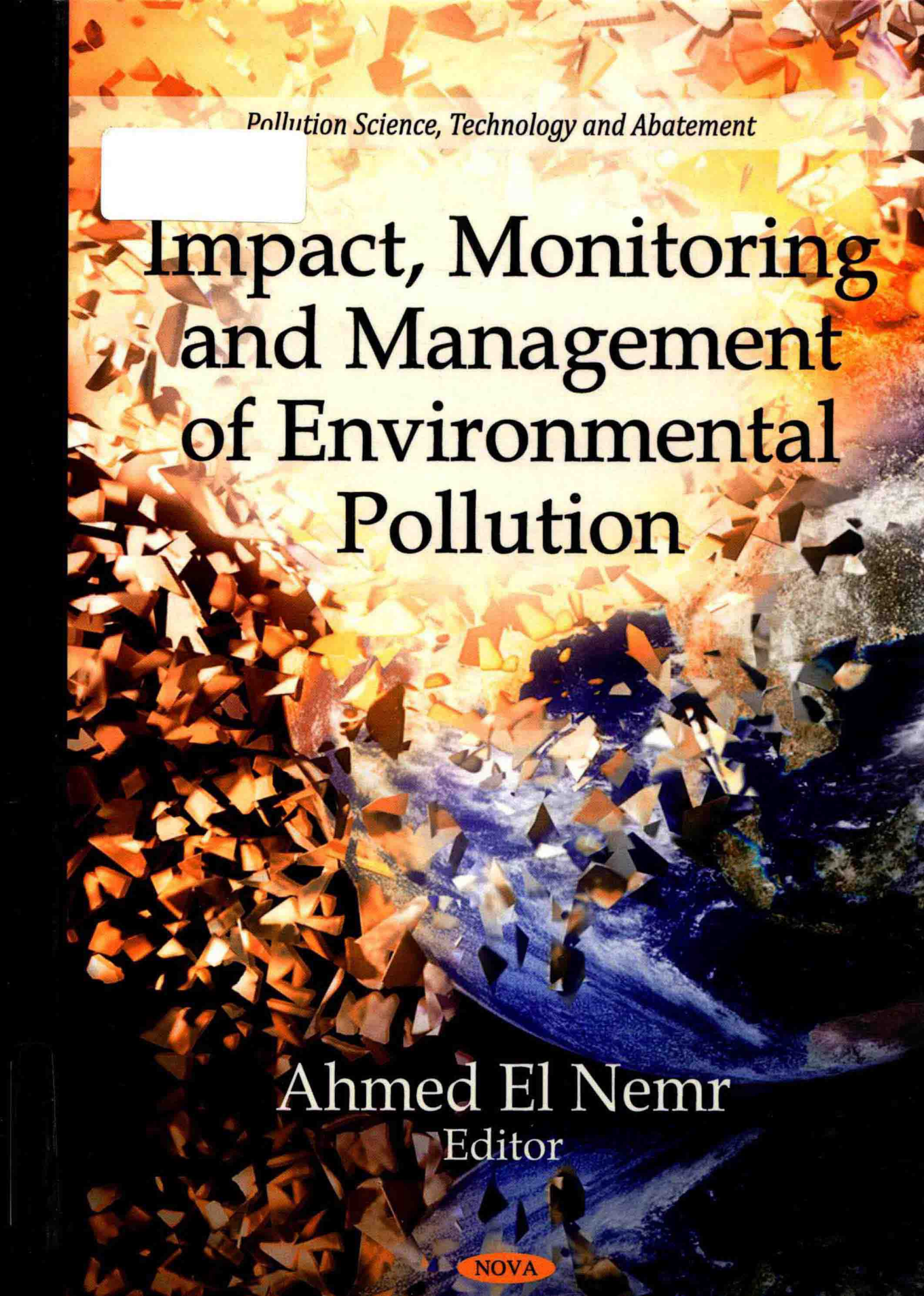

Pollution Science, Technology and Abatement
Impact, Monitoring and Management of Environmental Pollution
Ahmed El Nemr
Editor
NOVA

