineteenth century, reached 2 exojoules by 1900. With the twentieth century increase in automobiles, annual oil use rapidly increased to 15 exojoules in 1950, 35 exojoules in 1980, and 40 exojoules at the end of the century. Natural gas was used for lighting in the late nineteenth century at an annual rate of about 1 exojoule. As gas was increasingly used for heating, this rate increased to 5 exojoules by 1940 and 17 exojoules by 1960; it leveled off at 35 exojoules per year from 1980 through 2000.

Acid Precipitation

The phenomenon of acid precipitation was first recognized by Robert Angus Smith, a Scottish chemist, in 1852 following a survey of air pollution in Manchester. Smith coined the term 'acid rain', which he associated with sulphur dioxide emissions from fossil fuels burned in local factories. Various observers subsequently noted the impact of acid precipitation on aquatic and terrestrial ecosystems. For example, Gorham (1958) noted that the chemistry of upland lakes in the English Lake District was affected by acid precipitation from air masses that had passed over Britain's industrial heartland. Despite this recognition of its impact, acid precipitation did not emerge as a major environmental issue until the late 1960s. By this time, Scandinavian ecologists were becoming concerned about declining fish stocks; they were also beginning to recognize transboundary transportation of acid precipitation, i.e. the export of acid precipitation from source areas such as the industrial regions of Europe and the UK and its transport to and deposition in far distant areas such as Scandinavia. In this context, acid precipitation became a political as well as an ecological issue. The polluters were unwilling to recognize this, and the polluted demanded mitigation measures. The impact of acid precipitation manifests in many ways. Both terrestrial and aquatic ecosystems may be adversely affected through reductions in pH, which have repercussions for the biota and water quality; human health may be impaired and building materials may be corroded.

Internationally agreed measures to curb acid precipitation are now in operation in Europe and North America, where the problem is most acute. The first of these was established in 1979. This was the Convention on Long Range Transboundary Air Pollution (CLRTAP)[11], a protocol that was adopted in 1985 and that became known as the '30 percent club' because of the agreement between its thirty-five members to reduce sulphur emissions by 30 per cent of 1980 levels by 1993. Britain, Poland, Spain and the USA declined to subscribe to the convention, although eventually all succeeded in reducing sulphurous emissions to a degree. Another protocol was signed in 1994 in Oslo to tailor targets to polluters rather than to reassert overall objectives.

The measures discussed above have been confined to the Northern Hemisphere, where the impact of acid precipitation has been most intense and most extensive. By c. 1750, industrialization and the large-scale burning of fossil fuel were occurring, so there have been nearly 250 years of uncontrolled emissions of sulphurous and nitrous acids. The impact has been particularly severe in areas of acid bedrock (such as granite) that are in receipt of air masses from industrialized regions. While measures to curb acid precipitation have facilitated a degree of ecosystem recovery in parts of the temperate zone of the Northern Hemisphere, the problem is now spreading into the tropics as developing countries industrialize, especially in Southeast Asia and China. Acid precipitation is thus rapidly becoming an environmental issue of global proportions[11].

REFERENCES:

1)Bent, R., L. Orr, and R. Baker, eds. Energy: Science, Policy, and thePursuit of Sustainability. Washington, D.C.: Island Press, 2002.

2) Freese, Barbara. Coal: A Human History. New York: Penguin, 2004.

3)Hyne, Norman J. Nontechnical Guide to Petroleum Geology, Exploration,Drilling, and Production. 2d ed. Tulsa, Okla.: Pennwell, 2001.

4) Gardner, Gerald and Paul Stern. 1996. Environmental Problems and Human Behavior. Boston: Allyn & Bacon. Hodges, Laurent. 1977. Environmental Pollution. New York: Holt, Rinehart & Winston.

5) McBoyle, G. R. 1973. "Meteorological Aspects of Air Pollution." Pp. 36-48 in Ecological and Biological Effects of Air Pollution, edited by G. M. Woodwell. New York: MSS Information Corporation.

6) Moeller, Dade W. 2004. Environmental Health. 3rd ed. Boston: Harvard University Press.

7) Socha, Tom. 2006. "Air Pollution: Causes and Effects."

8) Speth, James. 1998. Environmental Pollution: A Long-Term Perspective. Washington, DC: World Resource Institute of the National Geographic Society.

9) U.S. Environmental Protection Agency. 2006. "Ozone Science: The Facts behind the Phaseout."

10) Causes of pollution : tutorvista.com

11) Soroos, Marvin. 1999. "Global Institutions and the Environment: An Evolutionary Perspective." Pp. 27-51 in The Global Environment: Institutions, Law and Policy, edited by N. Vig and R. Axelrod. Washington, DC: Congressional Quarterly Press.