English for Environmental
Science and Engineering

环境科学与工程
专业英语

ESP

游 霞 编著

西南交通大学出版社

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序　言

环境专业英语是在大学英语之后，环境专业本科生和研究生所需要掌握的应用型英语，其目的是让学生更多地了解国际环境科学领域的最新研究成果和发展动态，阅读、撰写和发表英文学术论文，参与国际学术交流与合作。

作者从事环境科学翻译20余年，对环境专业英语的价值有比较深刻的认识，在执教环境专业英语的过程中一直在思考：环境专业英语教材应当包含哪些内容？教师该怎么教？学生该怎么学？通过这些年的思考和学生对现有教材的评价及其对未来教材的期望，作者产生了自己编写环境专业英语教材的构想。

作者认为，环境专业英语课程的教学目的主要是两个方面，一是培养和提高学生对英语科技文献快速而系统的阅读能力，二是培养和提高学生对科技文献资料的英汉互译能力（而通常强调的是英语写作能力）。要达成上述目的，必然涉及大量的专业词汇和英语科技文献的语法、句法特点的运用，而专业词汇的积累，语法、句法特点的把握，只有通过大量的阅读和英汉互译，方能收到事半功倍之效。因此，只有学生强化了阅读能力和英汉互译能力，其听说读写译能力会得到全面的提升。

根据高等学校理工科《英语教学大纲》的要求和作者确定的教学目的，作者在阅读材料的选择中全面考虑了所涉及的单词和主题，并在练习中增加了能够真正检验学生阅读能力的练习题。本书共分7个部分，每个部分分若干单元，共32个单元，每个单元由一篇课文和一篇或多篇阅读材料组成。课文的内容是环境科学的一些基础原理，阅读材料是相应主题的延伸和新技术介绍。根据课文内容，配有相应练习题、注释和词汇表。课文和阅读材料均选自英文原版教材、科技报告、学术著作、专业期刊、国际会议论文集等，涵盖了环境科学与工程专业的相关领域。具体内容如下：

Part 1　介绍环境科学与工程的内涵及产生背景、全球环境问题等。

Part 2　介绍空气污染与控制，包括能源利用及能源效率（空气污染产生的主要原因）、空气污染类型及来源、空气污染影响、空气污染模拟及污染物排放估算方法、传统的和创新的空气污染治理技术等。

Part 3　介绍水污染及控制，包括水污染来源及种类、污水化学、污水中主要污染物的毒性影响、各种污水处理工艺、农业活动中产生的新兴的污染物等。

Part 4　介绍固体废弃物及处理方法，包括固体废物的来源及分类、垃圾填埋场对环境和健康的影响、危险废物管理、固体废物的回收及利用等。

Part 5　介绍噪声污染、土壤污染及控制技术。

Part 6　介绍环境工程中常用的技术手段，包括环境影响评价、生态风险评价及环境监测技术等。

Part 7　介绍污染预防，包括污染预防的基本概念和原则、绿色化学和可持续发展的基本原理以及生物技术的运用等。

本书的编写得到了重庆工商大学教材项目建设的资助，同时也得到了重庆工商大学环境与资源学院领导的大力支持。在编写的过程中，作者参阅了不少有益的资料和书籍，吸取了同行专家的宝贵经验。同时也得到了部分学生的问卷调查支持。谨在此一并表示感谢。

由于环境科学的多学科性，加之作者的水平有限，本书在材料选择上和文字处理上难免有疏漏和不妥之处，恳请读者不吝指教，使本书在使用过程中不断得到完善。

游　霞

2015 年 10 于重庆工商大学

Contents

Part 1

Introduction to Environmental Science and Engineering

UNIT 1 What is Environmental Science?

Environmental science is a multidisciplinary academic field that integrates physical, biological and information sciences (including but not limited to ecology, biology, physics, chemistry, zoology, mineralogy, oceanology, limnology, soil science, geology, atmospheric science, geography and geodesy) to the study of the environment, and the solution of environmental problems. Environmental science emerged from the fields of natural history and medicine during the Enlightenment①. Today it provides an integrated, quantitative, and interdisciplinary approach to the study of environmental systems. Related areas of study include environmental studies and environmental engineering. Environmental studies incorporate more of the social sciences for understanding human relationships, perceptions and policies towards the environment. Environmental engineering focuses on design and technology for improving environmental quality in every aspect. Environmental scientists work on subjects like the understanding of earth processes, evaluating alternative energy systems, pollution control and mitigation, natural resource management, and the effects of global climate change. Environmental issues almost always include an interaction of physical, chemical, and biological processes. Environmental scientists bring a systems approach to the analysis of environmental problems. Key elements of an effective environmental scientist include the ability to relate space, and time relationships as well as quantitative analysis.

