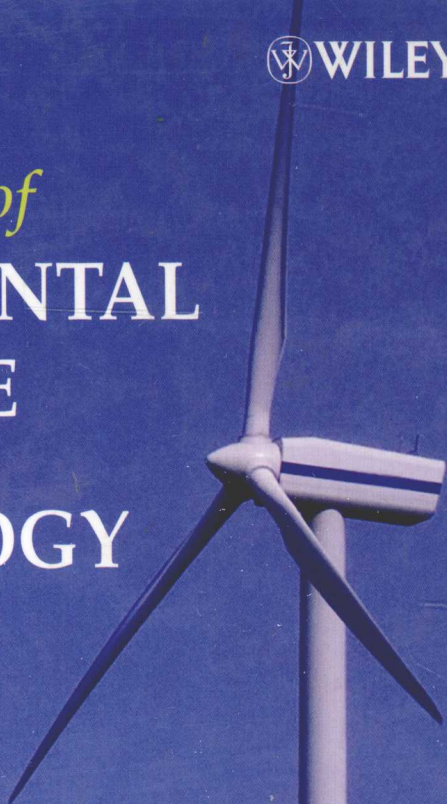


Dictionary of
ENVIRONMENTAL
SCIENCE
and
TECHNOLOGY

FOURTH EDITION

Andrew Porteous



Dictionary of Environmental Science and Technology

Fourth Edition

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John Wiley & Sons, Ltd

Fourth edition published 2008 by John Wiley & Sons Ltd,
Baffins Lane, Chichester,
West Sussex PO19 1UD, England
National (+44) 1243 779777
International (+44) 1243 779777

Third edition published 2000
Second edition published 1996
Revised edition published 1992
First edition published 1991 by Open University Press

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Library of Congress Cataloging-in-Publication Data

British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library

ISBN 978-0-470-06194-7 (cloth)

978-0-470-06195-4 (paper)

Typeset in 10/12pt Times by SNP Best-set Typesetter Ltd., Hong Kong
Printed and bound in Great Britain by TJ International Ltd., Padstow, Cornwall

*Dictionary of Environmental
Science and Technology*

Fourth Edition

By the rubbish in our wake, and the noble noise we make,
Be sure, be sure, we're going to do some splendid things!

Rudyard Kipling, *'The Road Song of the Bandar-Log'*



**To Margaret, for forty-five years of support,
care and love. And to Neil for the future**

Preface to Fourth Edition

This book is in effect, my '*apologia pro vita mea*,' thus all errors, omissions and commissions are down to me.

I have lived and breathed responsible environmental management all of my professional life, which commenced at the Thayer School of Engineering, Dartmouth College, USA, in 1964. The School instilled in me a thorough grounding in rational resource management, engineering rigour, and the necessity for accountable professional conduct.

It was with this background and in the belief that too much environmental illiteracy abounded that I essayed my first work *The Environment – A Dictionary of the World around Us*, published by Arrow in 1976. This was written in association with my friend and colleague Geoffrey Hollister, the visionary founding Dean of The Open University's Technology Faculty. Subsequently, this oeuvre metamorphosed into the current series of Dictionaries.

This edition would not have been possible without the unstinting help of my colleague and friend Dr Suresh Nesaratnam, Senior Lecturer in Environmental Engineering at The Open University, allied with the dedicated secretarial assistance of Mrs Rozy Carleton.

There is little left to say that has not been covered in the previous Prefaces except to bemoan (again) the levels of environmental ignorance and posturing of our political masters – *plus ça change*.

I conclude with the Persian proverb which has guided me since I discovered it in Dartmouth College Library in 1965.

'God will not seek thy race, nor will He ask thy birth. Alone, He will demand of thee "What hast thou done with the land that I gave thee?"'

Persian Proverb
Discovered in Dartmouth (USA) College Library (1965)

Preface to Third Edition

The need to consider the environmental impacts of any industrial activity is now taken for granted.

Advances in environmental literacy have led to much more questioning of, and accountability from, environmental professionals. Both are to be greatly welcomed.

This text has yet again been expanded to aid the above goals. I am gratified that it still is found to be useful.

My grateful thanks to all my colleagues (listed in the preface to the first edition) plus new colleagues, Dr Suresh T. Nesaratnam and Dr Stephen Burnley.

My secretary Mrs Morine Gordon has, as ever, helped the gestation immensely.

