Natural Pollution By Some Heavy Metals In The Tigris River

Air pollution has always been a trans-boundary environmental problem and a matter of global concern for past many years. High concentrations of air pollutants due to numerous anthropogenic activities influence the air quality. There are many books on this subject, but the one in front of you will probably help in filling the gaps existing in the area of air quality monitoring, modelling, exposure, health and control, and can be of great help to graduate students professionals and researchers. The book is divided in two volumes dealing with various monitoring techniques of air pollutants, their predictions and control. It also contains case studies describing the exposure and health implications of air pollutants on living biota in different countries across the globe.

Microbial Biodegradation and Bioremediation brings together experts in relevant fields to describe the successful application of microbes and their derivatives for bioremediation of potentially toxic and relatively novel compounds. This single-source reference encompasses all categories of pollutants and their applications in a convenient, comprehensive package. Our natural biodiversity and environment is in danger due to the release of continuously emerging potential pollutants by anthropogenic activities. Though many attempts have been made to eradicate and remediate these noxious elements, every day thousands of xenobiotics of relatively new entities emerge, thus worsening the situation. Primitive microorganisms are highly adaptable to toxic environments, and can reduce the load of toxic elements by their successful transformation and remediation. Describes many novel approaches of microbial bioremediation including genetic engineering, metagenomics, microbial fuel cell technology, biosurfactants and biofilm-based bioremediation Introduces relatively new hazardous elements and their bioremediation practices including oil spills, military waste water, greenhouse gases, polythene wastes, and more Provides the most advanced techniques in the field of bioremediation, including insilico approach, microbes as pollution indicators, use of bioreactors, techniques of pollution monitoring, and more

A successful modern heavy metal control program for any industry will include not only traditional water pollution control, but also air pollution control, soil conservation, site remediation, groundwater protection, public health management, solid waste disposal, and combined industrial-municipal heavy metal waste management. In fact, it should be a total environmental control program. Comprehensive in scope, Heavy Metals in the Environment provides technical and economical information on the development of a feasible total heavy metal control program that can benefit industry and local municipalities. The book discusses the importance and contamination of metals such as lead, chromium, cadmium, zinc, copper, nickel, iron, and mercury. It covers important research of metals in the environment, the processes and mechanisms for metals

control and removal, the environmental behavior and effects of engineered metal and metal oxide nanoparticles, environmental geochemistry of high arsenic aquifer systems, nano-technology applications in metal ion adsorption, biosorption of metals, and heavy metal removal by expopolysaccharide-producing cyanobacteria. The authors delineate technologies for metals treatment and management, metal bearing effluents, metal-contaminated solid wastes, metal finishing industry wastes and brownfield sites, and arsenic-contaminated groundwater streams. They also discuss control, treatment, and management of metal emissions from motor vehicles. The authors reflect the breadth of the field and draw on personal experiences to provide an in-depth presentation of environmental pollution sources, waste characteristics, control technologies, management strategies, facility innovations, process alternatives, costs, case histories, effluent standards, and future trends for each industrial or commercial operation. The methodologies and technologies discussed are directly applicable to the waste management problems that must be met in all industries.

"Heavy Metals: Problems and Solutions" is divided into three sections dealing with basic geochemical processes, remediation and case studies. The basic geochemical processes are discussed with respect to mobility in the environment and impact as well as methods to derive guidelines for heavy metals. Remediation focuses on currently available methods to treat contaminated sediments and soils. In addition, it considers the concept of geochemical engineering for remediation of large areas contaminated by metals. A number of case studies of polluted sediments and soils and their environmental impact highlight the principles discussed in the first two sections.

Water is an important natural resource which forms the core of the ecological system. Human use of water depends on ambient water quality and human alterations of the landuse have an extensive influence on water quality. Water is typically referred to as polluted when its quality is adversely affected by contaminants and undergoes a marked shift in its capability to support the biological communities. The book is written for research scholars, hydrologists and environmentalists and especially students.

Gebeng is an industrial estate that contained multifarious industries, which generate industrial effluents and consequently pollute the adjacent river water as well as surface water quality of the area. With the objectives to assess the water quality of the area with spatial and temporal variations, to classify the water based on water quality index, to assess the heavy metal contamination of soil due to the industrial pollution and to perform a water quality model to simulate the water quality parameters of Tunggak River, this study has been conducted. To fulfil the objectives, water and soil samples were collected and analysed. Water samples were collected for a period of one year from February 2012 to January 2013 from ten preselected sampling stations, and soil samples were collected from thirty sampling points according to the standard method of sample

