

Industrial Pollution Control and Environmental Audit

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AN ISO 9001:2008 CERTIFIED COMPANY

Vayu Education of India

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Preface

It is highly gratifying for me to present this book to the students, teachers and practicing engineers all over the country. The book has been written keeping in mind the syllabi of final year of civil engineering degree of GBTU, Lucknow (Formerly known as UPTU).

The main aim of this book is to kindle interest in students for the subject as well as have a clear understanding about the processes, the wastes generated and their treatment and reuse in different types of industries such as mining, tannery, brewery, power plants, to name a few. Each chapter is divided into sub-topics, which will help to bring clarity to the subject matter and make it easy for the readers to grasp the practices involved. Designed to instill confidence in students and engineers to tackle problems and provide solutions on industrial pollution and to help carry out environmental audit on the lines of ISO14000, the text includes a number of case studies, practical examples of various industries in India and abroad. At the end of each chapter, review questions have been included for the readers to practice the learning outcomes so as to perform well in their GBTU term end examination as well as other competitive examinations.

The author wishes to express his heartfelt gratitude to the authors and publishers of various books and other literature that have been referred to by the author in the course of writing this book.

This book would not have been possible without the active participation and co-operation provided by my wife Aparna and my children Namann and Kashika. I attach a high value to their unending support in this endeavour.

The author is highly thankful to the publisher for giving me an opportunity to author this book for the benefit of prospective readers.

Though adequate and due care has been taken to present an error-free book, the possibility of some errors creeping in into the final version cannot be ruled out. The author will be highly grateful to the readers for bringing out such errors to his notice. Any suggestion for improvement of any part or section of the book will be highly appreciated.

—Sanjay Gupta

Syllabus

UNIT-1

Industrial wastes and their sources: various industrial processes, sources and types of wastessolid, liquid, gaseous, noise & radiation emissions. Sources for industrial water usages and various industrial processes requiring water use and water quality.

UNIT-2

Processes responsible for deterioration in water quality, Various waste water streams, Control and removal of specific pollutants in industrial wastewaters, e.g., oil and grease, bio-degradable organics, chemicals such as cyanide, fluoride, toxic organics, heavy metals, radioactivity etc. Wastewater re-uses and recycling, concept of zero discharge effluent.

UNIT-3

Control of gaseous emissions: hood and ducts, tall stacks, particulate and gaseous pollutant control; Solid waste generation and disposal management; Hazardous wastes: definitions, concepts and management aspects; Noise and radiation: generation, control and management.

UNIT-4

Recent trends in industrial waste management, cradle to grave concept, life cycle analysis, clean technologies; Case studies of various industries, e.g., dairy, fertilizer, distillery, sugar, pulp and paper, iron and steel, metal plating, thermal power plants, etc.

UNIT-5

Environmental audit: definitions and concepts, environmental audit versus accounts audit, compliance audit, relevant methodologies, various pollution regulations, Introduction to ISO and ISO 14000.

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Unit-I

INDUSTRIAL WATER SOURCES AND PROCESSES

Industrial wastes and their sources: various industrial processes, sources and types of wastes solid, liquid, gaseous, noise and radiation emissions. Sources for industrial water usages and various industrial processes requiring water use and water quality.

1.1 INTRODUCTION

Waste includes all items that people no longer have any use for, which they either intend to get rid of or have already discarded. Additionally, wastes are such items which people are required to discard, for example by law because of their hazardous properties. Many items can be considered as waste e.g., household rubbish, sewage sludge, wastes from manufacturing activities, packaging items, discarded cars, old televisions, garden waste, old paint containers etc. Thus all our daily activities can give rise to a large variety of different wastes arising from different sources.

Over 1.8 billion tones of waste are generated each year in Europe. This equals to 3.5 tones per person. This is mainly made up of waste coming from households, commercial activities (e.g., shops, restaurants, hospitals etc.), industry (e.g., pharmaceutical companies, clothes manufacturers etc.), agriculture (e.g., slurry), construction and demolition projects, mining and quarrying activities and from the generation of energy. With such vast quantities of waste being produced, it is of vital importance that it is managed in such a way that it does not cause any harm to either human health or to the environment.

There are a number of different options available for the treatment and management of waste including *prevention*, minimisation, re-use, recycling, energy recovery and disposal. Under EU policy, landfilling is seen as the last resort and should only be used when all the other options have been exhausted, i.e., only material that cannot be prevented, re-used, recycled or otherwise treated should be landfilled.

According to Jensen (2003) in encyclopedia Americana, industrial wastes are solid, liquid or gaseous waste products discharged into the environment by an industrial enterprise which can cause harm to human life. Industrial waste is a type of waste

produced by industrial activity, such as that of factories, mills and mines (Wikipedia, 2010). These wastes cause pollution of several kinds- air, land, water and noise and constitute mainly chemicals, toxic substances, scraps which are harmful to the environment.