The holistic view of Lavoisier (1743–1794):

Rien ne se perd, rien ne se crée, tout se transforme

[Nothing is lost, nothing is created, everything is transformed] still holds true. It is how the transformation is effected that counts.

Andrew Porteous
Professor of Environmental Engineering
Faculty of Technology
The Open University
May 2000

Preface to Second Edition

Time marches on as they say, and this second edition is my way of documenting advances in environmental practices, knowledge and perceptions.

The opportunity has been taken to greatly expand the contents. I hope it meets with your approval.

My grateful thanks to my colleagues and my secretary Mrs Morine Gordon for typing this second edition.

Balaam (Numbers, Chapter 24), 'I came to curse [this task] but stayed to bless it!'

Andrew Porteous
Professor of Environmental Engineering
Faculty of Technology
The Open University

Preface

This text springs from an earlier attempt when, along with my colleague Geoffrey Holister, we endeavoured to lay the foundations for widespread environmental literacy in *The Environment – a dictionary of the world around us* published in 1976. This new work is not quite so ambitious; it is focused on the science and technology of environmental protection and resource management, as this is where the environmental payoffs are greatest.

The text has been principally written in basic SI units of kg, m, s, but in Tables and Figures, the units may be sub-values of the basic SI units, e.g. g/m³ or kg/h. The SI system is admirable for setting out theory and equations but can become cumbersome if numerical values have to be written frequently in terms of powers of ten. For example, volume flows have been written as litre/s which is much more familiar than using 10⁻³ m/s. Equations are written for temperatures in K, but Tables and Figures are given in °C because this is the common unit of practical measurement. On occasions, concentrations have been given in non-SI units as these are often enshrined in current legislation or codes of practice.

I should like to put on record my thanks to my colleagues Judy Anderson and Rod Barratt, who have reviewed the text with diligence, and to Lesley Booth who had the trying task of typing it. My colleagues Keith Attenborough, David Cooke, and David Yeoman have kindly commented on specific entries. Caryl Hunter-Brown, OU liaison librarian, compiled the invaluable directory of environmental organizations.

Andrew Porteous
Professor of Environmental Engineering
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Introduction

Stanley Clinton Davis in his 1987 Royal Society of Arts Lecture ‘The European Year of the Environment’ gave two reasons why the public wanted action by government on environmental issues now rather than later. These are given below.

All governmental decisions tend to be taken under pressure from particular special interest groups. And it is a sad fact that the producers of pollution are on the whole better at exerting such pressure than those who have to live with its consequences. The manufacturers of nitrate fertilizers are well organized to ensure that their views are known in official circles. Those who worry about the fish that subsequently die are not. There are, of course, exceptions to this rule. There are well organized campaigns in which the view of the man and woman in the street is fully brought home to the man (and sometimes woman) in the Ministerial Office – I vividly recall the recent example of baby seals – but they are rare. I have direct explanations of why they should continue to do whatever it is they are doing. And I receive a steady stream of letters from the public inevitably tending to be more personal, and less well argued. I find that I have to be constantly on the alert not to let myself be misled by the different levels of presentation.

The second reason why people are better than governments at spotting environmental needs goes still deeper. It is because environmental policy is fundamentally about the *future*, while governmental decision making is often too exclusively focused on the present.

These were brought home to me when I heard two senior British politicians respectively declaim on a television discussion programme ‘PCBs cause toxic algae blooms in the North Sea’ and ‘Fitting catalytic converters to cars may reduce sulphur dioxide but will still produce gases that deplete the ozone layer’.

More recently, the December 2007 political announcement that the UK will install 33 GW-worth of wind turbines around the coast by 2020, without regard to the feasibility of such an undertaking in terms of its cost, rate of construction and installation, and ensuring the National Grid can cope, let alone the ecological consequences, beggars belief. This is equivalent to the construction of 15–20 thermal power stations.

This book is written in the hope that it may contribute to environmental literacy, by providing basic definitions and data plus demonstrate the nature of the issues. Where appropriate, the technology and/or measures that are already available to prevent pollution and aid resource conservation are outlined. As our understanding of these becomes clearer, we may at least begin to appreciate a number of things that we must obviously *not* do and that is a start of sorts.

In writing this book I have had to select information from an almost infinite source of data, much of it conflicting. In making this selection, I have naturally had to apply my own value judgements as to which data are relevant and important and which are not. In doing this, I have attempted to be as objective as possible, but under such circumstances perfect objectivity is quite impossible. We cannot assess the value of data without passing a tacit judgement on the character of the source. Objectivity does not consist in giving equal weight to all statements.