Environmental science came alive as a substantive, active field of scientific investigation in the 1960s and 1970s driven by (a) the need for a multi-disciplinary approach to analyze complex environmental problems, (b) the arrival of substantive environmental laws requiring specific environmental protocols of investigation and (c) the growing public awareness of a need for action in addressing environmental problems. Event that spurred this development included the publication of Rachel Carson's landmark environmental book *Silent Spring*② and helped increase the visibility of environmental issues and create this new field of study.

Terminology

In common usage, "environmental science" and "ecology" are often used interchangeably, but technically, ecology refers only to the study of organisms and their interactions with each other and their environment. Ecology could be considered a subset of environmental science, which also could involve purely chemical or public health issues (for example) ecologists would be unlikely to study. In practice, there is considerable overlap between the work of ecologists and other environmental scientists.

Components

Atmospheric sciences focuses on the Earth's atmosphere, with an emphasis upon its interrelation to other systems. Atmospheric sciences can include studies of meteorology, greenhouse gas phenomena, atmospheric dispersion modeling of airborne contaminants, sound propagation phenomena related to noise pollution, and even light pollution.

Taking the example of the global warming phenomena, physicists create computer models of atmospheric circulation and infra-red radiation transmission, chemists examine the inventory of atmospheric chemicals and their reactions, biologists analyze the plant and animal contributions to carbon dioxide fluxes, and specialists such as meteorologists and oceanographers add additional breadth in understanding the atmospheric dynamics.

Ecology is the study of the interactions between organisms and their environment. Ecologists might investigate the relationship between a population of organisms and some physical characteristic of their environment, such as concentration of a chemical; or they might investigate the interaction between two populations of different organisms through some symbiotic or competitive relationship. For example, an interdisciplinary analysis of an ecological system which is being impacted by one or more stressors might include several related environmental science fields. In an estuarine setting where a proposed industrial development could impact certain species by water and air pollution, biologists would describe the flora and fauna, chemists would analyze the transport of water pollutants to the marsh, physicists would calculate air pollution emissions and geologists would assist in understanding the marsh soils and bay muds.

Environmental chemistry is the study of chemical alterations in the environment. Principal areas of study include soil contaminationand water pollution. The topics of analysis include chemical degradation in the environment, multi-phase transport of chemicals (for example, evaporation of a solvent containing lake to yield solvent as an air pollutant), and chemical effects upon biota.

As an example study, consider the case of a leaking solvent tank which has entered the habitat soil of an endangered species of amphibian. As a method to resolve or understand the extent of soil contamination and subsurface transport of solvent, a computer model would be implemented. Chemists would then characterize the molecular bonding of the solvent to the specific soil type, and biologists would study the impacts upon soil arthropods, plants, and ultimately pond-dwelling organisms that are the food of the endangered amphibian.

Geosciences include environmental geology, environmental soil science, volcanic phenomena and evolution of the Earth's crust. In some classification systems this can also include hydrology, including oceanography.

As an example study of soils erosion, calculations would be made of surface runoff by soil scientists. Fluvial geomorphologists would assist in examining sediment transport in overland flow. Physicists would contribute by assessing the changes in light transmission in the receiving waters. Biologists would analyze subsequent impacts to aquatic flora and fauna from increases in water turbidity.

(Selected from "http: //www. en. wikipedia. org/wiki/Environmental_science")

Words and Expressions

multidisciplinary	[mʌltidisə'plinəri]	*adj*. 多学科的
mineralogy	[minə'rælədʒi]	*n*. 矿物学
limnology	[lim'nɒlədʒi]	*n*. 湖沼学
geology	[dʒi'ɒlədʒi]	*n*. 地质学
geodesy	[dʒi'ɒdisi]	*n*. 测地学
interdisciplinary	[intə'disiplin(ə)ri]	*adj*. 跨学科的
enlightenment	[in'lait(ə)nm(ə)nt]	*n*. 启蒙
quantitative analysis		定量分析
perception	[pə'sepʃ(ə)n]	*n*. 感知
alternative	[ɔ: l'tɜ: nətiv]	*adj*. 可替代的
mitigation	[miti'geiʃ(ə)n]	*n*. 减轻
interaction	[intər'ækʃ(ə)n]	*n*. 相互作用
protocol	['prəʊtəkɒl]	*n*. 议定书
interchangeably	[intə'tʃeindʒəbl]	*adv*. 可交换地
subset	['sʌbset]	*n*. 子集
overlap	[əʊvə'læp]	*n*. 重叠
atmospheric dispersion modeling		大气扩散模拟
meteorology	[ˌmi: tiə'rɒlədʒi]	*n*. 气象学
terminology	[ˌtɜ: mi'nɒlədʒi]	*n*. 术语
approach	[ə'prəʊtʃ]	*n*. 方法、途径
phenomena	[fə'nɒminə]	*n*. 现象
airborne contaminants		空气传播污染物
propagation	[ˌprɒpə'ɡeiʃən]	*n*. 传播
circulation	[sɜ: kjʊ'leiʃ(ə)n]	*n*. 循环

