



**Workshop on African Regional Network  
for Environmental Chemistry**

**Nairobi, Kenya, 19-23 September 1977**

**FINAL REPORT**

**UNESCO Regional Office for Science and Technology for Africa  
P.O. Box 30592, Nairobi, Kenya.**

U N E S C O  
Regional Office for Science and Technology  
for Africa

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F I N A L R E P O R T

WORKSHOP  
ON  
AFRICAN REGIONAL NETWORK  
FOR  
ENVIRONMENTAL CHEMISTRY

19-23 September 1977

held at

UNESCO Regional Office for Science  
and Technology for Africa

Nairobi Kenya

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**REPORT OF THE WORKSHOP ON AFRICAN REGIONAL  
NETWORK FOR ENVIRONMENTAL CHEMISTRY**

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**INTRODUCTION**

The January 1974 Dakar Conference, under the auspices of UNESCO, of Ministers of African Member States Responsible for the Application of Science and Technology to Development (CASTAFRICA) emphasized the need for the training of African scientific and technological personnel at all levels as a matter of priority. To achieve this objective, the Conference made important recommendations, one of which was the creation of an African Network of Scientific and Technological Institutions devoted to higher education, training, research and development. As a follow-up to this recommendation, UNESCO employed a top consultant, Professor S. O. Awokoya, to sample opinions in various African countries on this idea of a network. The consultant visited 19 African universities in East, West and Central Africa and found that all the institutions strongly welcomed the creation of such a network and believed it would help in the development of their faculties. The Awokoya Report<sup>(1)</sup> was accepted by UNESCO and it then identified Environmental Chemistry as an important discipline of global interest on which the first African sub-regional networks on basic sciences can be established.

UNESCO then commissioned Professor S. Jensen, University of Stockholm and Professor D. Odhiambo, University of Nairobi, to undertake a survey of the problems, interests and capabilities for the training and research in Environmental Chemistry in selected African countries, based on the Awokoya report. They summarized their findings in a report to UNESCO.<sup>(2)</sup>

**Meeting of Experts on Environmental Chemistry**

A Constitutive Assembly of the Deans of Faculties of Science of African universities, in which the environmental chemistry experts took part, was convened at the UNESCO Regional Office for Science and Technology for Africa (ROSTA), Bruce House, Nairobi, Kenya from 19 to 23 September 1977 to formally launch the "Association of Faculties of Science in African Universities" and draw up its Constitution. Overlapping with this Assembly was the Workshop of Experts on Environmental Chemistry, also convened by UNESCO to examine Awokoya and Jensen report and advise on how to successfully organize the African Regional Network for Environmental Chemistry.

The first meeting of the Workshop on the Environmental Chemistry Network commenced on Wednesday, 21 September 1977 at 2.30 p.m. in the Conference Room of ROSTA, Nairobi.

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(1)

A report on the creation of an African Network of Institutions engaged in Scientific and Technological Research and Higher Education by S. Oluwole Awokoya.

(2)

Mission report on problems, interests and capabilities for the training and research in Environmental Chemistry in selected African countries by S. Jensen and D. Odhiambo.

Dr. Maybury of UNESCO enumerated useful guidelines on what the Workshop may deliberate on and the expectations of UNESCO after the Workshop had completed its task.

Before the meeting set about its business, officers were elected as follows:

Chairman	Professor Ernest H. Wright Head of Chemistry Department Fourah Bay College University of Sierra Leone <u>FREETOWN</u> Sierra Leone
Vice-Chairman	Professor A. Adjangba Département de Chimie Ecole des Sciences Université du Bénin B.P. 1515 <u>LOME</u> Togo
English Language Rapporteur	Dr. Oladele Osibanjo Department of Chemistry University of Ibadan <u>IBADAN</u> Nigeria
French Language Rapporteur	Dr. P. Rasoanaivo Etablissement d'Enseignement Superieur des Sciences Laboratoire Chimie Organique Structurale B.P. 906 <u>TANANARIVE</u> Madagascar

#### Jensen and Odhiambo Report

The mission highlighted four main capabilities in the various places visited, namely:

1. Lack of adequate number of trained personnel
2. Lack of availability of equipment and other laboratory facilities which could facilitate work in Environmental Chemistry.
3. Acute shortage of adequately trained laboratory technicians
4. The need for postgraduate training in environmental chemistry, if the network is to be effective.