collection. Twenty-four water quality parameters including ten heavy metals and heavy metals in soil samples were analysed. The water quality model was calibrated and validated with the collected data. All testing and analyses were done in accordance with the standard method procedures. Data analysis was conducted using SPSS 16.0 statistical software. The results of water quality analyses showed that the concentrations of DO observed were very low (less than 4.0 mg/L) over the whole area, accordingly BOD (6.8 - 27.1 mg/L) and COD (14.0- 59.6 mg/L) were observed very high. Ammoniacal nitrogen and phosphorus were also recorded in higher concentrations. Compared to all areas the water qualities at the industrial zone were more deteriorated. According to the INWQS Malaysia recommended threshold levels, fifteen parameters were found to be beyond this level. The results from the calculation of the DOE-WQI revealed that the water of the Tunggak River was under class III and class IV and the swampy area was class III. According to the INWQS Malaysia, class IV water cannot be used for any purpose except irrigation. Soil heavy metal contamination investigation showed that five heavy metals were found contaminating the area that led to soil pollution. Soils of the industrial zone were polluted with arsenic, mercury, lead, cobalt and zinc. Arsenic and mercury contamination was observed all over the study area. Source apportionment study revealed that the major sources of pollution in both cases of water and soil were due to anthropogenic activities. The sources of physicochemical parameters were primarily of the industrial effluents associated with domestic wastewater, and agricultural and urban runoffs. Some parameters with heavy metals contamination were due to natural sources. The water quality model calibration and validation result showed that the model has represented the field data quite well. RMSE showed good match between the observed and simulated data. The model suggested that the lower concentration of DO could not be revived without taking proper management, including water quality control strategy. Several water quality control strategies were tested with the model to propose the best one for use to revive the water quality of the Tunggak River. It is proposed that the pollution load modification with 20.0 mg/L BOD + flow augmentation and imposing three weirs in critical locations- strategy would be able to control the minimum level of DO and maximum level of nitrogen and phosphorus of the Tunggak River. At the same time, it also recommended that the industries should be compelled to adhere strictly the Environmental Quality (Industrial Effluent) Regulations 2009, Malaysia before discharging BOD more than 20.0 mg/L and 6.0 kg/day into the Tunggak River.

Heavy-metal contamination is one of the world's major environmental problems, posing significant risks to agro-ecosystems. Conventional technologies employed for heavy-metal remediation have often been expensive and disruptive. This book provides comprehensive, state-of-the-art coverage of the natural, sustainable alternatives that use a wide range of biological materials in the removal/detoxification of heavy metals, consequently leading to the improvement

of crops in these soils. Novel, environmentally friendly and inexpensive solutions are presented based on a sound understanding of metal contamination and the roles of plants and microbes in the management of these toxic soils. Written by worldwide experts, the book provides not only the necessary scientific background but also addresses the challenging questions that require special attention in order to better understand metal toxicity in soils and its management through bioremediation.

Soil is an irreplaceable resource that sustains life on the planet, challenged by food and energy demands of an increasing population. Therefore, soil contamination constitutes a critical issue to be addressed if we are to secure the life quality of present and future generations. Integrated efforts from researchers and policy makers are required to develop sound risk assessment procedures, remediation strategies and sustainable soil management policies. Environmental Risk Assessment of Soil Contamination provides a wide depiction of current research in soil contamination and risk assessment, encompassing reviews and case studies on soil pollution by heavy metals and organic pollutants. The book introduces several innovative approaches for soil remediation and risk assessment, including advances in phytoremediation and implementation of metabolomics in soil sciences.

This third edition of the book has been completely re-written, providing a wider scope and enhanced coverage. It covers the general principles of the natural occurrence, pollution sources, chemical analysis, soil chemical behaviour and soil-plant-animal relationships of heavy metals and metalloids, followed by a detailed coverage of 21 individual elements, including: antimony, arsenic, barium, cadmium, chromium, cobalt, copper, gold, lead, manganese, mercury, molybdenum, nickel, selenium, silver, thallium, tin, tungsten, uranium, vanadium and zinc. The book is highly relevant for those involved in environmental science, soil science, geochemistry, agronomy, environmental health, and environmental engineering, including specialists responsible for the management and clean-up of contaminated land.

This book covers hydrocarbon pollution, measurement techniques for hydrocarbons, risk assessment, and environmental impact. This comprehensive book takes a broad view of the subject and integrates a wide variety of approaches. This book attempts to address the needs of graduate and postgraduate students and other professionals or readers interested in food, soil, water, and air pollution. The aim of this book is to explain and clarify important studies, and compare and develop the new and groundbreaking measurement techniques. Written by leading experts in their respective areas, the book is highly recommended to professionals interested in environmental and human health because it provides specific and comprehensive examples.

Global water crisis is a challenge to the security, political stability and environmental sustainability of developing nations and with climate, economically and politically, induces migrations also for the developed ones. Currently, the urban population is 54% with prospects that by the end of 2050 and 2100 66% and 80%, respectively, of the world's population will live in urban environment. Untreated water abstracted from polluted resources and destructed ecosystems as well as discharge of untreated waste water is the cause of health problems and death for millions around the globe. Competition for water is wide among agriculture, industry, power companies and recreational tourism as well as nature habitats. Climate changes are a major threat to

the water resources. This book intends to provide the reader with a comprehensive overview of the current state of the art in integrated assessment of water resource management in the urbanizing world, which is a foundation to develop society with secure water availability, food market stability and ecosystem preservation.

