2. Recommendations

We have examined the present state of the human environment and the most important environmental problems. We have found that the basic problems result from adverse side-effects of advancing technologies and from the increasing rate of exploitation and unwise use of natural resources. Of special importance are the side-effects that have or may have a deleterious impact on human health and well-being. We have also found that the present machinery for environmental management and resource exploitation is based on insufficient knowledge. It is not possible at present to provide the information we need to define and understand the large-scale processes going on in the biosphere, partly influenced by man's activities. We are convinced, however, that better definition and understanding can be brought about by appropriate research and monitoring. This will not only provide criteria for environmental management in developed countries but will also enable developing countries to avoid environmental disamenities and to establish a rational system of natural resource management.

We have determined that a global environmental monitoring system is desirable, timely and feasible. We have also determined that such a global system can best be created through national efforts and by inter-governmental co-operation at the level of the United Nations, combined with strong supportive and advisory activities within the international scientific community.

In the light of our findings we, the Monitoring Commission of SCOPE, submit the following recommendations.

RECOMMENDATION 1

We *recommend* that the United Nations take immediate steps to foster and co-ordinate among the nations of the world a permanent global environmental monitoring system.

RECOMMENDATION 2

We *recommend* that, in view of the existence within the United Nations system and non-governmental organizations of both ongoing and planned monitoring activities for different media and the need for inter-media integration, the most efficient ways or means for co-ordinating these activities into a global environmental monitoring system be studied and particularly the need for establishing a Central Monitoring Co-ordinating Unit.

RECOMMENDATION 3

We *recommend* that the United Nations request the International Council of Scientific Unions to establish permanent institutional arrangements to

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provide scientific assistance in (a) the evolution and design of the global environmental monitoring system and (b) the analysis and interpretation of data pertinent to global environmental changes and the effects of such changes.

RECOMMENDATION 4

We have carefully analysed the possible ways by which a global environmental monitoring system could be created. We have found that it can best be brought about through inter-governmental co-operation based on national efforts. We therefore *recommend* that the United Nations invite each government and each inter-governmental and non-governmental organization actively involved in monitoring to designate an appropriate Monitoring Office for participation in the global environmental monitoring system. We *further recommend* that these Offices be so designed that close co-operation can be achieved between international, regional and national activities. We *also recommend* that, whenever practicable, the programmes of each nation or organization be evolved to obtain maximum integration between monitoring activities in the different media.

RECOMMENDATION 5

We *recommend* that an international integrated network of reference stations (low exposure or "baseline" and medium exposure or "regional" areas, transects or sites) based on national activities be established for the collection of data pertinent to global environmental monitoring.

We *further recommend* that an establishment period be initiated immediately which includes a minimum priority monitoring programme and pilot research programmes, followed by a development period that emphasizes the establishment of additional stations and the inclusion of additional variables into the monitoring system.

RECOMMENDATION 6

We *recommend* that within the network of reference stations at least ten terrestrial (including freshwater) baseline stations be established immediately and that at least one be located in each of the following regions: (1) northern tundra, (2) northern coniferous forest, (3) northern hemisphere temperate grassland, (4) arctic or antarctic, (5) high mountain, (6) tropical forests, (7) desert or semi-desert, (8) tropical savanna or grassland, (9) oceanic island, (10) temperate deciduous forest.

Baseline stations in the marine environment should be established after pilot studies (Recommendation 15).

We *further recommend* that nations be invited to nominate sites for immediate establishment as baseline stations or for inclusion at a later stage.