On page 26 of its report, the mission recommended the immediate setting up of two network centres at :

Nairobi for the East African sub-region; and

Ibadan for the West African sub-region.

Ibadan and Nairobi are to be centres of activity and secretariats for Networks in the respective sub-regions. It was however suggested that the secretariat for networks should rotate among the universities in each sub-region.

Part of the programme of activity suggested by the mission are:

- i. that the scientists interested in Analytical Chemistry should during this inaugural meeting formulate detailed programmes for a workshop on analytical techniques relevant to environmental chemistry early in 1978.
- ii. that the Workshop be attended by one person in each department to strengthen their analytical techniques used in environmental chemistry
- iii. that consultants for these workshops be identified, one each for West Africa and East Africa.
- iv. that funds be made available for the networks in 1978.

After going through the consultant report, the meeting was opened for discussion. Attempts were made to define Environmental Chemistry. There was no acceptable absolute definition. However, there is a general feeling among delegates that while there is a need for a broad definition of Environmental Chemistry, natural products chemistry should not be included in such a definition.

After a prolonged deliberation, a consensus was reached that Environmental Chemistry may be defined as : "The Chemistry of or associated with changes that occur in our environment as a result of man's exploitation of its natural resources".

## DOCUMENT ON AFRICAN REGIONAL NETWORK FOR ENVIRONMENTAL CHEMISTRY

### INTRODUCTION

The Network for Environmental Chemistry is part of the programme of African Regional Networks of basic scientific institutions. The meeting of the experts therefore prepared a document outlining the network structure, functions, programmes, institutional assignments and budget.

### Network Structure

It was generally agreed that all African universities and institutions whose teaching and research programmes fall within the acceptable definition of Environmental Chemistry shall be participating institutions in the network.

For administrative convenience, the African region was divided into two, namely: the Eastern sub-region and the Western sub-region. The meeting agreed with the consultant report that two coordinating centres for the networks be created one each in the East and West sub-regions respectively. The selection of Ibadan and Nairobi as the coordinating institutions was ratified by the experts based on the following criteria:

- i. Staffing position - availability of competent academic staff and services, laboratory and electronic technicians.
- ii. Equipment
- iii. Facilities for postgraduate training, e.g. running an M. Sc. course in Analytical Chemistry or Environmental Chemistry.
- iv. Degree of research activity in environmental chemistry
- v. Good library facilities.

It was a general view of the meeting that the coordinating centres should continue to do active research, be training centres for other institutions in their sub-networks and also serve as secretariats. The two sub-networks should coordinate their activities and not work in isolation. Moreover, there should be a coordinator for each sub-network who may be appointed by the Head of Department of Chemistry in the institution concerned. There should also be an executive committee for each sub-network with a secretary-general.

#### Functions of the Network

The major functions of the network would be:

- i. the carrying out of cooperative research in areas related to environmental chemistry,
- ii. improve capabilities of laboratories in the network to carry out those functions in (i) above by training of research personnel, technical staff, maintenance of old equipment provision of new equipment and encouraging inter-institutional services such as the provision of a mobile team of service engineers or offering analytical services by well equipped laboratories to less-equipped departments.
- iii. organisation of workshops and seminars; dissemination of research activities and the results of these by means of publications in form of journals, newsletters, etc. and maintaining a directory of environmental chemists.
- iv. as a matter of urgency, upgrade one of the institutions in the French speaking countries to be able to carry out training programmes for technicians, for example, Dakar, Abidjan or Madagascar.
- v. To encourage proper teaching of analytical chemistry at the undergraduate level and at the same time increase awareness of the students in environmental chemistry.
- vi. to institute postgraduate educational programmes in Environmental Chemistry in the member institutions to provide the necessary manpower for teaching, research and society needs.