Environmental problems are essentially multi-faceted and demand at least a nodding acquaintance with many previously separate specialisms – ecology, economics, sociology, technology, physics, chemistry, and so on. The world is an enormously complex system and it is in the nature of complex systems that the characteristics of the connections between the constituent parts are often more important than the nature of the separate parts themselves.

This book is designed for a multi-access approach on the part of the reader – it can be dipped into, as well as read straight through. The reason for this format is the obvious diversity of backgrounds and interests of the readers. Most of you who read this book will have some specialist knowledge of some aspect of our technological society, and are likely to be interested in one particular aspect of our environment more than another. The format of this book allows you to select those areas of interest, although because of the complex nature of environmental issues, you will find that *wherever* you start in this book, you will be led inexorably by the references to other areas of the problem that are probably new to you. But that is the nature of environment; everything is related, in some way or another, to everything else.

As Chief Seattle of the Suquamish Indians said of the earth over 130 years ago:

... The earth does not belong to man; man belongs to the earth . . . all things are connected . . .

Man did not weave the web of life, he is merely a strand in it. Whatever he does to the web, he does to himself.

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Phillip Russell and Hannah Rogers, of West Sussex County Council Waste Management Services, for their valued contribution to the entries for Hazardous Household Wastes, and Waste Electrical and Electronic Equipment.

Veolia Environmental Services, United Kingdom, for permission granted to publish emission data from the Energy-from-Waste Plants in Sheffield and Portsmouth.

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Abbreviations

AC	Activated carbon
ADAS	Agricultural Development and Advisory Service
ADI	Acceptable daily intake
A/G ratio	Arithmetic–geometric ratio
AOX	Adsorbable organically-bound halogens
ATU	Allythiourea
BAF	Biological aerated filter
BATNEEC	Best Available Technique Not Entailing Excessive Cost
BHC	Benzene hexachloride
BMWP	Biological Monitoring Working Party
BOD	Biochemical oxygen demand (BOD _x signifies measurement over x days)
BP	British Petroleum
BPEO	Best Practicable Environmental Option
BPM	Best Practicable Means
BS	British Standard (i.e. a standard set by the British Standards Institute (BSI))
BSE	Bovine spongiform encephalopathy
BSI	British Standards Institute
CEFIC	European Chemical Industry Council
CFRR	Catalytic flow reversal reactor
Ci	Curie
CNG	Compressed natural gas
CNL	Corrected noise level
COC	Committee on the Carcinogenicity of Chemicals in Food, Consumer Products and the Environment
COE	Catalytic oxidation of effluents
COMEAP	Committee on the Medical Effects of Air Pollutants
COP	Coefficients of Performance
CV	Calorific Value (units MJ/kg: MJ/Nm ³)
CWAO	Catalytic wet air oxidation
DANI	Department of Agriculture for Northern Ireland
dB	Decibel

dB(A)	Decibels A-scale
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DDVP	Dichlorvos 2,2-dichlorovinyl dimethyl phosphate
DES	Diethylstilboestrol
DETR	Department of the Environment, Transport and the Regions
DIPNs	Diisopropylnaphthalenes
DMT	Dimethyl terephthate
DNA	Deoxyribonucleic acid
DO	Dissolved oxygen
DOA	Dioctyladipate
DRE	Destruction and removal efficiency
EA	Environmental Assessment/Environment Agency
EALs	Environmental assessment levels
EB	Environment burden
EC	European Commission
ECF	Elemental chlorine free
EDTA	Ethylenediamine tetraacetate disodium salt or ethylenediamine tetraacetic acid
EEZs	Economic exclusion zones
EfW	Energy from Waste
EG	Ethylene glycol
EMAS	Eco-Management and audit scheme
EMS	Environmental Management System
EPA	Environmental Protection Act (1990)/Environmental Protection Agency (USA)
EPAQS	Expert Panel on Air Quality Standards
EPNdB	Effective perceived noise level
ER	Electroremediation
ERTS	Earth Resources Technology Satellite
ES	Environmental statement
ESA	Environmental Services Association
EU	European Union
FBR	Fluidized bed biofilm reactor
FID	Flame ionization detector
FMA	Forest Management Association
FMC	Field moisture capacity
GAC	Granulated activated carbon
GC	Gas chromatography
GHG	Greenhouse gas
GMO	Genetically modified organisms
GNP	Gross National Product
HACCP	Hazard Analysis and Critical Control Point