The pollution of soil and groundwater by heavy metals and other chemicals is becoming a serious issue in many countries. However, the current bioremediation processes do not often achieve sufficient remediation, and more effective processes are desired. This book deals with advances in the bioremediation of polluted soil and groundwater. In the former chapters of this book, respected researchers in this field describe how the optimization of microorganisms, enzymes, absorbents, additives and injection procedures can help to realize excellent bioremediation. In the latter chapters, other researchers introduce bioremediation processes that have been performed in the field and novel bioremediation processes. Thus, the readers will be able to obtain new ideas about effective bioremediation as well as important information about recent advances in bioremediation.

INTRODUCTION Environmental science is the systematic study of the interaction of two worlds. The word 'Environment' is derived from an old French word 'environ' meaning 'encircle'. The environment consists of four segments: atmosphere, hydrosphere, lithosphere and biosphere. Among all of substances, water is a marvelous substance on earth. Water is one of the abundantly available substances in nature. Water is essential for all kinds of life and is the medium in which all living processes occur. Water is renewable source, but renewable takes time. The hydrological cycle constantly purifies and redistributes fresh water on landmasses, providing endless renewable resource. At present, there are many environmental issues, which have grown in size and complexity day by day, threatening the survival of mankind and all living organisms on earth. Unfortunately, with progress in science and technology, man has been dumping waste material into atmosphere and causing pollution. Environmental pollution can be divided among the categories of water, air and soil pollution. Emission of pollutants in air, water and soil has caused considerable damage to our environment. Water pollution disturbs the normal uses of water for irrigation, agriculture, industries, public water supply and aquatic life. Most of the human activities produce liquid effluents, which are the prime cause of water pollution. Rapid increase in population, intensive agriculture, growing industrialization and urbanization has resulted in progressive deterioration in the quality of water in our natural reservoirs. Most of the water related diseases are some way or other concerned with the polluted water supply. Water borne infections diseases like cholera, dysentery, typhoid, jaundice and worm infection are still the major public health problems in developing countries. Another substance, which plays a very important role, is soil as it produces food for human beings and animals. Soil is a complex of physical and biological systems, which give support to the plants and supplies water and essential nutrients to them. It is the main reservoir of the minerals essential for normal growth of the plants. The soil consists of four major components, i.e. mineral matter, organic matter, soil air and soil water. All these components cannot be separated with much satisfaction because they are present very intimately mixed with each other. With careful husbandry, soil can be replenished and renewed indefinitely. Hazardous chemicals heavily pollute soil day by day. Disposal of industrial waste is the major problem responsible for soil pollution.

These waste products are also tipped on soil, enhancing the extent of soil pollution. As a result, hazardous chemicals can enter into human food chain from the soil or water, disturb the biochemical process and finally lead to serious effects on living organisms. Large-scale soil and water pollution is one of the primary factors behind the high prevalence of soil and water borne diseases. Soil degradation can reduce the quality of our food, whereas deforestation can reduce the availability plants to make current medicines and medicines for the future. Heavy metal pollution has also a serious impact. Metal pollution can affect all environments but its effects most long lasting in soil. Drinking is one of the major routes of intake of heavy metals by the human body. Soil contamination should be a primary concern in India, because the country relies heavily on agriculture. Toxic metal is the one, which is neither essential nor beneficial but exhibits a positive catastrophic effect on normal metabolic function even when present in small amounts and may, at times, be responsible for permanent disorders or malfunctioning of organ system leading finally to death. This BOOK consists of five chapters. CHAPTER 1: INTRODUCTION This chapter is divided into two parts: 1A: WATER This part contains Introduction of Water, Properties of Water, Major Water Compartments, Types & Forms of Water, Water and its Significance, Potability of Water, Water Consumption Pattern & Demand, Water Resources, Water Quality for Irrigation and Ground Water Quality Status in Rajasthan. 1B: SOIL & VEGETATION This part contains Introduction of Soil, What is Soil?, Composition of Soil, Process of Soil Formation, Soil Profile, Soil Texture, Types of Soil, Soil pH, Life on Soil, Macro and Micro Plant Nutrients, Functions of Various Nutrients and Agricultural Status w.r.t. Soil. CHAPTER 2: WATER & SOIL POLLUTION This chapter is divided into two parts: 2A: WATER POLLUTION (i) This part contains Environmental Pollution, Water Pollution, Causes of Water Pollution, Sources of Water Pollution, Types of Water Pollution, Classification of Pollutants, Types of Pollutants, Characteristics of Fresh Water, Chemical Characteristics of Water, Characteristics of Industrial Wastes, Control of Water Pollution, Diseases Caused by Water Pollution, Various Effluents and Their Effects on Aquatic Organisms, Fluoridation and Defluoridation of Water, Water Management, Water Pollution in India and Water Pollution in Rajasthan. (ii) 2B: SOIL POLLUTION This part contains Soil Pollution, Sources of Soil Pollution, Diseases Caused by Soil Pollution, Control of Soil Pollution, Heavy Metal Toxicology, Sources of Heavy Metals and Environment Friendly Technologies. CHAPTER 3: METHODS & METHODOLOGY METHODOLOGY FOR WATER Wastewater samples were collected from eleven different sites from the 'AMANISHAH NALA' and groundwater (Hand pump) samples were taken from nine different vicinal locations of various industrial sites. Samples were collected in good quality screw–capped polyethylene bottles of one litre capacity, labeled properly and analyzed in laboratory for their all physico–chemical parameters. Monitoring was done during the three seasons (pre-monsoon, during monsoon and post-monsoon) throughout the two-years from different industrial areas and adjacent places of Jaipur city (June, 2002 to May, 2004). Various physical parameters like pH, EC, DO and TDS, which are important to evaluate the suitability of wastewater for irrigation, were determined on the site with the help of digital portable water analyzer kit (CENTURY–CK–710). For rest of the analysis, water samples were preserved and bought to the laboratory. The chemical analysis carried out for BOD by incubation method, COD by $KMnO_4$ method, Calcium (Ca^{2+}), Magnesium (Mg^{2+}),