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### Programme and Institutional Assignments

Research projects in environmental chemistry are by nature interdisciplinary and therefore, the meeting suggested that the centres in the network should make all efforts to involve other disciplines in their researches as the situation demands.

The experts mapped out four broad areas of research and training activities, namely:

- a) Air environment
- b) Water environment
- c) Land environment
- d) Industrial pollution

These research programmes are distributed into the various institutions as shown in the tables below, based on 2 criteria:

- institutions already doing research in these areas;
- institutions who indicate future interest in these topics.

#### A. Air Environment

	<u>Research Areas</u>	<u>Participating Institutions</u>
1.	Pesticide residues and pesticides studies	Burundi, Malawi, Nairobi, Dar-es-Salaam, Ibadan, Legon (Accra), Sierra Leone, IITA (Ibadan), Benin (Lome)
2.	Air pollution and atmospheric studies	Malawi, Khartoum, Accra, (Atomic Energy Unit), Ibadan, Abidjan, Cape Coast (Ghana), Sierra Leone, Lagos, Tananarive, Nairobi
3.	Energy resources	Malawi, Sierra Leone, Ibadan, Dakar, Niger.
4.	Environmental laboratory techniques	Ibadan

#### B. Water Environment

	<u>Research Areas</u>	<u>Participating institutions</u>
1.	Water quality and water pollution	Malawi, Nairobi, Khartoum, Benin (Nigeria), Ibadan, Kumasi, Legon (Accra), Cape Coast (Ghana), Sierra Leone, Benin (Lome).



B. Water Environment

<u>Research Areas</u>	<u>Participating institutions</u>
2. Food contamination and nutritive aspects of foodstuffs	Dar-es-Salaam, Benin (Nigeria), Ibadan, Sierra Leone, IITA (Ibadan), Benin (Lome)
3. Pesticide pollution and pesticide studies	Same as A <sub>1</sub>
4. Environmental aspects of the utilisation of natural resources	Rwanda, Nairobi, ICIPE (Nairobi), Mauritius, Tananarive, Dar-es-Salaam, Benin (Lome), Ibadan, Sierra Leone.
5. Wildlife pollution	Nairobi, SRI (Tanzania)
6. Energy resources	Same as A <sub>3</sub>
7. Environmental laboratory techniques	Same as A <sub>4</sub>

C. Land Environment

<u>Research Areas</u>	<u>Participating institutions</u>
1. Food contamination and nutritive aspects of foodstuffs	Same as B <sub>2</sub>
2. Soil studies, soil pollution and fertilizers studies	Lesotho, Nairobi, Abidjan, Ibadan, Sierra Leone, IITA (Ibadan), Benin (Lome), Cape Coast (Ghana)
3. Pesticide pollution and pesticide pollution studies	Same as A <sub>1</sub>
4. Environmental aspects of the utilisation of natural resources	Same as B <sub>4</sub>
5. Wildlife pollution	Same as B <sub>5</sub>
6. Energy resources	Same as A <sub>3</sub>
7. Environmental laboratory techniques	Same as A <sub>4</sub>

D. Industrial Pollution

<u>Research Areas</u>	<u>Participating institutions</u>
1. Pollution in mining	Zambia, Dar-es-Salaam, Cape Coast (Ghana), Kumasi, Guinea, Ibadan.

D. Industrial Pollution

	<u>Research Areas</u>	<u>Participating institutions</u>
2.	Environmental laboratory techniques	Same as A <sub>4</sub>
3.	Occupational health hazards	Ibadan, Lagos.

Network Budget

Since the take off of the network depends on availability of funds, a provisional estimated budget was arrived at by the experts.

