

DICTIONARY
OF
ENVIRONMENTAL
TERMS

Alan Gilpin

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Preface

Few words in the English language are quite so all-embracing as the word "environment", a word indicating everything external to an organism, which itself is part of the environment of other creatures.

Restraint must prevail, therefore, particularly in a Dictionary such as this of modest proportions; the terms included have been selected in a somewhat pragmatic manner, partly on the basis of those most frequently encountered by the writer within the context of environment protection responsibilities largely concerned with pollution in all its forms and its control, and partly on the basis of the kind of terminology heard at, and embodied in the supporting documents of, the first United Nations Conference on the Human Environment held in Stockholm in 1972.

Comments by users which might be useful in considering later revisions of, and additions to, this Dictionary will be welcomed and appreciated.

The assistance of those who have courteously given permission for the reproduction of diagrams and photographs is gratefully acknowledged.

A. G.
Melbourne
Victoria
September, 1974

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List of Abbreviations

g	gram
g/m ³	grams per cubic metre
kg	kilogram
kg/h	kilograms per hour
km	kilometre
m	metre
m ²	square metre
m/s	metres per second
mg	milligram
mg/m ² /d	milligrams per square metre per day
N/m ²	newtons per square metre
μg	microgram
μg/m ³	micrograms per cubic metre
μm	micron or micrometre
mg/l	milligrams per litre
μg/l	micrograms per litre
ng/l	nanograms per litre
ppm	parts per million (in air pollution measurements, parts per million by volume; in water pollution measurements, parts per million by weight)
MW	megawatt

In water quality 1 ppm = 1 mg/l = 1 g/m³

A

Abiotic Non-biological; thus an abiotic element is a physical or chemical feature of an ecosystem *q.v.*, or environment. *q.v.*

See Biotic.

Abyssal Zone The cold, dark, water zone of the ocean depths, below the euphotic zone *q.v.*; it corresponds roughly to the profundal zone *q.v.* of the lake habitat. No photosynthesis *q.v.* can occur at this level and animal life is sparse.

Acclimatization The process of phenotypic *q.v.* variation, as distinct from genetic variation, during which an organism undergoes morphological and/or physiological adaptation in response to various abiotic *q.v.* elements in the ecosystem *q.v.*, e.g. a response to nutritional levels or different altitudes or climates.

Accommodation The location of a population *q.v.* within a specific geographical area or volume of habitat *q.v.*

Acid Soot or 'acid smut. An agglomeration of carbon particles held together by moisture which has become acidic through combination with sulphur trioxide; soot particles range in size from about 1 mm to about 3 mm in diameter. The carbon particles are mainly coke spheres produced during combustion. Acid soot emitted from chimneys, leaves brown stains on materials and damages paintwork; the brown stain is caused by iron sulphate. The problem has been mainly associated with oil-fired installations equipped with metal chimneys. The potential hazard can be reduced by using fuels of relatively low sulphur content; operating plant with a minimum of excess air in order to reduce the formation of sulphur trioxide; elimination of air in-leakage to flues; the raising of back-end temperatures; the use of additives; the insulation of chimneys and ductwork; or by a combination of such measures.

Acoustic Reflex The mechanism by which the ear protects itself from extra loud sounds by in fact reducing them; just as the eye protects itself from extra bright light by contracting the pupil. When sound enters the ear, the

waves pass through the ear-canal to the eardrum which vibrates. The eardrum conducts these vibrations to three tiny bones or "ossicles". The ossicles change the loudness of sound before it enters the inner ear. The ossicles normally amplify soft sounds and dampen loud sounds as the connecting muscles contract or relax in response to the pressure of the sound waves. However, this mechanism operates successfully only over a certain range and its response is too slow to protect the ear from a sudden noise, e.g. a gunshot. Pain occurs as the ear unsuccessfully attempts to protect itself.

See also Sound Wave.

Acre-foot The volume of liquid or solid required to cover one acre to a depth of one foot.