Chloride (Cl–), Sulphate (SO42–), Carbonate (CO32–) and Bicarbonate (HCO3–) by volumetric titration methods; while Fluoride (F–) by spectrophotometric (AIMIL–C160–80314) & ion selective electrode method and Nitrate (NO3–) by spectrophotometric (ELICO–CL–54D) method; Sodium (Na+), Potassium (K+) by flamephotometry (ELICO–CL–220) and heavy metals by AAS. In order to estimate the quality of the groundwater for drinking purposes, an indexing system, Water Quality Index (WQI), based on Adak and Purohit(20), was determined. Evaluation of the quality of wastewater on the basis of percent sodium (%Na) is excellent, was determined. Quantitatively, United States Salinity Laboratory (USSL) proposed, for the first time, a better index called 'Sodium Absorption Ratio (SAR)', was determined. Sodium hazard of irrigation water can be well understood by knowing SAR. There is a significant correlation between SAR values of irrigation water and the extent to which sodium is absorbed by the soil. METHODOLOGY FOR SOIL Soil samples were collected from thirteen different vicinal locations of various industrial sites where industrial wastewater use for irrigation. Samples were collected in good quality polyethylene bags, labeled properly and analyzed in laboratory for their all parameters. Monitoring was done during the four intervals throughout the year from different vicinal locations of various industrial sites of Jaipur city where industrial wastewater use for irrigation (April, 2004 to March, 2005). Soil samples may be analyzed for the following parameters like: pH, EC, Organic Carbon, Nitrogen, Phosphorous, Potassium, Fe, Zn, Cu, Mn, etc. CHAPTER 4: RESULTS AND DISCUSSION This chapter is divided into three parts: 4A: WATER FOR DOMESTIC PURPOSES In these sites, positive correlation between surface and ground water was recognized. The groundwater near solid waste and liquid waste disposal sites was polluted, whereas the groundwater away from disposal sites was not much affected. The values obtained were compared with standards of ISI, ICMR and WHO. From the observations, it may inferred that the concentration of pH, EC, Ca2+, Na+, K+, Mg2+, SO42–, CO32–, HCO32–, Cl–, DO and BOD are within permissible limits of ISI, ICMR & WHO but NO3–, TDS, TH, COD and WQI values show the poor water quality in most of the studied groundwater samples taken from vicinal locations of various industrial sites. Concentrations of all heavy metals like Cr, Cu, Cd, Mn, Ni, Pb, Fe, As & Zn are within permissible limits. Higher concentrations of Zn in very few samples have been observed. WQI values of these samples were ranging from 35.08 to 268.78 which means that only 37.5% sample's water were fit for human consumption directly, but 62.5% water of all sources can be used for domestic consumption after appropriate treatment whereas remaining 37.5% water of samples were of very poor quality and was not recommended for domestic purposes. So it may be accomplished with the help of WQI that the water of the various samples were unfit for drinking purpose without further treatment (mainly disinfections). It may be concluded that the general characteristics of groundwater samples from the study area classify the water under moderate category and are tolerable for household and commercial purposes However, high WQI and COD values suggest purification may be necessary for domestic consumption. 4B: WATER FOR IRRIGATION PURPOSES The suitability of groundwater and wastewater for irrigation depends upon its mineral constituents. The salts present in the water, besides affecting the growth of the plants directly also affect the soil structure, permeability and aeration, which indirectly affect the plant growth. Jaipur is undergoing rapid urbanization and industrialization.