The financing of the activities of the network was considered under 4 major areas of activities, viz:

- a) Information and Communication
- b) Training
- c) Research and development functions
- d) Secretariat

(as shown below)

a)	<u>Information and Communication</u>	<u>US \$</u>
	Meetings	25,000.-
	Informative Service	25,000.-
	Directory of scientists	500.-
	Publications	5,000.-
	Specialized seminars	10,000.-
	Professional Organizations	5,000.-
	Inventory of equipment	1,000.-
		<u>\$ 71,500.-</u>
b)	<u>Training</u>	
	Exchange of specialists	25,000.-
	Student exchange and postgraduate scholarships	10,000.-
	Training of technical staff	25,000.-
	Fellowships	60,000.-
	Training courses (lecturers, participants costs, materials)	50,000.-
		<u>\$170,000.-</u>
c)	<u>Research and Development Functions</u>	
	Mobile service engineers	60,000.-
	Sharing of facilities	10,000.-
	Coordination of research and development	5,000.-
	Grants for additional equipment to participating institutions	500,000.-
	Special chemicals	5,000.-
		<u>\$580,000.-</u>
d)	<u>Secretariat (2 headquarters)</u>	10,000.-
	<b>T O T A L</b>	<u><u>\$831,500.-</u></u>

### PRIORITY BUDGET

This estimated budget of US \$831,500.- would be progressively reached. This sum indicates the network's financial expenditure when it has finally taken off.

Being the first year of activity, the budget was re-examined in the light of the immediate priorities of the network. The meeting decided that priorities be given to:

- i. Training of technicians
- ii. Mobile team of service engineers
- iii. Research areas. In order of priority, the experts recommended research work should commence on the following 4 projects in the first year, i.e.
  - A (1) Pesticide pollution and pesticide studies
  - B (1) Water quality and water pollution
  - B (4) Environmental aspects of the utilisation of natural resources
  - B (ii) Food contamination and nutritive aspects of food

Based on the above considerations, the estimated expenditure budget of the network for the research projects is US \$150,000.- and US \$85,000.- for the training of technicians (US \$25,000.-) and for the mobile team of service engineers (US \$60,000.-). The grand total for the priority budget is US \$235,000.-.

### Network Workshop

The meeting agreed that the Workshop should not take place at one centre but in 2 or more centres to avoid overcrowding, and afford small participants groups opportunities to do useful work during the workshop. However, because of limited funds available, it was decided that the workshop in 1978 be limited to participants currently doing active work in environmental chemistry. The proposed 2 workshops at Ibadan and Nairobi are to run consecutively for 10 days each. The need for the same consultant for both workshops was suggested.

The meeting elected Dr. O. Osibanjo, Chemistry Department, University of Ibadan to organize the publication of a newsletter with the cooperation of ROSTA, Nairobi.

Annex A

MEETING ON AFRICAN REGIONAL NETWORK  
FOR ENVIRONMENTAL CHEMISTRY

A G E N D A

1. Opening Session
2. Election of Chairman, Vice-Chairman and Rapporteurs
3. Statement by UNESCO/ROSTA on objectives of work
4. Presentation and discussion of working papers.
  - a) Background paper on Networks  
by Professor S. O. Awokoya
  - b) Mission report by Professors  
Odhiambo and Jensen
5. Preparation of document outlining network structure, functions, programmes, institutional assignments and budget.
6. Adoption of Report
7. Closing Session

Meeting on African Regional Networks  
of Basic Scientific Institutions  
Nairobi, Kenya : 19-27 September 1977

Workshop on African Regional Network  
for Environmental Chemistry

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III. List of Environmental Chemistry Projects  
being undertaken at the Institute of  
Aquatic Biology -- C.S.I.R., Ghana