infra-red radiation		红外辐射
transmission	[trænz'miʃ(ə)n]	*n.* 传播
inventory	['inv(ə)nt(ə)ri]	*n.* 清单
flux	[flʌks]	*n.* 流量
oceanographer	[ˌəʊʃiə'nɒ g rəfə]	*n.* 海洋学家
dynamics	[dai'næmiks]	*n.* 动力学
concentration	[kɒns(ə)n'treiʃ(ə)n]	*n.* 浓度
symbiotic	[simbai'ɒtik]	*adj.* 共生的、共栖的
stressor	['stresə]	*n.* 胁迫因子
estuarine	['estjʊərain]	*adj.* 江口的、河口的
flora and fauna	['flɔ: rə]&['fɔ: nə]	植物和动物群
marsh	[mɑ: ʃ]	*n.* 沼泽
alteration	[ɔ: ltə'reiʃ(ə)n]	*n.* 改变、变更
degradation	[ˌdegrə'deiʃ(ə)n]	*n.* 退化
species	['spi: ʃi: z]	*n.* 物种
emission	[i'miʃ(ə)n]	*n.* 排放、排放物
evaporation	[iˌvæpə'reiʃən]	*n.* 蒸发
solvent	['sɒlv(ə)nt]	*n.* 溶剂
biota	[bai'əʊtə]	*n.* 生物群
habitat	['hæbitæt]	*n.* 栖息地
endangered species		濒危物种
amphibian	[æm'fibiən]	*n.* 两栖动物
contamination	[kənˌtæmi'neiʃən]	*n.* 污染
arthropod	['ɑ: θrəpɒd]	*n.* 节肢动物
dwelling	['dweliŋ]	*v.* 居住
volcanic	[vɒl'kænik]	*adj.* 火山的
evolution	[ˌi: və'lu: ʃ(ə)n]	*n.* 进化
crust	[krʌst]	*n.* 地壳
hydrology	[hai'drɒlədʒi]	*n.* 水文学
oceanography	[ˌəʊʃə'nɒgrəfi]	*n.* 海洋学
soil erosion		水土流失、土壤侵蚀
surface runoff		地表径流
fluvial geomorphologist		河流地貌学家
sediment	['sedim(ə)nt]	*n.* 沉积、沉淀物
overland flow		坡面流
aquatic	[ə'kwætik]	*adj.* 水生的、水栖的
turbidity	[tɜ: 'bidəti]	*n.* 浊度
organism	['ɔ: g(ə)niz(ə)m]	*n.* 生物

Notes

① the Enlightenment 指 17—18 世纪发生在欧洲的启蒙运动。

② *Silent Spring*《寂静的春天》，1962 年出版，作者是美国海洋生物学家蕾切尔·卡逊。书中描述了由于农药的大量使用，人类可能将面临一个没有鸟、蜜蜂和蝴蝶的世界。正是这本不寻常的书，唤起了人们的环境意识，开启了全世界环境保护事业。

Exercises

1. Reading Comprehension Check.

Choose the best answer from the options given or fill in the blanks wherever required.

(1) Which of the following is *NOT* included in environmental science? __________.

A. Biology

B. Chemistry

C. Civil engineering

D. Mathematics

(2) The publication of book __________ initiated the growing environmental awareness of the public.

(3) According to the passage, computer models are created to simulate __________.

(4) Describe your understanding on symbiotic or competitive relationship.

(5) The changes of light transmission in the receiving waters is assessed by __________.

(6) "Population" of organism refer to __________.

(7) According to the passage, hydrology and oceanography can also be included in ________.

(8) Flora and fauna in the passage can be replaced by __________.

2. Describe your understanding on environmental science in English.

3. Translate the following passage into Chinese.

Environmental science came alive as a substantive, active field of scientific investigation in the 1960s and 1970s driven by (a) the need for a multi-disciplinary approach to analyze complex environmental problems, (b) the arrival of substantive environmental laws requiring specific environmental protocols of investigation and (c) the growing public awareness of a need for action in addressing environmental problems. Event that spurred this development included the publication of Rachel Carson's landmark environmental book *Silent Spring* and helped increase the visibility of environmental issues and create this new field of study.