Wastewater generated from various industries discharged into 'AMANISHAH NALA' where this water is used for irrigation purpose. The values obtained were compared with standards of ISI, ICMR and WHO. The concentrations of pH, Na^+, K^+, Ca^{2+}, Mg^{2+}, SO_4^{2-}, CO_3^{2-}, HCO_3^-, TH, Cl^-, NO_3^-, Oil & Grease, DO and F^- are within permissible limits in both groundwater and wastewater but definite contaminations with special reference to EC, TDS, BOD and COD in wastewater have been observed, calls for at least primary treatment of wastewater before being used for irrigation. High EC and TDS values reflect greater salinity of water and it cannot be suitable for irrigation under ordinary conditions. There was also a significant correlation between SAR values of irrigation water and the extent to which sodium is absorbed by the soil. No excellent conclusion can be drawn to observed values but general conclusion can be drawn as: The general characteristics of groundwater and industrial wastewater samples from the study area classify the water under moderate category and are good for household, irrigation and commercial purposes and results of suitability evaluation indicate that there is no major pollution hazard in wastewater of AMANISHAH NALA. However, high BOD and COD values suggest purification may be necessary for sensitive crops and human consumption. 4C: SOIL FOR AGRICULTURAL PURPOSES In all studied locations, soil is moderate for all kinds of crops except sensitive ones. Adjacent locations of all industrial areas under study have concentrations of pH, EC, organic carbon, Fe, Cu and Mn are within permissible limits and show good soil quality in most of the studied soil samples taken from vicinal locations of various industrial sites. There is lack of concentrations of Zn is all soil samples and is need to give zinc sulphate fertilizer to compensate this but definite concentrations of P and K in soil samples have been observed at critical limit. Some samples also have higher pH i.e. alkaline in nature and they need to give gypsum for reducing alkalinity from soil samples. CHAPTER 5: WASTEWATER TREATMENT AND SUGGESTIONS The ultimate disposal of wastewater can only be onto the land or into the water. But whenever the watercourses are used for the ultimate disposal, the wastewater is given a treatment to prevent any injury to the aquatic life in the receiving water. Normally, the treatment consists of the removal of suspended and dissolved solids through different units if the treatment plants. The treatment of industrial wastewater may be accomplished in part or as a whole either by the biological processes, as done in the sanitary sewage, or by processes very special for the industrial wastewater only. Depending upon the constituents present in it, the treatment may consist of any one or more treatment (chemical or biological or both) processes. The chemical treatment should be provided only when it becomes unavoidable. The selection of the particular treatment process depends on the effluent requirements and the characteristics of the waste. Today it is not enough to emphasize the protection of the environment. The fundamental purpose of water treatment is to remove impurities that may be offensive or injurious to health and well being of the individual and community. Disinfectant should kill the pathogens quickly at room temperature. It should be inexpensive, and non-toxic, to humans and should provide protection against only contamination in water during conveyance or storage. The Govt. should immediately make laws banning industrial pollution. Failure to do so will lead to substantial penalties and fine. The water treatment plants should be installed in rural areas. The rural inhabitants should try to avoid the use of pesticides in their fields. All small scale and big industries must have anti-pollution unit. Create the

awareness about the effects of high concentration of nitrate, fluoride, solids and hardness among villagers. Through strict implementation of the Government's Water Treatment Programme, water can be rendered safe for drinking. Chapter 1, 2, 3 & 5 precisely details under various heads and chapter 4 details under water for domestic & irrigation purposes and soil for agricultural purposes, results, discussion, tables and graphs of each parameters results, evaluations, assessments and comparison followed by a comprehensive list of relevant references after everything else of the BOOK. Pollution is the release of chemical, physical, biological or radioactive contaminants to the environment. Principal forms of pollution include: air pollution, the release of chemicals and particulates into the atmosphere. Common examples include carbon monoxide, sulphur dioxide, chlorofluorocarbons (CFCs), and nitrogen oxides produced by industry and motor vehicles. Ozone and smog are created as nitrogen oxides and hydrocarbons react to sunlight. Water pollution affects oceans and inland bodies of water. Examples include organic and inorganic chemicals, heavy metals, petrochemicals, chloroform, and bacteria. Water pollution may also occur in the form of thermal pollution and the depletion of dissolved oxygen. Soil contamination often occurs when chemicals are released by spill or underground storage tank leakage. Contaminants include hydrocarbons, heavy metals, MTBE, herbicides, pesticides and chlorinated hydrocarbons. Often occurs with water pollution, thanks to surface runoff and groundwater. Radioactive contamination was added in the wake of 20th-century discoveries in atomic physics. Noise pollution encompasses roadway noise, aircraft noise, industrial noise as well as high-intensity sonar. Light pollution, includes light trespass, over-illumination and astronomical interference. Visual pollution, which can refer to the presence of overhead power lines, highway billboards, scarred landforms (as from strip mining), open storage of junk or municipal solid waste. The nature, distribution and ecological effects of all types and forms of pollutants in air, soil and water are the subject of this book.

This study evaluated the use of statistical randomization tests in data analysis regarding heavy metals content in sediments from the Caí River basin (Brazil). During one year, four samplings took place at eleven sites in the Caí River and tributaries. The results showed significant differences between some locations, enabling spatial segregation of sites affected by natural and anthropic sources. Considering a significance level (?) of 5%, the control station, above polluted areas, showed the best quality; Caí River station after the mouth of Pinhal/Belo stream indicated influence from the industrial complex of Caxias do Sul region, as well as copper compounds use in vineyards; and the Cadeia and Forromeco streams showed effects of natural contribution from basalts and surface runoff on naked soils. For ?=10%, it was possible to identify chromium pollution by tanneries in the Cadeia stream. Long-term studies should be performed, since understanding temporal aspects such as alteration processes in sediments involves a much longer time scale.