POLLUTION SCIENCE, TECHNOLOGY AND ABATEMENT

IMPACT, MONITORING AND MANAGEMENT OF ENVIRONMENTAL POLLUTION

AHMED EL NEMR
EDITOR

Nova Science Publishers, Inc.
New York

LIBRARY OF CONGRESS CATALOGING-IN-PUBLICATION DATA

Impact, monitoring, and management of environmental pollution / editor, Ahmed El Nemr.
p. cm.
Includes index.
ISBN 978-1-60876-487-7 (hardcover)
1. Civil engineering--Environmental aspects. 2. Construction industry--Environmental aspects.
3. Pollution--Measurement. I. El-Nemr, Ahmed, 1962-
TD195.C54I47 2009
628.5--dc22

2009040471

Published by Nova Science Publishers, Inc. † New York

POLLUTION SCIENCE, TECHNOLOGY AND ABATEMENT

IMPACT, MONITORING AND MANAGEMENT OF ENVIRONMENTAL POLLUTION

POLLUTION SCIENCE, TECHNOLOGY AND ABATEMENT

Additional books in this series can be found on Nova's website under the Series tab.

Additional E-books in this series can be found on Nova's website under the E-book tab.

PREFACE

In the 21st century, the fate of the environment has become a critical issue in both developed and developing countries throughout the world. The environment is considered the surroundings in which an organism operates, including air, water, land, natural resources, flora, fauna, humans and their interrelation. Water pollution, poor air quality, global warming, acid rain, ozonosphere hole, etc., these issues are featured regularly in our newspapers, news reports and TV programs. Pollution has been used quite freely for many years without a clear definition, and it is generally accepted that environmental pollution can be defined as the contamination of air, water, or soil in such a manner as to cause real or potential harm to human health or well-being, or to damage or harm nonhuman nature without justification.

Pollution can take many forms, the air we breathe, the water we drink, the soil where we grow our food, and even the increasing noise we hear every day, all contribute to health problems and a lower quality of life. The result of human activities is the main cause of environmental pollution; most people have witnessed pollution in the form of an open garbage dump or an automobile pouring out black smoke. However, pollution can also be invisible, odorless, and tasteless. Some kinds of pollution do not actually dirty the land, air, or water, but they reduce the quality of life for people and other living things, for example, noise from traffic and machinery. We have become much more aware of how vulnerable it is to destruct our world by the human activities. Population increases and technological advances are creating a burden on society by requiring continued expansion and concomitant resource use. Substantial evidence exists showing that such development has led to detrimental impacts on the environment. We know that increased societal activities and demands are changing soil, water, air, climate, and resources in unexpected ways. This in turn has led to a renewed interest in protecting the environment and has focused attention on the concept of environmental monitoring and site characterization, including an evaluation of the physical, chemical, and biological factors that impact the environment. This information is necessary for researchers, decision-makers, and the community as a whole, to implement social changes needed to preserve and sustain a healthy environment for future generations. We also know that the environment exists as a continuum of biosystems and physio-chemical processes that help sustain life on earth. Therefore environmental monitoring should ideally consist of examining the integrative nature of these processes.

The purpose of this review book is to document the latest research in this field which is vital for everyone. As reported in chapter 1, environmental pollution includes any substance that may adversely impact our possessions or lives. It may be in the form of particulate solids, liquids, gases or vapors. Pollutants are created artificially by various industrial processes, accidents, and from some in house activities and materials. But some arise from natural processes, some of which are sudden and dramatic, such as lightning, volcanoes and forest fires, whilst others derive from slow continuous processes such as the decay of animal and vegetable matter. Thus, the effects of pollution would cause harm or discomfort to humans or other living organisms, or damage the environment.

In chapter 2, given the international focus on sustainability in recent years, there is a dire need to evaluate the aspects and impacts in the construction industry and identify methods and techniques that would facilitate sustainability and impact assessment and decision making at the various project level interfaces. The construction activities are being kept under rigid analysis and control due to its intimacy and direct association with the outdoor (external) environment. Any construction, irrespective of size, type and location will cause impacts onto the environment arising from the construction activities, for as long as the construction goes on until the commissioning stage. These environmental impacts are typically classified as air pollution, land contamination and degradation, noise pollution and water pollution. Construction activities impart significant impacts on the environment across a broad spectrum whether it is off-site, on-site and operational activities. Off site activities comprehend office management, documentation, policy, and planning, engineering and architectural drawings. On site construction activities relate to the pre-construction and the actual construction of a physical facility, resulting in air pollution, water pollution, traffic problems and the generation of construction wastes. Activities in the construction industry are complex, highly dispersed and resource demanding.