4. List all environment-related sciences mentioned in the passage in English.

Reading Material

Environmental Chemistry and Environmental Biochemistry

Environmental chemistry encompasses many diverse topics. It may involve a study of Freon reactions in the stratosphere or an analysis of PCB deposits in ocean sediments. It also covers the chemistry and biochemistry of volatile and soluble organometallic compounds biosynthesized by anaerobic bacteria. Literally thousands of other examples of environmental chemical phenomena could be given.

Environmental chemistry may be defined as *the study of the sources, reactions,* transport, effects, and fates of chemical species in water, soil, air, and living environments, and the effects of technology thereon.

Environmental chemistry is not a new discipline. Excellent work has been done in this field for the greater part of a century. Until about 1970, most of this work was done in academic departments or industrial groups other than those primarily concerned with chemistry. Much of it was performed by people whose basic education was not in chemistry. Thus, when pesticides were synthesized, biologists observed firsthand some of the less desirable consequences of their use. When detergents were formulated, sanitary engineers were startled to see sewage treatment plant aeration tanks vanish under meter-thick blankets of foam, while limnologists wondered why previously normal lakes suddenly became choked with stinking cyanobacteria. Despite these long standing environmental effects, and even more recent and serious problems, such as those from hazardous wastes, relatively few chemists have been exposed to material dealing with environmental chemistry as part of their education.

Environmental Chemistry and the Environmental Chemist

An encouraging trend is that in recent years many chemists have become deeply involved with the investigation of environmental problems. Academic chemistry departments have found that environmental chemistry courses appeal to students, and many graduate students are attracted to environmental chemistry research. Helpwanted ads have included significant numbers of openings for environmental chemists among those of the more traditional chemical subdisciplines. Industries have found that well-trained environmental chemists at least help avoid difficulties with regulatory agencies, and at best are instrumental in developing profitable pollution control products and processes.

Some background in environmental chemistry should be part of the training of every chemistry student. The ecologically illiterate chemist can be a very dangerous species. Chemists must be aware of the possible effects their products and processes might have upon the environment. Furthermore, any serious attempt to solve environmental problems must involve the extensive use of chemicals and chemical processes.

There are some things that environmental chemistry is not. It is not just the same old chemistry with a different cover and title. Because it deals with natural systems, it is more complicated and difficult than "pure" chemistry. Students sometimes find this hard to grasp, and some traditionalist faculty find it impossible. Accustomed to the clear-cut concepts of relatively simple, well-defined, though often unrealistic systems, they may find environmental chemistry to be poorly delineated, vague, and confusing. More often than not, it is impossible to come up with a simple answer to an environmental chemistry problem. But, building on an ever-increasing body of knowledge, the environmental chemist can make educated guesses as to how environmental systems will behave.

Chemical Analysis in Environmental Chemistry

One of environmental chemistry's major challenges is the determination of the nature and quantity of specific pollutants in the environment. Thus, chemical analysis is a vital first step in environmental chemistry research. The difficulty of analyzing for many environmental pollutants can be awesome. Significant levels of air pollutants may consist of less than a microgram per cubic meter of air. For many water pollutants, one part per million by weight (essentially 1 milligram per liter) is a very high value. Environmentally significant levels of some pollutants may be only a few parts per trillion. Thus, it is obvious that the chemical analyses used to study some environmental systems require a very low limit of detection.

However, environmental chemistry is not the same as analytical chemistry, which is only one of the many subdisciplines that are involved in the study of the chemistry of the environment. Although a "brute-force" approach to environmental control, involving attempts to monitor each environmental niche for every possible pollutant, increases employment for chemists and raises sales of analytical instruments, it is a wasteful way to detect and solve environmental problems, degenerating into a mindless exercise in the collection of marginally useful numbers. Those responsible for environmental protection must be smarter than that. In order for chemistry to make a maximum contribution to the solution of environmental problems, the chemist must work toward an understanding of the nature, reactions, and transport of chemical species in the environment. Analytical chemistry is a fundamental and crucial part of that endeavor.

Environmental Biochemistry

The ultimate environmental concern is that of life itself. The discipline that deals specifically with the effects of environmental chemical species on life is environmental biochemistry. A related area, toxicological chemistry, is the chemistry of toxic substances with emphasis upon their interactions with biologic tissue and living organisms. Toxicological chemistry deals with the chemical nature and reactions of toxic substances and involves their origins, uses, and chemical aspects of exposure, fates, and disposal.