This book evolved from the 5th School of Environmental Research entitled „Persistent Pollution – Past, Present and Future", which has set a focus on Persistent Organic Pollutants (POPs), heavy metals and aerosols. - reconstruction of past changes based on the scientific analysis of natural archives such as ice cores and peat deposits, - evaluation of the present environmental state by the integration of measurements and modelling and the establishment of cause-effect-patterns, - assessment of possible

environmental future scenarios including emission and climate change perspectives. This book addresses issues related to sources of groundwater pollution such as arsenic, uranium, fluoride and their effects on human health. It discusses extensively the removal of heavy metals, arsenic and fluoride from drinking water. Bioremediation and phyto remediation on biomass productivity are treated in several chapters in the book. The volume highlights leachate characteristics analysed both in the laboratory and in field studies assessing the trace metals in rainwater. This book is a study on the judicious management of natural resources and exposes environmental problems particularly those related to pollution and bioremediation.

Carbon monoxide (CO) is a toxic air pollutant produced largely from vehicle emissions. Breathing CO at high concentrations leads to reduced oxygen transport by hemoglobin, which has health effects that include impaired reaction timing, headaches, lightheadedness, nausea, vomiting, weakness, clouding of consciousness, coma, and, at high enough concentrations and long enough exposure, death. In recognition of those health effects, the U.S. Environmental Protection Agency (EPA), as directed by the Clean Air Act, established the health-based National Ambient Air Quality Standards (NAAQS) for CO in 1971. Most areas that were previously designated as "nonattainment" areas have come into compliance with the NAAQS for CO, but some locations still have difficulty in attaining the CO standards. Those locations tend to have topographical or meteorological characteristics that exacerbate pollution. In view of the challenges posed for some areas to attain compliance with the NAAQS for CO, congress asked the National Research Council to investigate the problem of CO in areas with meteorological and topographical problems. This interim report deals specifically with Fairbanks, Alaska. Fairbanks was chosen as a case study because its meteorological and topographical characteristics make it susceptible to severe winter inversions that trap CO and other pollutants at ground level.

This book is concerned with the heavy metal toxicity of estuaries, estuaries are important resources for coastal aquaculture, whereby they act as natural filters for suspended materials and pollutants. Human activities have drastically altered natural concentrations of many substances in estuaries. Prolonged bio-monitoring of pollutants has been given increasing attention due to ability of various aquatic organisms to accumulate these heavy metals. Among all types of pollution, aquatic pollution is of greater concern as each and every kind of the life depends on water. Millions tons of pollutants are introduced into environment by various industries by way of gaseous, aqueous and solid waste. These waste changes the natural conditions of aquatic medium, in turn causing behavioral response in crustaceans, mollusks, fishes and other aquatic organisms, ultimately leading to physiological adjustment., toxicity testing is an essential component of evaluating water pollution.This study change in ecological degradation, reflecting environmental pollution. Toxicant like heavy metal ions are non degradable, resulting into bioaccumulations with ecosystem and its biotic components

In the past two decades there has been an increasing public awareness of the hazards that exist from the contamination of the environment by toxic substances. 'Heavy metals' and the terrestrial environment are but one facet of the impact of toxic substances on the natural environment, and the use of biological materials for indicating the occurrence of, and continually monitoring the presence of, these materials is a specific topic which is of considerable interest to a diverse range of

individuals, organisations and disciplines. It was our intention when we first en visaged this book that it should contain a description of a range of circumstances in which biological monitoring techniques have been employed in the terrestrial environment and that it should be seen as a practical text which dealt with the merits, shortcomings and suitability of biological monitoring materials. Monitoring is, however, a manifold process. It serves not only to provide information on past and present concentrations of toxic materials in various components of the environ ment, but also to provide information on the processes of environmental release, transport, accumulation and toxicity. Indeed, this may be one of the greatest virtues of biological monitoring over other forms of monitor ing. According to the skill of the staff employed in the monitoring procedure, the information that is accrued can have a vastly different value.

This series is dedicated to serving the growing community of scholars and practitioners concerned with the principles and applications of environ mental management. Each volume is a thorough treatment of a specific topic of importance for proper management practices. A fundamental objective of these books is to help the reader discern and implement man's stewardship of our environment and the world's renewable re sources. For we must strive to understand the relationship between man and nature, act to bring harmony to it, and nurture an environment that is both stable and productive. These objectives have often eluded us because the pursuit of other individual and societal goals has diverted us from a course of living in balance with the environment. At times, therefore, the environmental manager may have to exert restrictive control, which is usually best applied to man, not nature. Attempts to alter or harness nature have often failed or backfired, as exemplified by the results of imprudent use of herbicides, fertilizers, water, and other agents. Each book in this series will shed light on the fundamental and applied aspects of environmental management. It is hoped that each will help solve a practical and serious environmental problem.