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RECOMMENDATION 7

We *recommend* that the following first priority physical and chemical data be collected as a minimum programme at the baseline stations and in all relevant media of air, water, soils and biota from the beginning of the establishment period.

a) For assessing secular changes of the global climate:
  1. Atmospheric turbidity (aerosol content)
  2. Atmospheric carbon dioxide
  3. Solar radiation
     a) broad-band direct, and diffuse radiation
     b) narrow-band direct radiation
     c) net (incident minus reflected) all-wave radiation
  4. Standard meteorological data
b) For assessing the degree of pollution in all media:
  5. Mercury
  6. Lead
  7. Cadmium
  8. DDT, its metabolites and degradation products
  9. Polychlorinated biphenyls

We *further recommend* that the following variables be seriously considered for addition to the baseline station programme during the development period and if necessary after pilot studies.

a) For assessing secular changes of the global climate.
  1. Vertical distribution of aerosols
  2. Size distribution of aerosols
  3. Rawindsonde data
  4. Surface vertical fluxes of carbon dioxide
  5. Ozone, water vapour and trace gases in the stratosphere (in association with the reference station programme)
  6. Global albedo by satellites (in association with the reference station programme)
b) For assessing the degree of pollution of the biosphere:
  7. Petroleum products
  8. Persistent organochlorine compounds other than DDT
  9. Chlorinated aliphatic hydrocarbons
  10. Chlorinated phenoxy acetic acid derivatives
  11. Relevant compounds in the cycles of S, N, P and C
  12. Certain metals (As, V, Zn, Se, Cr, Cu, Be, Ni, Mn)
  13. Organophosphorus compounds
  14. Oxygen in water

We *also recommend*

  1. That other potentially harmful substances be continuously reviewed for possible inclusion in the routine programme (for example antibiotics, hormones, carcinogens, teratogens, mutagens).

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2. That the possibilities of using biological accumulators and indicators be investigated by pilot studies.
3. That all the measurements be standardized and co-ordinated in space and time so that the resulting data together with appropriate information about sources and flux rates in the environment can be used to construct global dynamic budgets of pertinent substances.

RECOMMENDATION 8

We *recommend* that a number of regional stations be established and included in the network of reference stations and that nations be invited to nominate one or more sites for that purpose.

RECOMMENDATION 9

We *recommend* that the programme of the regional stations should be correlated with that of the baseline stations especially to allow global budgeting. For the establishment period we *recommend* the following variables to be measured:

1. Atmospheric turbidity (aerosol content)
2. Solar radiation
   a) broad-band direct and diffuse radiation
   b) net (incident minus reflected) all-wave radiation
3. Standard meteorological data
4. Mercury
5. Lead
6. Cadmium
7. DDT, its metabolites and degradation products
8. Polychlorinated biphenyls

We *further recommend* that the variables to be included at the baseline stations during the development period also be examined for possible inclusion at the regional stations.

RECOMMENDATION 10

We *recommend* that the different nations be invited to establish high exposure areas to investigate the correlation between high levels of contaminants (single and in combination) and possible effects on human health and the performance of biological systems and that the results from these studies be made available.

RECOMMENDATION 11

We *recommend* that a coherent programme, broadly along the lines indicated below, be developed to monitor those aspects of human health

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known or suspected to be environmentally induced. Accordingly, we *recommend* that the geographical distribution of the following be periodically surveyed wherever data can be obtained: actuarial data on life-expectancy, age-structure of populations and excess crude mortality and growth rate in terms of body weight and height.

We *further recommend* that the frequency of certain age-linked and other relevant diseases and disorders, known or suspected to be induced by the long-term ingestion of trace amounts of environmental contaminants, be periodically surveyed wherever data can be obtained (special attention should be given to diseases of the blood and cardiovascular system and certain forms of cancer). As far as is possible, these disease-surveys should be carried out in populations carefully selected to represent various age-groups and degrees of exposure to urban, industrial and intensively-agricultural conditions. In association with carefully selected sample populations from these surveys, analyses of human tissue (blood, soft tissue and bone), human food, drinking water and air, should be carried out for heavy metals and organochlorine compounds. Pb, Hg, Cd, DDT and PCB are suggested for the initial programme.

RECOMMENDATION 12

We *recommend* that at least two International Research Reference Stations be established, of which at least one should be in a tropical area. They should be internationally staffed and funded. In addition to the objectives of the ordinary reference baseline stations, these research stations should have the major function of determining other variables to be measured at all stations and of developing standard methods for accomplishing such measurements. These stations, which should be fully counselled by the international scientific community, should also serve as a training centre for national scientists and technicians who will participate in reference station programmes.