Activated Sludge Process An aerobic *q.v.* process utilized in the secondary treatment *q.v.* plants for sewage; organic wastes are brought into contact with biologically active micro-organisms (in returned sludge) in the presence of mechanically introduced air. The activated sludge process is in effect an artificially accelerated self-purification process. When untreated sewage is mixed with a sufficient amount of biologically active sludge a rapid clarification takes place, the finely divided suspended and dissolved solids in the sewage being transferred to the surface of the sludge floc in which large numbers of organisms are concentrated. An artificial supply of air enables the organisms to continue their work of purification. A continuous supply of active sludge is mixed with the incoming sewage, and this necessitates returning a portion of the sludge obtained from the final settling tank to the sewage before it enters the activated sludge tank. The most common method of introducing oxygen into the sewage is to blow compressed air through porous plates placed in the bottoms of the tanks. Under-water paddles assist in the distribution of the air and help to keep the sludge in suspension. Improved designs of brush or blade-type surface aerators and other devices have increased the efficiency with which air is introduced into the aeration tanks. The sewage after passing through the activated sludge tanks is allowed to settle in secondary sedimentation tanks. After a detention time of two hours, the

activated sludge (other than that mixed with fresh sewage) is pumped to sludge digestion chambers
See Secondary Treatment. Also Figure 1.

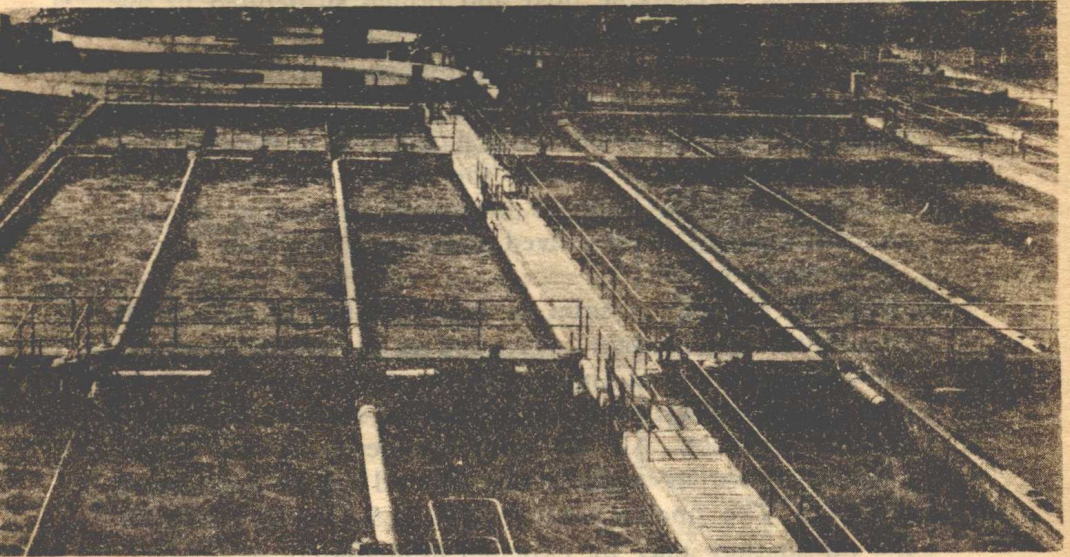


Figure 1 Rye Meads Sewage Works, England, showing in the foreground the activated sludge tanks in which aeration is controlled automatically (Source: Water Pollution Research Laboratory, Stevenage, England)

Adaptive Radiation Diversification of a group of organisms into subgroups which spread in various directions and into various environments *q.v.*; or, the phenomenon of distantly related organisms evolving similar ecological tolerances, and hence occupying similar niches *q.v.* in similar habitats *q.v.*

Adiabatic Process A process in which heat does not enter or leave the system. Adiabatic processes play a fundamental role in meteorology *q.v.*, e.g. if a parcel of air rises it expands against a falling environmental pressure, the work of expanding being at the expense of its internal energy resulting in a fall in temperature, despite the fact that no heat leaves the parcel.

Adjustment A behavioural response of organisms as a result of experience, resulting in internal changes to the social organization or in movement to a different situation.

Aerator A device for introducing air into a liquid, either

Aeroallergens

submerged (perforated pipe) or surface (mechanical paddles).

See Sewage Treatment.

Aeroallergens Vegetable dust and pollen suspended in the air which cause allergic diseases such as hay fever.

Aerobic Living or active in the presence of free oxygen; an aerobic process is one taking place in the presence of free oxygen. A state in which oxygen dissolved in water acts as an oxidizing agent. This is the normal condition of a healthy river, the rate of cleansing depending on the concentration of the dissolved oxygen *q.v.* available.

See Anaerobic.

Aerosol A particle of solid or liquid matter of such small size that it can remain suspended in the atmosphere *q.v.* for a long period of time; aerosols diffuse light, and the larger particles settle out on horizontal surfaces or cling to vertical surfaces. All air contains aerosols, the larger particles above 5μ in size being filtered out in the nose or bronchia. The smaller particles below 5μ in size pass into the lungs; they may be expelled immediately or retained for varying periods of time. Aerosols are classified into smoke, fumes, dust and mists.