The major sources of air pollution are the chemical, cosmetic and processing industries. These industries produce a large amount of particulate matter, smoke, carbon monoxide, hydrocarbons, sulphur dioxide, nitrogen oxides, etc. which when introduced into the atmosphere, adds to the atmospheric pollution.

Industrial wastes causing soil pollution include scraps, effluents, sludge, fly ash, radioactive wastes, mine dust, rock tailings, slack and slag. These add toxic chemicals into the soil which harm the soil thereby decreasing its productivity. Industrial wastes also pollute rivers and other water bodies. Coastal waters are polluted by prawn culture farms, fish processing and other industries while storm water from urban and industrial sites contains a lot of biodegradable as well as toxic metals, acids and other chemicals. Such waters are called waste waters. Sound and noise pollution is produced by equipments, industrial machines, mine site detonation and other out door equipments.

Some of the industrial wastes include: inorganic salts, acids, alkalis, detergents, suspended particulate organic compounds, dissolved organic, surfactants, slurries of rock particles, ammonia, cyanide, hydraulic oils and grease, paints, dyes, plastics, pesticide residues, effluents from vegetables, fruits and meat products. Other industrial wastes include metals such as zinc, arsenic, lead and mercury.

1.2 POLLUTION

Pollution may be defined as addition of undesirable material into the environment as a result of human activities. The agents which cause environmental pollution are called pollutants. A pollutant may be defined as a physical, chemical or biological substance intentionally released into the environment which is directly or indirectly harmful to humans and other living organisms.

1.2.1 Types of Pollution

Pollution may be the following types:

- Air pollution
- Water pollution
- Soil pollution
- Noise pollution
- Radiation pollution

1.2.1.1 Air Pollution

Air pollution is a result of industrial and certain domestic activity. An ever increasing use of fossil fuels in power plants, industries, transportation, mining, construction of

buildings, stone quarries had led to air pollution. Air pollution may be defined as the presence of any solid, liquid or gaseous substance including noise and radioactive radiation in the atmosphere in such concentration that may be directly and indirectly injurious to humans or other living organisms, plants, property or interferes with the normal environmental processes. Air pollutants are of two types (1) suspended particulate matter, and (2) gaseous pollutants like carbon dioxide (CO_2) NO_x etc.

Sources of Air Pollution

The sources of air pollution can be divided into two categories (i) natural, and (ii) man-made

(i) Natural Sources

- (i) Ash from burning volcanoes, dust from storm, forest fires.
- (ii) Pollen grains from flowers in air.

(ii) Anthropogenic (human-made) sources

- (i) Power station using coal or crude oil.
- (ii) Furnaces using coal, cattle dung cakes, firewood, kerosene, etc.
- (iii) Steam engines used in railways, steamers, motor vehicles, etc.
- (iv) Motor and internal combustion engines which run on petrol, diesel, kerosene, etc.
- (v) Vegetable oils, kerosene, and coal as household fuels
- (vi) Sewers and domestic drains emanating foul gases
- (vii) Pesticide residues in air.

Major Air Pollutants

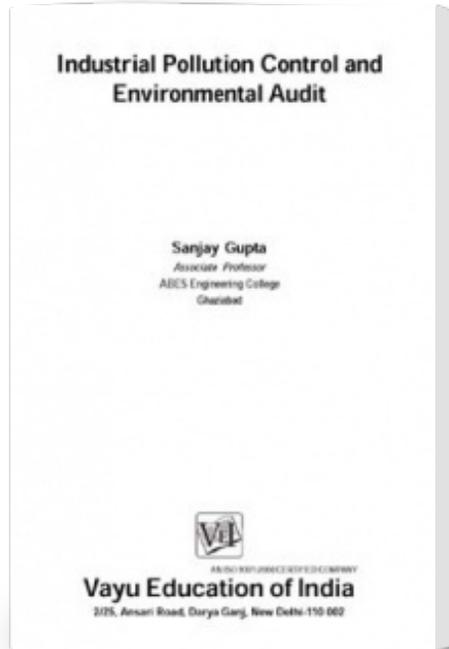
Some major air pollutants are discussed here.

Carbon Dioxide

Carbon dioxide is one of the major gases which contribute to air pollution. It is mainly produced during the combustion of fuel in factories, power stations, household etc. The increasing CO_2 in the atmosphere is likely to have the following effects:

- (i) Arise in atmospheric temperature due to greenhouse effect.**
- (ii) Reduced productivity of the marine ecosystem.** This is due to the fact that water in the oceans would be more acidic due to increased concentration of CO_2 in the air, which dissolves in the water.
- (iii) Global warming:** The increased surface temperature would cause melting of continental and mountain glaciers and thus would cause flooding of coastal areas of some countries.

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