This volume entitled "Radionuclides and Heavy Metals in Environment" contains the Proceedings of the NATO Advanced Research Workshop (ARW) "Monitoring of Natural and Man-Made Radionuclides and Heavy Metal Waste in Environment" that was held at the Joint Institute for Nuclear Research (JINR), Dubna, Russia from 3 October to 6 October, 2000. Originally, it was planned to held the ARW in 1999, the year when NATO was celebrating its 50th anniversary. Few days before opening it had to be postponed because of problems in issuing visa for all the colleagues who intended to participate. The ARW was organized and conducted by the co-directors Prof. Vladimir P. Perelygin, Joint Institute for Nuclear Research, Dubna, Russia and Dr. Peter Vater, Philipps Universitat, Marburg, Germany. The JINR was chosen as the host institute of ARW because of the lack of contact and real co-operation between the former Soviet Union (FSU) countries specialists in ecology and their Western well experienced colleagues. The selection of this location and supplementary funds provided by Russian Foundation on Basic Research, Moscow, Russia, and the JINR, Dubna., Russia made it possible to attain a rather large number of participants and observers from FSU countries. The JINR provided to all the participants of the workshop an effective car/minibus transportation Moscow-Dubna-Moscow and a rather good accommodation in Dubna.

Some 65 of the known 92 elements are metallic in nature. The term metal designates an element that is a good conductor of electricity whose electrical resistance is directly proportion to absolute 0T. In addition, metals share some distinctive characteristics such as high thermal conductivity and high density. Metallic elements are intrinsic components of the environment. Some 19 heavy metals of the known 65 metals are toxic in nature and cause a great threat to the living as well as non-living world, and so man is no exception. Actually toxic heavy metals

are present at

Contamination of fish and aquatic environment is one of the most important contemporary problems that preoccupied many scientists over recent years. Fish is considered as one of the most foods susceptible to contamination from various sources either from natural environment or during hunting, transferring and handling. Therefore fish play an important role in transport of pollutants whether chemical pollutants such as heavy metals or microbial contaminants such as pathogenic bacteria which could cause serious risk to the health of consumers. This book provides valuable scientific information's about contamination of fish and aquatic environment with heavy metals and microbiological pollutants. Also, this book provides information's about sources of heavy metals, uptake, transport and accumulation of heavy metals in fish, toxicity of heavy metals, levels of heavy metals in fish as well as effect of technological methods (blanching, frying, roasting, baking and soaking in different solutions) on the reduction of some heavy metal levels. This book is useful to professionals in environmental pollution field also for workers in the field of food technology especially fish processing.

Heavy metal and metalloid contamination of groundwater and surface water ecosystems involves important policy-related and ethical issues besides its more well-known scientific aspects. Heavy Metal and Metalloid Contamination of Surface and Underground Water: Environmental, Policy, and Ethical Issues has brought these three dimensions under a single volume. The book presents an updated status of the nature and extent of heavy metal and metalloid contamination of water and discuss its future implications. In Section I, the book provides a state-of-the-art review of research findings on entry, storage, and release, human health risks, and the uptake and accumulation by freshwater biota and the toxic effects experienced by them. The book also provides information on the bioremediation of heavy metals and metalloids, and the possible effects of climate change on their distribution and toxicity. Section II of the book throws light on the policies and legislations adopted in several countries to deal with the vexed issue of metal contamination of waters in both historical and current perspectives. Special emphasis has been given to the contamination of drinking water and its attendant implications for human health. The book also treats the relevance and applications of Integrated Water Resources Management (IWRM), which forms the backbone of the water policies of several countries. In Section III, discussions focus on ethical issues rising out of heavy metal and metalloid contamination of water, and on the different ethical approaches and principles in both indigenous and other societies. Features: A systematic overview of the major facets of heavy metal and metalloid contamination of water Compilation and analysis of the latest research in the subject area Ample case studies in all chapters that highlight specific problems Review of policy and legislation for the control of heavy metal pollution of water Water ethics in indigenous societies This book will be a vital resource for students and research scholars in the field of environmental science, ecotoxicology, and pollution studies.

While oceans are vast, they represent a fragile resource that must be protected if we want to protect our livelihoods and our planet. Marine pollution has been a topic of concern for a long time, and it has recently attracted the attention of scientists, environmentalists, economists, politicians and journalists in mainstream media. Besides providing food, transportation routes and other resources, the oceans serve as a heat absorbing sink which offsets the extreme heating effects of climate change, but only to a limited degree. Pollution in marine environments such as the oceans, poses a threat to coastal communities by affecting the fauna and flora in the environment and the health of the nearby population. This has a disruptive effect on the health and economy of these communities. Marine Pollution: Current Status, Impacts and Remedies emphasizes the limitations of marine resources that relevant environments provide. Readers will find chapters on methods to assess pollution as well as important information for identifying, measuring, and remediating various pollutants. The book

also covers some known pollutants (heavy metals, organic pollutants, microplastics) and ways to manage these substances. Other issues covered in the book include problems caused by invasive species, and the ecological problems caused by pollutants which affect local fauna and flora. This book will prove to be a useful resource for students, researchers, and policymakers, who are working in environmental science, marine conservation and allied fields. [Series Intro] Marine Ecology: Current and Future Developments brings forth contemporary issues in the study of marine environments. The scope of the series includes ecological, toxicological and biological aspects of the topic. Each volume of the series focuses on a broad theme, with reviews contributed by several experts in the field. The series is essential reading for environmental scientists, ecologists, conservationists and marine biologists.