Radiation is transport of energy in the form of electromagnetic waves or energetic particles through space or material. Although all forms of radiation are important, the main concern in this chapter is the ionizing radiation, i.e. those that can cause ionization in the medium through which they traverse. The environment is permeated by ionizing radiation from diverse artificial and natural sources. Ionization can disrupt normal biological processes in living tissues; therefore it may be harmful to living organisms in the environment, including human beings. But as a natural component of the environment, ionizing radiation is not always detrimental to life; rather it is compatible with life. A complete elimination of ionizing radiation from the environment is therefore neither possible (because some of the sources are not amenable to control) nor desirable since it has many important beneficial applications. Indeed there are clear evidences that the authors present and emerging lifestyles will not be sustainable without applications of radiation technologies, e.g., in health, agriculture, energy, environmental studies, etc. There are many authoritative books and reviews on various aspects of radiation and radioactivity in the environment. Therefore chapter 3 will focus mainly on the impacts of radiation in the environment: on one hand as an environmental contaminant or pollutant arising partly from both natural phenomena and human activities, and on the other hand as a tool for studying and conserving the environment. An overview of the various natural and artificial sources of environmental radiation is first presented, followed by a presentation of the environmental and radiological impacts of the various sources. The latter includes reviews of the developments in radiation

dose assessment and radioactivity measurement techniques, as well as a brief description of the beneficial uses of radiation particularly in environmental studies.

As reported in chapter 4, the harmful algal blooms (HABs) are natural phenomena however, due to human activities and interventions incidences of HABs have increased globally. Onset, development and proliferation of blooms are closely associated with nutrient enrichment of water bodies (eutrophication) and climatic changes; and their possible interaction. Cyanobacteria are amongst the most successful bloom forming algae. They can convert and use different form of C, N, P, and S that help them in occupying almost all kind of aquatic habitats. Moreover, they grow well in shaded light, show resistance against grazing pressure and release allelochemicals to out-compete co-occurring organisms. Presence of gas-vacuoles facilitates their migration in water column to ensure enough light and nutrient availability. Cyanobacterial blooms adversely affect water quality, structure and composition of biological communities and a range of ecological services. Many of the bloom forming cyanobacteria produce toxins responsible for mass mortality of aquatic and exposed vertebrate populations. Chapter 2 describes the causes and consequences of cyanobacterial blooms and a few measures adopted to control bloom formation proliferation. Impact of climatic change on cyanobacterial bloom formation has also been discussed.

Immunotoxicology is a relatively recent subdiscipline of the larger field of toxicology with the majority of its studies focused on mammalian systems. Immunotoxicological studies that concentrate on avian species have steadily increased over the past two decades. Birds occupy a wide variety of ecological niches and are good representatives of many different trophic levels, making them good indicators for environmental health assessments. Chapter 5 describes current methods that are commonly used to assess immune status in birds and suggests directions for future efforts. The usefulness of measures that assess the effects of environmental contaminant exposure on immunological structure will be compared to those that test function. Particular attention is paid to emerging issues in the field, such as developmental immunotoxicology (DIT) and the use of cytokine measures in immunotoxicity evaluations, and how they are being, or should be, addressed in avian species.

In chapter 6, some emergency planning policies in Sylhet urban area are taken by Government. It is seen that a considerable part of the concerned area is under high-risk zone and some parts come under very high-risk zone. It is also found that about half of the population (55.22%) comes under very high-risk zone and it constitutes about 51.29% of total area. Again, 44.78% of population is living in the rest area having high-risk exposure due to existing surface water quality. The author concluded that if the surface water of Sylhet Municipality is being used as the source of water supply system it should be treated under high degree of treatment. Detail study will help to take a sustainable urban planning and also the way to improve the situation.