(Selected from "Manahan, Stanley E., *Environmental Science, Technology, and Chemistry, Environmental Chemistry*, Boca Raton: CRC Press LLC, 2000")

Unit 2 What is Environmental Engineering?

Environmental engineering is the integration of sciences and engineering principles to improve the natural environment, to provide healthy water, air, and land for human habitation and for other organisms, and to clean up pollution sites. Environmental engineering can also be described as a branch of applied science and technology that addresses the issue of energy preservation, production asset and control of waste from human and animal activities. Furthermore, it is concerned with finding plausible solutions in the field of public health, such as waterborne diseases, implementing laws which promote adequate sanitation in urban, rural and recreational areas. It involves waste water management and air pollution control, recycling, waste disposal, radiation protection, industrial hygiene, environmental sustainability, and public health issues as well as a knowledge of environmental engineering law. It also includes studies on the environmental impact of proposed construction projects.

Environmental engineers study the effect of technological advances on the environment. To do so, they conduct studies on hazardous-waste management to evaluate the significance of such hazards, advice on treatment and containment, and develop regulations to prevent mishaps. Environmental engineers also design municipal water supply and industrial wastewater treatment systems as well as address local and worldwide environmental issues such as the effects of acid rain, global warming, ozone depletion, water pollution and air pollution from automobile exhausts and industrial sources.

At many universities, environmental engineering programs follow either the department of civil engineering or the department of chemical engineering at engineering faculties. Environmental "civil" engineers focus on hydrology, water resources management, bioremediation, and water treatment plant design. Environmental "chemical" engineers, on the other hand, focus on environmental chemistry, advanced air and water treatment technologies and separation processes.

Additionally, engineers are more frequently obtaining specialized training in law and are utilizing their technical expertise in the practices of environmental engineering law.

Development

Ever since people first recognized that their health and well-being were related to the quality of their environment, they have applied thoughtful principles to attempt to improve the quality of their environment. The ancient Harappan civilization① utilized early sewers in some cities. The Romans constructed aqueducts② to prevent drought and to create a clean, healthful water supply for the metropolis of Rome. In the 15th century, Bavaria③ created laws restricting the development and degradation of alpine country that constituted the region's water supply.

The field emerged as a separate environmental discipline during the middle third of the 20th century in response to widespread public concern about water and pollution and increasingly extensive environmental quality degradation. However, its roots extend back to early efforts in public health engineering. Modern environmental engineering began in London in the mid-19th century when Joseph Bazalgette designed the first major sewerage system that reduced the incidence of waterborne diseases such as cholera. The introduction of drinking water treatment and sewage treatment in industrialized countries reduced waterborne diseases from leading causes of death to rarities.

In many cases, as societies grew, actions that were intended to achieve benefits for those societies had longer-term impacts which reduced other environmental qualities. One example is the widespread application of the pesticide DDT to control agricultural pests in the years following World War II. While the agricultural benefits were outstanding and crop yields increased dramatically, thus reducing world hunger substantially, and malaria was controlled better than it ever had been, numerous species were brought to the verge of extinction due to the impact of the DDT on their reproductive cycles. The story of DDT as vividly told in Rachel Carson's *Silent Spring* (1962) is considered to be the birth of the modern environmental movement and the development of the modern field of "environmental engineering".

Conservation movements and laws restricting public actions that would harm the environment have been developed by various societies for millennia. Notable examples are the laws decreeing the construction of sewers in London and Paris in the 19th century and the creation of the U. S. national park system in the early 20th century.

(Selected from "http//www. en. wikipedia. org/wiki/Environmental_engineering")

Words and Expressions

integration	[inti'greiʃ(ə)n]	*n.* 综合
engineering	[endʒi'niəriŋ]	*n.* 工程、工程学
habitation	[hæbi'teiʃ(ə)n]	*n.* 居住、住所
organism	['ɔ: g(ə)niz(ə)m]	*n.* 生物
applied science		应用科学
plausible	['plɔ: zib(ə)l]	*adj.* 似乎有理的
adequate	['ædikwət]	*adj.* 充足的、适当的
sanitation	[sæni'teiʃ(ə)n]	*n.* 环境卫生、下水道设施
disposal	[di'spəʊz(ə)l]	*n.* 处置
hygiene	['haidʒi: n]	*n.* 卫生、卫生学
sustainability	[sə'steinəbiləti]	*n.* 持续性、永续性
propose	[prə'pəʊz]	*v.* 建议