Aetiology The science of the investigation of the cause or origin of disease.

Aggradation The building up of land by the deposition of material, e.g. by the deposition of detritus by streams where they flow over a surface of reduced gradient.

Air Mass Formed in the troposphere *q.v.*, a vast body of air having fairly uniform meteorological characteristics. Air masses are comparable in size with continents, moving in one of the atmospheric currents of the general atmospheric circulation. Fronts are theoretical surfaces dividing one air mass from another. An air mass is designated by geographic origin as either continental or maritime, tropical or polar.

Air Pollution The contamination of the atmosphere *q.v.* with undesirable solids, liquids and gases. In a strict sense, air may be considered polluted when there is added to it any substance foreign or additional to its normal composition. This definition of pollution is much too wide, however, for the purposes of practical air pollution control,

Substances with known effects on health (acute or chronic)	Substances thought to have long-term effects <i>per se</i> ^a	Potential long-term effects of combinations
Arsenic	Arsenic (arsenical dermatitis)	Be + F (fluorides potentiate pulmonary changes in berylliosis) Synergistic in pO ₂ depression Carcinogens produce tumours in presence of promoters Fluoride (promotes or accelerates lung disease) HC + O ₃ → tumorigen + influenza → cancer Antagonizes pollutants (strictly speaking not detrimental to health)
Asbestos	Asbestos (asbestosis, mesothelioma)	
Beryllium	Beryllium (berylliosis)	
Carbon monoxide		
Carcinogens		
Fluoride	Fluoride (fluorosis)	N ₂ O + micro-organisms (pneumonia) + HNO ₃ (bronchiolitis, fibrosa obliterans) + tars (smoker's lung cancer)
Hydrocarbons		
Hydrogen sulfide (possibly with mercaptans)		
Inorganic particulates	Inorganic particulates (pulmonary sclerosis)	
Lead		
Nitric Oxide		O ₃ + micro-organisms (lung-tumour accelerator) SO ₂ , SO ₃ + particulates aggravate lung disease
Nitrogen dioxide	Nitrogen dioxide (mild accelerator of lung tumours)	
Organic oxidants (peroxyacetylnitrates)		
Organic particulates (asthmagenic agents)	Asthmagenic agents (asthma)	
Ozone	Ozone (chronic lung changes, accelerated aging)	
Sulfur dioxide, sulfur trioxide		

^a Effects are given in parenthesis.

Table 1 Air pollutants with recognized or potential long-term effects on health at usual air-pollution levels (Source: World Health Organisation, *Research Into Environmental Pollution*, Technical Report Series No. 406, Geneva: 1968)

and the term "air pollution" is usually restricted to those conditions in which the general atmosphere contains substances in concentrations which are harmful, or likely to be harmful, to man or to his environment. A fuller definition of American origin is — "substances present in the atmosphere in concentrations great enough to interfere directly or indirectly with man's comfort, safety or health, or with the full use or enjoyment of his property". In respect of health, this reiterates the dictum that there are no such things as toxic substances, only toxic concentrations. The concept of concentration cannot be divorced, however, from time or duration of exposure; or from the acute or chronic effects likely to arise from high short-term or low long-term exposures respectively.

While London smog has diminished under the impact of progressive measures, it is interesting to distinguish between this type of smog and that of Los Angeles, which is of photochemical origin.

Photochemical smog is significant in other American cities and in Tokyo, while some of the eastern state capitals of Australia, notably Sydney and Melbourne, have proved to be candidates for this affliction in the course of time. Undoubtedly, the use in technical literature of such an imprecise term as "smog", as well as its variants such as "smaze" and "smust", creates confusion. The interchange of the results of air quality investigations is being made easier, however, through the adoption of a common nomenclature, consistent metric units, and uniform methods; this process is, however, far from complete.

See London Smog Incidents, Los Angeles Smog; Self-Cleansing. *also* Table 1.

Aitken Nuclei Small particles a few hundredths of a micron in diameter, which normally exist in the atmosphere *q.v.* in concentrations varying from a few thousand to a few hundred thousand per millilitre. They are produced in large number by most combustion processes.

Albedo That fraction of incoming solar energy *q.v.* which is reflected directly without being absorbed, a measure of the reflectivity of the Earth.