A survey on ecologo-toxicological experiments exploring the karyotype responses of small mammalian species to heavy metal load is proposed in chapter 7. The animals used were laboratory mice *Mus musculus alba* inbreed line BALB/c and wild Guenther's vole *Microtus guentheri*, adapted to laboratory conditions. Industrial mixture containing lead and cadmium in high concentrations was applied as representative of emission to the environment. The polymetal dust was mixed with conventional animal food at 1% concentration. The metal quantities in animals' diet were about 780 mg/kg lead and 64 mg/kg cadmium. The type of chromosomal aberrations and chromosomal aberration frequency in bone marrow cells as well as the changes in the nuclear proteins in liver and kidney tissues

were studied. The presented mathematical model describes successfully the time course of chromosomal aberration frequency in female BALB/c mice. The responses of both species were compared and the high relevance of their use in ecotoxicology and zoomonitoring was confirmed. The frequencies of the chromosomal aberrations in the exposed Guenther's vole and BALB/c mice differed insignificantly. The most frequently encountered aberrations were chromatide breaks and centromere-centromeric fusions (c/c). In Guenther's vole, significant damages of the chromosomal protein were found on day 60 after exposure. In BALB/c mice changes in the electrophoretic profiles were recorded yet on day 15. No trend of continued increase of the chromosomal aberration frequency in both rodents was established during the exposure. This fact suggests a relative high resistance of genetic apparatus to heavy metals as a component of the anthropogenic pollution.

In chapter 8, many potentially toxic chemical adhere to tiny particles which are then taken up by plankton and benthos animals. Most of them are either deposit or filter feeders, concentrating upward within ocean food-chains. In addition, since most animal feeds contain high fish meal and fish oil content, toxins could be found a few weeks later in commonly consumed food items derived from livestock and animal husbandry. As rivers are the common entrance of contaminants to the marine environment, many particles combine chemically in a manner highly depletive of oxygen, leading to estuaries to become anoxic.

Chapter 9: Metals which in their standard state have a specific gravity (density) of more than about 5 g cm^{-3} are described as 'heavy metals'. Some of them such as copper, iron, chromium, zinc and nickel are essential in very low concentrations for the survival of all forms of life. These are described as essential trace elements. Only when present in greater quantities, these can cause metabolic anomalies like the heavy metals lead, cadmium, arsenic and mercury which are already toxic in very low concentrations. Heavy metals are produced from a variety of natural and anthropogenic sources. Human beings release a high anthropogenic emission of heavy metals into the biosphere. Waste (i.e. emission, wastewater and waste solid) is the origin of heavy metal pollution to water, soil and plants.

In aquatic environments, metal pollution can arise from direct atmospheric deposition, geological weathering or through discharge of agricultural, municipal, residential or industrial waste. Under certain environmental conditions, heavy metals may accumulate to a level of toxic concentration causing ecological damage. As a result, living things inhabited in contaminated waters may show rather high metal concentrations. In addition, metal bioaccumulation causes biochemical or pathological effects on fish resulting in decrease of growth, fecundity and survival.

The members from the upper level of the food chain may carry a critical level of metals and are hence more explanatory than observing water or sediments. Therefore, numerous reports describe metal residues in aquatic organisms such as mussels, shrimps and wild fish from marine and freshwater species. Such studies have been carried out to determine the levels of some heavy metals in some tissues of aquatic organisms from marine and inland waters. Liver, spleen and kidney tissues are known to have high metabolic activities and thus have been used to observe the level of absorbed metals. Gonads, which can be attributed to the reproductive cycle of fish, have also accumulated high amount of heavy metals. Metal concentrations in the skin and gill have reflected the concentration of metals in waters. Although it is well known that muscle is not an active tissue in accumulating heavy metals, muscle tissue accumulation levels were also studied because of their consume by humans.

Metal uptake by aquatic organisms from contaminated water may differ depending on its ecological needs and metabolism, as well as other factors such as salinity, temperature, contamination gradients of water, food, sediment and interacting agents. Two main objectives prevail in aquatic pollution monitoring programs: (1) determining contaminant concentrations in consumed part of organisms considering the health risk for humans, and (2) using organisms as an environmental indicator of aquatic ecosystems quality.