We *further recommend* that nations be invited to propose areas for these stations.

RECOMMENDATION 13

We *recommend* that biome studies be started immediately in association with the reference stations. These biome studies should be designed to provide information on the structure and functioning of representative ecosystems pertinent to the rational management of their resources and to obtain methods for monitoring the effects on biota of environmental change (See also Recommendation 15, item 2). We further *recommend* that monitoring for the following be implemented immediately.

1. Vanishing or endangered ecosystems
2. Vanishing or endangered vertebrates

3. Population size and distribution of birds
4. Short-lived biological phenomena

RECOMMENDATION 14

We *recommend* that pilot programmes be designed for the following monitoring activities, that cannot be confined to the networks of stations.

1. Repetitive surveys of gross vegetation pattern and land use of earth's surface (if possible with a satellite sensing system).
2. Repetitive surveys of erosion and soil cover of the continents (if possible with a satellite sensing system).
3. Monitoring of abundance and distribution of vanishing or endangered species, particularly mammals and birds, and endangered ecosystems or biocoenoses.
4. Monitoring changes in abundance and distribution of birds (a system of numerous sample plots for whole communities and special systems for selected groups of species, namely birds of prey, certain oceanic species and waterfowl).
5. Monitoring selected significant aspects of abundance, composition or activity of soil organisms in suitable areas.

RECOMMENDATION 15

We *recommend* that proper action be taken immediately to implement research activities and pilot studies to define and, if necessary, develop efficient monitoring programmes in the following areas:

1. The design of a programme for monitoring physical and chemical variables in the marine environment including the selection and establishment of reference networks. High priority should be given to those variables given high priority at the terrestrial reference stations and to petroleum products.
2. The isolation and development of biological parameters pertinent to the monitoring of specific and integrative effects on biota of environmental changes, namely relevant population characteristics (for example life-expectancy, age-structure and fecundity), community characteristics (for example species diversity), data on indicator species and processes (for example sensitive plant species or physiological processes) and incidence of congenital malformations and genetical changes.
3. The development of a programme for continuous registration of short-lived phenomena as early indicators of potential future global problems.
4. The design of a system for preserving samples from air, water, soils and biota in order to make future re-examinations of past environmental conditions possible (environmental archives).

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5. Analyse the needs and possibilities of aerobiology as a method for global environmental monitoring.

RECOMMENDATION 16

We *recommend* that operations-manuals be prepared, describing in detail the basic methods of measurement and observation for the networks of reference stations and other monitoring programmes. Periodic revisions of the manuals will be necessary as existing techniques are improved and new items are added to the agreed list of parameters within the global environmental monitoring system.

RECOMMENDATION 17

We *recommend* that the United Nations invite its agencies and other relevant organizations, in collaboration with the Central Monitoring Co-ordinating Unit, (Recommendation 2), to institute discussions to formulate, define and assign responsibility for individual contributions to a practicable and unitary monitoring programme.

We *further recommend* that these discussions recognize the value of the very wide range of environmental monitoring which is proposed and planned and of the competent ongoing programmes which have been in existence for some time. These include (a) territorial monitoring activities which are the sole concern of each national government, (b) regional programmes where a sharged resource or region is collaboratively monitored by those governments directly affected and (c), the UN agency and other intergovernmental or non-governmental programmes for climatic change, human health and toxicology, marine conditions, radioactivity, education and training.

RECOMMENDATION 18

We recognize that the global environmental monitoring system is an integrated part of a much more comprehensive framework for policies, research and actions in the field of environmental affairs in general, and that monitoring cannot operate with maximum efficiency without close connection to these other environmental activities. We also recognize that no organization presently exists with the responsibility of co-ordinating all global environmental activities.

We therefore *recommend* that serious considerations be given to identifying or establishing within the United Nations system an appropriate unit to carry out this function.

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