Inorganic Pollutants in Water provides a clear understanding of inorganic pollutants and the challenges they cause in aquatic environments. The book explores the point of source, how they enter water, the effects they have, and their eventual detection and removal. Through a series of case studies, the authors explore the success of the detection and removal techniques they have developed. Users will find this to be a single platform of information on inorganic pollutants that is ideal for researchers, engineers and technologists working in the fields of environmental science, environmental engineering and chemical engineering/ sustainability. Through this text, the authors introduce new researchers to the problem of inorganic contaminants in water, while also presenting the current state-of-the-art in terms of research and technologies to tackle this problem.

Heavy Metals in the Environment: Impact, Assessment, and Remediation synthesizes both fundamental concepts of heavy metal pollutants and state-of-the-art techniques and technologies for assessment and remediation. The book discusses the sources, origin and health risk assessment of heavy metals as well as the application of GIS, remote sensing and multivariate techniques in the assessment of heavy metals. The various contamination indices like contamination factor, geoaccumulation index, enrichment factor, and pollution index ecological risk index are also included to provide further context on the state of heavy metals in the environment. Covering a variety of approaches, techniques, and scenarios, this book is a key resource for environmental scientists and policymakers working to address environmental pollutants. Covers state-of-the-art techniques for the assessment and remediation of heavy metals Presents the interdisciplinary impacts of heavy metals, including human health, ecosystems and water quality Includes various contamination indices, such as contamination factor, geoaccumulation index, enrichment factor, pollution index and ecological risk index Heavy metals can be emitted into environment by both natural and anthropogenic sources, mainly mining and industrial activity. Human exposure occurs through all environmental media. Infants are more susceptible to the adverse effects of exposure. Increasing attention is now being paid to the mental development of children exposed to heavy metals. The purpose of this book is to evaluate the existing knowledge on intellectual impairment in children exposed to heavy metals in their living environment and to identify the research needs in order to obtain a clearer picture of the situation in countries and regions at risk, in which the economy is closely related to metallurgy and heavy metals emission, and to recommend a strategy for human protection. In greater detail the main objectives could be formulated as follows: to review the principal sources of single, and complex mixtures of, heavy metal pollutants in the environment; to identify suitable methodology for chemical analyses in the environment and in humans; to evaluate the existing methods for measuring mental impairment, including their reliability and validity; to recommend a standard testing protocol to be used in future research; to assess the future role of environmental heavy metal pollution in countries and regions at risk and its effects on children's neurological development; to recommend a prevention strategy for protecting children's health and development.

This important new volume presents a plethora of research on the distribution of heavy metals

in soils and rocks of natural habitats, farmlands, and urbanized areas along with the factors influencing their bioavailability. The authors evaluate the content of organic matter, soil acidity, mineral fertilizers, and more. Developed for ecologists and specialists in the field of environmental protection and the conservation of biological diversity, the book presents the problems of reducing the anthropogenic load on the surrounding countryside and focuses on sustainable agricultural development.

Fundamental societal changes resulted from the necessity of people to get organized in mining, transporting, processing, and circulating the heavy metals and their follow-up products, which in consequence resulted in a differentiation of society into diversified professions and even societal strata. Heavy metals are highly demanded technological materials, which drive welfare and progress of the human society, and often play essential metabolic roles. However, their eminent toxicity challenges the field of chemistry, physics, engineering, cleaner production, electronics, metabolomics, botany, biotechnology, and microbiology in an interdisciplinary and cross-sectorial manner. Today, all these scientific disciplines are called to dedicate their efforts in a synergistic way to avoid exposure of heavy metals into the eco- and biosphere, to reliably monitor and quantify heavy metal contamination, and to foster the development of novel strategies to remediate damage caused by heavy metals.

Pollution of waters by toxic metals is accelerating worldwide due to industrial and population growth, notably in countries having poor environmental laws, resulting in many diseases such as cancer. Classical remediation techniques are limited. This books reviews new, advanced or improved techniques for metal removal, such as hybrid treatments, nanotechnologies and unconventional adsorbents, e.g. metal-organic frameworks. Contaminants include rare earth elements, arsenic, lead, cadmium, chromium, copper and effluents from the electronic, textile, agricultural and pharmaceutical industries.

The term "Heavy Metal" is somewhat imprecise, but includes most metals with an atomic number greater than twenty, but excludes alkali metals alkaline earths, lanthanum andactinides. Human civilization started with the accidental discovery of - especially Copper. Since then living organisms have taken long strides with the help of metals.

Trace metals occur as natural constituents of the earth's crust, and are ever present constituents of soils, natural waters and living matter. The biological significance of this disparate assemblage of elements has gradually been uncovered during the twentieth century; the resultant picture is one of ever-increasing complexity. Several of these elements have been demonstrated to be essential to the functions of living organisms, others appear to only interact with living matter in a toxic manner, whilst an ever-decreasing number do not fall conveniently into either category. When the interactions between trace metals and plants are considered, one must take full account of the known chemical properties of each element. Consideration must be given to differences in chemical reactivity, solubility and to interactions with other inorganic and organic molecules. A clear understanding of the basic chemical properties of an element of interest is an essential pre-requisite to any subsequent consideration of its biological significance. Due consideration to basic chemical considerations is a theme which runs through the collection of chapters in both volumes.

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