The Mediterranean Region, embracing parts of two continents as diverse as Europe and Africa, is a complex geographic, ecological, cultural and socio-political set-up based around the Mediterranean Sea basin. The Mediterranean climate, with mild wet winters and hot dry summers, has been used as a model for many other regions around the world. Its landscape and monuments continues to be the greatest tourist destination in the entire world. As a consequence, urbanization has been particularly growing along the coastal strip, to accommodate both permanent and temporal population, with the result of a substantial modification of the coast itself and adverse effects on the quality of the environment. The highly developed industrial countries in the North stand in stark contrast to the countries in the South. These differences have significant implications when addressing environmental issues and particularly those related with the management of persistent toxic substances (PTSs). The description of the contamination of Mediterranean coast sediment with heavy metals is summarized in this review. The concentrations of Fe, Mn, Ni, Hg, Cd, Pb, Zn, etc. in sediment collected from Mediterranean coast of eight countries were presented in chapter 10. Most of the published articles about the contamination of sediment of Mediterranean with heavy metals have been discussed in this work.

The total heavy metal concentrations have been monitored for almost thirty years, while organotin compounds have only been evaluated in the last few years. Inter-tidal as well as subtidal surface sediments were fully analyzed and the corresponding results are included in chapter 11. Cadmium contents within sediments were slightly higher close to the area where the industrial effluents are discharged, as well as near the harbor zones during the study period.

The analysis revealed that with the exception of the last analyzed period-cadmium is at background concentrations within the study system. A permanent monitoring program within the inner zone of the estuary has demonstrated that cadmium concentrations slightly increased during the study period, indicating a regular input of these metals into the system. In addition, recent studies have shown similar contents of cadmium on both tidal flats and sub-tidal sediments within the estuary. Organotin compounds (DBT and TBT) were found in sediments of the entire studied area. Their concentrations ranged from very low values within low impacted areas to higher ones next to the most active harbor facilities. The highest amounts of both DBT and TBT were recorded in the neighborhood of dry docks where careenage of ships may be the main source. These results throw light upon the process of accumulation of cadmium and organotin compounds within the analyzed sediments, allowing the author to conclude that the inner area of the Bahía Blanca estuary could be considered an intermediate polluted system.

Antimony (Sb) is one of the elements of increasing environmental significance. In chapter 12, concentrations of Sb were measured on 21 roadside surface soil samples collected from a medium-size city, Xuzhou (China), in order to assess the magnitude of contamination and to identify the possible contamination sources. The mode of occurrence of Sb and the effect of particle size fractions on Sb concentration distributions were also investigated from

two specific soil samples. Median of Sb concentrations of the investigated urban surface soils is 0.96 mg/kg. This value is a little higher compared to the regional background value. The Sb in the Xuzhou surface soils is mainly attributed to the inputs of coal combustion and almost independent of the particle size fractions. The most common mode of occurrence of Sb is in association with Fe-Mn oxides.

In chapter 13, the production and intensive agricultural or industrial use of persistent organohalogenated pollutants (POPs), such as organochlorine pesticides (OCPs) or polychlorinated biphenyls (PCBs), have led to the widespread contamination of the environment. Polybrominated diphenyl ethers (PBDEs) have come into extensive use as flame retardant additives to plastics, textiles, electronics and paints. Persistent organic pollutants (POPs) have been found in food since the 1960s. Fish is a suitable indicator for the environmental pollution monitoring because they concentrate pollutants in their tissues directly from water, but also through their diet, thus enabling the assessment of transfer of pollutants through the trophic web. Data on the presence and distribution of organohalogenated contaminants in fish and especially edible fish species is therefore important not only from ecological, but also human health perspective.

As reported in chapter 14, wind erosion, airborne particle production, their transport, deposition and accumulation on different natural and anthropic surfaces have always given rise to inconvenience for many people. During the last decades this phenomenon has become a very important international problem. A major effect of the atmospheric particles corresponds to the broad term of air pollution.

Air pollution is essentially caused by the presence of what is called "fugitive dust emissions". The latter term denotes dust that is injected into the atmosphere by the combined effects of man's activity and the action of the wind, especially over farms, unpaved roads and other ground surfaces, industrial activity and re-suspension of particles by traffic flow.

Wind-blown dust is also an efficient way to spread pathogens that are harmful to people, animals and plants. Particles less than 2 μm in diameter are retained in the human lungs. Some of these particles are pathogenic and may have a considerable negative impact on health.

The field measurements (PM10 and PM2.5 concentrations), the laboratory analysis (particle size distribution, micromorphology, mineralogy, and chemistry) and the study of the data and the correlations with the atmospheric dynamics, lead to the following general conclusion: the majority of the airborne particle concentrations measured in Brussels belongs to sources located out of the urban area.