Aldehydes A class of chemical compounds intermediate

between alcohols and acids; most are colourless, volatile fluids with suffocating odours.

Aldrin A white insecticide containing a chlorinated derivative of naphthalene, $C_{12}H_8Cl_6$. It is especially effective against pests resistant to DDT *q.v.*

Algae Simple plants, containing chlorophyll *q.v.* and/or other photosynthetic pigments, found widely in water and other damp situations. Usually microscopic, these plants may be freely suspended or attached to surfaces. Component groups are classified on the basis of structure, pigments, flagella, and chemical nature of the cell wall. Algal growth is dependent upon the presence of a number of chemical elements in suitable proportions; these elements include phosphorus, nitrogen, carbon and many others. These nutrients are derived from a variety of sources; decay of natural vegetation, weathering of rocks including phosphorus deposits in some areas, human wastes, phosphate detergents, industrial effluents, and agricultural run-off.

See Eutrophication.

Alkyl Sulphonates (AS) Surface-active agents and basic components of synthetic detergents. Alkyl benzene sulphonate (ABS) is stable and resistant to biodegradation. The discharge of detergent residues containing ABS results in foaming of the receiving waters and interference with sewage treatment processes. Linear alkyl sulphonates (LAS) show much better biodegradability.

See Detergents.

Allelochemistry The study of secondary substances involved in interference occurring between two or more populations *q.v.*

Allelopathy Interference between populations involving the release of inhibiting chemicals.

Allopatric Populations *q.v.* with separate dispersal areas.

Alluvium Sediment transported by streams and deposited on land.

Alpha Diversity or niche *q.v.* diversification. Diversity occurring as a result of competition between species *q.v.* in more favourable environments; as a result the variation in individual species becomes more limited.

See Beta Diversity.

Alpha Radiation

Alpha Radiation Particulate radiation, each alpha particle being a helium nucleus of high velocity; the particles have a relatively low penetrating power.

See Beta Radiation, Gamma Radiation.

Altruistic Term applied to traits which have been selected because of their effects on group rather than individual survival.

Alveoli Innumerable minute, air-filled sacs in the human lungs; they are thin-walled and surrounded by blood vessels. It is through their surfaces that the respiratory exchange of oxygen and carbon dioxide occurs.

See Bronchitis.

Ambient Quality Standards or environmental quality standards. Maximum permissible limits, maximum allowable concentrations, maximum acceptable levels of pollutants in specified media other than the receptor *q.v.* designed to ensure that under specified circumstances a primary or secondary standard *q.v.* is not exceeded.

Ammonification The reduction of nitrates and nitrites to ammonium compounds by soil saprobes (putrid bacteria).

Anabatic Wind or mountain wind. Caused by air being warmed by contact with the ground during day-time and flowing uphill. Opposite of a katabatic wind *q.v.*

Anabolism A facet of metabolism *q.v.* relating to those changes involving the breakdown of foodstuffs and their rebuilding to form body tissues.

Anadromous Fish Fish, such as the salmon, which spends most of its growing years in the ocean and, after attaining sexual maturity, ascends freshwater streams in order to spawn. The erection of power and irrigation dams, or the presence of thermal pollution, may isolate considerable numbers of fish from their traditional spawning grounds.

Anaerobic Living or active in the absence of free oxygen; an anaerobic process is one taking place in the absence of oxygen. The remaining oxygen may be combined in the form of some organic or inorganic compound, e.g. nitrate or sulphate. If sulphate acts as an oxidizing agent, hydrogen sulphide *q.v.* is formed giving rise to objectionable odour. Sulphate-reducing bacteria, though present in rivers, are normally inhibited by the presence of dissolved or free oxygen.

See Aerobic.

Anaerobic Digestion A digestion process which permanently removes the offensive odour of many organic wastes so that they can be utilized on agricultural land without causing nuisance. A high proportion of the chemical oxygen demand *q.v.* can be removed with the recovery of the organic carbon as methane *q.v.*, while most of the lipids *q.v.* and other constituents which otherwise might attract flies and vermin are degraded. The wide variety of bacteria involved in the process may be classified into two broad groups:

1. Acid-producers (non-methanogenic bacteria) which, together with their associated enzymes, degrade most types of organic material mainly into the lower fatty acids (acetic acid accounting for about 80 per cent of the total) with much smaller amounts of lower aldehydes and ketones;
2. Methane-producers (methanogenic bacteria) which convert the soluble products of the acid-producers into a mixture of methane and carbon dioxide *q.v.*

Anion A negatively charged ion of an electrolyte which migrates towards the anode under the influence of a potential gradient.