A smaller percentage of the particles originate from local sources. They are caused by different human activities: road traffic, domestic heating, building industry, general industrial activities, etc... Under dry weather conditions, wind and local activities may lead to the re-suspension of the coarser particles (between PM2.5 and PM10) formerly deposited on different urban surfaces.

The formation of secondary aerosols (e.g. ammonium salts), under conditions with mild temperature and a relative high humidity range, seems to be an important contributor to the PM2.5 concentration.

Recent EC directives on the allowed concentrations of PM10, PM2.5 and, especially, smaller particles in urban and rural areas imposes further investigations in order to determine with enough accuracy their origin, shape and chemical composition.

As the recent outbreak of Saharan dust storm over the Brussels region has shown, the constant field monitoring, laboratory analysis and data study of extreme events involving airborne particles are an important part of our research program.

The methods of biological monitoring for estimating environmental contamination, a solution to the problems of environmental monitoring using wildlife and the using of the CSRL for data obtained from wildlife are reported in chapter 15.

In chapter 16, a detailed account of the hydrographic features including nutrient distribution in the coastal waters of Kalpakkam is discussed. Keeping this view in the backdrop, recent results of studies (2006-2008) on i) qualitative and quantitative abundance of phytoplankton, ii) seasonal variations in phytoplankton community organization and iii) the influence of environmental variables on phytoplankton species assemblage in the Kalpakkam coastal waters, southeast coast of India are also discussed in chapter 16. Notwithstanding the interest driven by either, the three important parameters for practical use undoubtedly are a) type of benthos, b) their growth rate and c) their seasonal variations. Therefore, monthly and seasonal status of benthic community in the southeast coast of India is discussed in this chapter as part of ecological studies. The impact of the presence of such a high density of fouling organisms residing inside the tunnel on the adjacent coastal environment is also discussed.

The degradation of the habitat, together with the overexploitation of natural resources, the invasion by alien species as well as pollution, represent the major problems jeopardizing coastal regions. Human activities are the main cause of marine pollution, including recurrent spills of toxic agents both in open sea and in estuarine areas. Besides, natural disasters such as landslides and flash floods also contribute significantly to the increase of marine pollution.

Over the last decades, the use of biomarkers for biomonitoring the impact of several contaminants has been increased. A biomarker can be defined as measure at a molecular, cellular or whole organism level, of the exposure to contaminants (exposure biomarkers) or of the organism response to the pollutants (effects biomarkers). Genotoxicity biomonitoring is one of the most important features to evaluate the environmental stress and the pollution impact on marine organisms. In this sense, the development of suitable and sensitive biomarkers, such as those for the assessment of DNA damage, is required.

The aim of chapter 17 is to provide an overview of the practical use of genotoxicity biomarkers in marine bivalve molluscs to evaluate the extent and consequences of environmental contamination in these organisms. This review illustrates the results obtained during the development and application of exposure/effect biomarkers for biomonitoring purposes in several sentinel species.

In chapter 18, some ecotoxicological investigations are presented to illustrate the common use of the biomarkers and the biomarkers more recently developed.

Anthropogenic inputs of pollutants such as heavy metals into the marine environment have increased their levels to large extents within past few decades. The available literature on heavy metal bioaccumulation by freshwater crayfish has been analysed. A very uneven data distribution was found, Orconectes, Cambarus Procambarus and Astacus are the most commonly investigated orders of crayfish. Furthermore, Zn, Cu, Pb and Cd are the most intensively researched heavy metals, and only infrequent investigations of other metals are documented. At some conditions bioaccumulation levels of some heavy metals were as follows Mn> Zn >Cu>Ni>Cr>Pb>Cd. Accumulated metal concentrations are interpreted in terms of different trace metal accumulation patterns, dividing accumulated metals into two

components - metabolically available metal and stored detoxified metal. Chapter 19 will focus on bioaccumulation of some heavy metals on freshwater crayfish.

In chapter 20, marine environment is considered to be as one of the most important habitats that must be protected from pollution worldwide. In recent years marine pollution has increased, due to increase in ship traffic and the uncontrollable dumping of toxic materials and wastes to the seas. Heavy metals have received considerable attention in recent years with regard to toxicity to aquatic life. Chapter 20 deals with sources, distribution and fate of heavy metals in the sea water. Heavy metals accumulation by microorganisms is regarded as an attractive alternative to the physical and chemical methods applied for the treatment of heavy metals contamination. *Bacillus Staphylcoccus, Corynebacterium, Enterobacter, Escherichia, Aeromonas, Pseudomonas, Klebsiella, Vibrio, Arthrobacter, Brevibacterium, Deinococcus, Erwinia, Micrococcus, Nacardia, Sarratia, Tthiobacillus,* and *Zoogloea* are the most important bacterial species that used in the bioaccumulation processes. Chapter 20 also reviews bacteria-metals interactions and mechanisms of metal cations accumulation by bacteria. Moreover minimal inhibitory concentrations (MICs) of most heavy metals to *E. coli*, resistance mechanism to copper, zinc and arsenic and finally, the accumulation of metal inside the bacterial cell and change in cell morphology were also reviewed.

In chapter 21, the molecular mechanism of AhR mediated CYP1A induction in aquatic organisms is described and the way it could be applied as a suitable biomarker for the early detection of organic pollution in aquatic environment is explained.

The control of environmental pollution is a multi facet management system which encompasses the role of individuals, industries, states, nations as well as international agencies. Its success demands a great vision and zeal for the sustainable developments and requires great care at the topmost hierarchy of environmental management system followed by the economy of the industries. The first step in this process is the knowledge of impact of pollutants. In order to understand the impact of different types of environmental pollution and to establish ways and means to address the issues, we need to look at the inevitable trade-off situation that characterizes all pollution-control activities. An effort made in reducing the generation of hazardous wastes or the release of emissions and effluents would require the industry to seek change to some part of processing and management of the industry and this might be procured from intense research and development. Absence of such effort will inadvertently increase the damages incurred onto the environmental. The management of hazardous wastes by industries is done through 'command-and-control' approach through governing laws which is based on various types of standards to bring about improvements in environmental quality. However managing hazardous wastes via complying with standards alone is not sufficient. The increasing cost in end of the pipe hazardous waste management in addition to mainstreaming and operating efficient pollution control equipment has led many industries to find better ways to delay with the hazardous wastes handling and disposal. Chapter 22 presents a set of heuristics to stimulate an investigation aimed at clearing the doubts and complexities pertaining to the requirements of pollution-control specifically for multi-product plants and initiate the implementation of improved pollution-prevention and pollution-control solutions.

In recent years, due to the advance in knowledge of landfill behavior and decomposition processes of municipal solid wastes (MSW), there has been a strong thrust to upgrade existing landfill technology from a storage/containment concept to a process-based approach, in other words, as a bioreactor landfill. Operating landfills as bioreactors and hence enhancing the

stabilization of wastes is one such option that has been elaborately investigated and already been in practice in the U.S. and European countries. As compared to many developed countries, the concept of leachate recirculation is still relatively new to Asia. Nevertheless, there are laboratory scale and pilot scale researches including few full-scale implementation of this technology in Asia. Research and development activities relating to aspects of landfill bioreactor are keeping the interest of scientists and engineers alive and enriching the literatures. Findings of bioreactor landfill research have resulted in generation of enormous data and their publication in variety of journals and books. Collating data from such diverse sources would help understand the bioreactor landfill concept, benefits to be derived, design and operational issues, possible solutions to many of these issues, ongoing researches, etc. Chapter 23 is an attempt to present an overview in this direction in Asian perspective.