Anode The electrode of an electrolytic cell at which oxidation occurs. Usually, in corrosion processes, it is the electrode that has the greater tendency to go into solution.

Anomaly A deviation from uniformity; a geological feature considered capable of being associated with commercially-valuable hydrocarbons *q.v.* or minerals.

Anoxia A deficiency of oxygen, e.g. in the tissues or in the blood, or in a body of water. In the Baltic, anoxic bottom-water conditions tend to persist in the deeper parts.

Antagonistic Effect The tendency of some chemicals and processes to react together to form combinations which may have a less powerful effect than the substances or processes taken separately, opposite of a synergistic effect *q.v.*. The term is also applied where the growth of one organism is inhibited by another through the creation of unfavourable circumstances, e.g. by exhaustion of the food supply.

Antibiotic A secondary biotic substance secreted by an organism which inhibits growth in other organisms.

Anticyclone

Anticyclone A high pressure area with winds rotating clockwise around the centre in the northern hemisphere and anti-clockwise in the southern hemisphere. There is a general slow descent of air over wide areas. In summer an anticyclone generally means fine, warm, sunny weather; in winter however dense sheets of stratocumulus cloud may be formed under high-pressure influences giving conditions known as "anti-cyclonic" gloom; as the air descends it is compressed and heated so that a deep inversion *q.v.* layer is formed, often resulting in fog.

See also London Smog incidents.

Application Factor The ratio between the concentration of some substance producing a selected chronic response and that causing 50 per cent mortality in 40 to 168 hours. From this may be derived the concept of the "safe application factor", i.e. that fraction of the lethal level of substance that would be environmentally safe for the organisms concerned.

See Incipient Lethal Level.

Aquiclude A geological formation of rock or soil which, although porous and capable of absorbing water slowly, will not transmit it fast enough to furnish an appreciable supply for a spring or well.

Aquifer A geological formation or porous soil *q.v.* through which water may percolate for long distances, perhaps very slowly, yielding ground water to springs and wells. The contamination of aquifers with industrial wastes may lead to the pollution of water supplies.

Aquitard A geological formation of rock or soil which retards the movement of ground-water. *q.v.*

Arboreal Relating to trees; hence an arborist is a person who studies trees, and arboriculture is concerned with forestry and the culture of trees.

Arthropoda A phylum *q.v.* of invertebrate animals with jointed limbs and a body divided into segments; the body generally is covered with a chitinous shell. The largest group in the animal kingdom in number of species, it includes crustaceans, insects, spiders, centipedes, and related forms.

Artificial Reef A method of solid waste disposal, which comprises the tipping into deep water of junk and debris,

rusting car bodies, used car tyres, and other material. The reef provides cover and breeding sites for various marine fish. The method has been used to advantage in New York City and San Francisco, without apparent detrimental effects.

Asbestos A broad term embracing several fibrous minerals with chrysotile, a hydrated magnesium silicate, being the most common form. Asbestos fibres may enter the general environment from the activities of asbestos cement industries and from the abrasion of brake linings in motor vehicles. Occupational exposure may cause specific chronic lung disease (asbestosis *q.v.*) while inhalation of asbestos by the general population may be a possible additional factor in the incidence of lung disease along with other air pollutants and smoking. Inhalation of asbestos has also been associated with mesothelioma (a rare form of cancer.)

Asbestosis A disease of the lungs caused by the inhalation of asbestos particles; sufferers are particularly liable to develop cancer of the lungs.

Association A conceptual grouping of populations in a community *q.v.* characterized by particular dominant species *q.v.*

Atmosphere The gaseous envelope of air surrounding the earth, the principle constituents of which are nitrogen and oxygen in proportions by volume of about 79.1 per cent and 20.9 per cent respectively. Carbon dioxide *q.v.* is also present to the extent of about 0.03 per cent, together with very small amounts of inert gases such as argon, krypton, xenon, neon and helium. Also present are water vapour, traces of ammonia, organic matter, ozone, salts, and suspended solid particles.

See also Greenhouse Effect; Meteorology.

Attribute Sampling Sampling in which the characteristic determined is simply a quality or attribute.

Australasian Region The biogeographical region comprising Australia, New Zealand, New Guinea, some eastern Indonesian Islands and some Pacific Islands.

Autotrophic Descriptive of organisms which synthesize organic from inorganic substances.