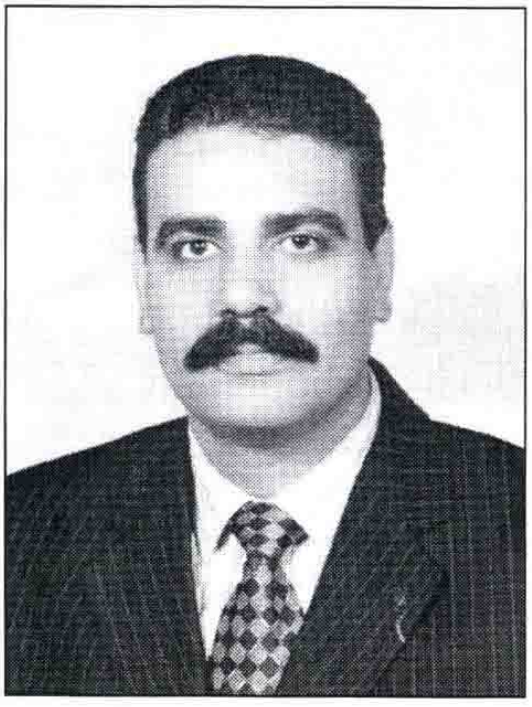
As reported in chapter 24, in the context of environmental pollution, it is of prime importance to study the organism's overall response to harmful environments. This could be carried out if there were suitable dynamic variables, describing the state of a living system. In this respect, a new approach to life phenomena is needed because in phenomenological aspect, the biological objects in their entirety could be not adequately described in the terms of other science fields. The main features of the living system are its integrity and self-regulation. Energy dissipation runs in the living systems but there the more substantial property is the increase of the energy worth. Here a new theoretical basis and new science field, biodynamics, is suggested. A new state variable vitality as integral characteristic of a biological object is stated. It is impossible to deduce the macro-characteristics of a living system based on the processes on molecular level. Vitality could be a phenomenological characteristic uniquely determining the status of the living object. Quantities biological energy and synergy are introduced. The synergy is assumed as a measure of self-regulation quality. Biological principle for maximum synergy is stated. The conception proposed is illustrated on the case of recovery process of some biological object after some transitory disturbance. Based on variational principle of Hamilton type an equation describing the recovery process is obtained. If a quantity as vitality could be measured this could provide a great benefit for biology, medicine, and ecology.

The UNECE Heavy Metals in Mosses Surveys measure environmental concentrations of metals in mosses throughout Europe for ecotoxicological risk assessments. The metal loads depend on the deposition rate as well as on local and regional boundary conditions.

In chapter 25 the most important boundary conditions are identified with help of the German moss survey data 1990, 1995, and 2000 using tree based models: moss species, precipitation, slope direction, and landuse. The knowledge of their influence on the metal accumulation is essential for the interpretation of the biomonitoring data and is of importance for designing the monitoring nets of succeeding monitoring campaigns. A shift of the geographical distribution of mosses could be observed by means of Classification and Regression Trees (CART). Based on the model, a predictive map was calculated in a GIS environment.

Alexandria in 15 April, 2010 Ahmed El Nemr

The Editor



Professor Ahmed El Nemr was born 1962 in El Behera, Egypt. He received his BSc degree in chemistry in 1984 with a general grade of excellent and his MSc degree in organic chemistry from Alexandria University under the supervision of Professor E. S. H. El Ashry, after which he was awarded his PhD in Engineering in Applied Chemistry by Keio University, Yokohama, Japan. He worked from 1991 to 1997 (six years) as a researcher at the Institute of Bioorganic Chemistry, Kawasaki, Japan with Professor Tsutomu Tsuchiya. He is now working as Professor at the Environmental Division, National Institute of Oceanography and Fisheries, Egypt. He is the head of Egypt National Oceanography data center (ENODC) and the national coordinator of Egypt at IODE-IOC-UNESCO. Professor El Nemr has over 124 published research papers in international journals and author of two books published by Blackwell and Nova Science publishers as well as he is Editor to one book in corrosion published by research sign post publishers. He is Editor of two web sites. His research interest is devoted to explore novel approaches for synthetic methodologies in carbohydrate chemistry and the synthesis of natural compounds. Syntheses of deuterated carbohydrates using different methods are one of his main works. Syntheses of carbohydrates in the form of their nitrogen derivatives as raw materials for the synthesis of other classes of organic compounds and heterocyclic compounds were also of his great interest. Isolation of some natural compound from marine algae as well as isolation of chitin and chitosan and their chemical modification study. Corrosion inhibition and its prediction for selected organic compounds using Quantum chemical calculations. New activated carbons development from agriculture wastes is also of his great interest. Removal of textile dyes, organic pollutants and heavy metals from water using macro algae, activated carbons and agriculture wastes as well as water treatment and wastewater purification. The distribution of petroleum hydrocarbon, pesticides, polycyclic aromatic hydrocarbons, polychlorinated biphenyls and heavy metals in the Mediterranean, Red Sea and inland waters (Egypt) was investigated and correlated with pollution and environmental aspects. Oil spill and Machine oil treatment technologies.

CONTENTS