1. Nutrients levels in the inland and coastal water systems in Ghana
2. Chlorophyll contents of the Volta Lake and the Volta River
3. Heavy metal levels in inland and coastal ecosystems in Ghana
4. Fluoride content of waters and surface soils in Ghana
5. Nutrient and microbiological pollution in streams and lagoons in Accra region.
6. Levels of pesticide residues in water, sediments, soils and tissues of livestock and wildlife.
7. The stability of pesticides, Abat and other possible insecticides to be used in Onchocerciasis Control Project in West Africa.
8. The Effect of Pesticides on fish and other non-target biota in an aquatic ecosystem
9. Toxicity of pesticides to fish and biota in the laboratory and field.
10. The uptake, accumulation and excretion of pesticides by laboratory mammals

Equipment

1. Pye Unicam SP 500
2. Orion Ion-Selective Electrode
3. Pye Unicam Series 104 Gas Chromatograph with ECD

IV. Fields of Research in Togo

A. Research at the University of Benin

1. Chemistry Department (School of Science)

- Organic Chemistry of natural substances
- Isolation, analysis and pharmacological and physiological testing of natural vegetable substances
- Total synthesis and hemisynthesis of natural vegetable substances of medicinal interest (example : "lignanes" coumarin (tonka bean) etc.)
- Structural study of lignins and their breakdown (Project of industrial scientific importance; formation and identification of new compounds).

Instruments: Infra-red spectrophotometer  
Ultra-violet spectrophotometer  
Analytic gas chromatograph

Collaboration

- i. Laboratory of animal physiology of the University of Benin (Lomé)  
(Study of cardiovascular properties of natural products)
- ii. Tropical Products Institute (London)  
(Pharmacological tests: anti-inflammatory properties of isolated products)
- iii. Georgia Institute of Technology  
School of Chemistry (Atlanta, Georgia)  
(anti-tumour testing)

Director of Chemistry Research - Professor M.Adjangba

- Biological Chemistry

In combatting malnutrition (lack of proteins) among children in Togo, the chemical study (chemical composition in nutrients) of animal and vegetable foods in Togo has been undertaken. Natural antinutritive substances in food are identified.

Aim:

- to fight proteino-caloric malnutrition in Togo : its causes and frequency in various regions and seasons
- to draw up a list of foods rich in proteins, to be used in fighting proteino-caloric malnutrition (Kwashiakor)

Director of Research : Dr. A. Doh

Collaboration: University Hospital Centres in Lomé - Togo  
Dijon and Paris (France)

2. Advanced School of Agronomy (University of Benin)

Programme: Research in the field of chemistry of natural vegetable substances and their pharmacological applications.

Field: Polynitrate heterocycles and their applications in pharmaceutical, agricultural and food chemistry

Directors of Research: Drs. J. Thomas (Chemist), M. Gumedzou (Agronomist, phytopathologist, crop protection).

3. Department of Botany (Microbiology) (School of Science)

i. Study of biological qualities of foodstuffs in towns : determination of degree of contamination of foodstuffs : identification of microbe species.

- ii. Study of agents of "Candidose", a severe illness caused by microscopic fungi which causes death in infants and children.

Aim - knowledge of the microbe species

- germicidal effect of tropical plants used locally in treating "candidose". Active principles which these plants contain.

Director of Research: Dr. Anani

Collaborators: Department of Chemistry, University Hospital Centre (Lomé)

Equipment           Leitz microscope with immersion objective  
Lyophilizer

## V. Madagascar

### 1. National Centre for Pharmaceutical Research

The Centre is attached to the Ministry of Higher Education. It was just established in December 1976. Its aim is the appreciation of local medicinal plants: it is a commercial and industrial organization.

It has four departments:

- Botany: concerned with gathering and identification of plants
- Chemistry: extraction, structural analysis
- Pharmacology: Physiological tests
- Applied Pharmacy: medical preparations : cough mixtures vermifuges, etc.

Equipment:       Infra-red, Ultra violet, gas chromatograph (chemistry)

Staff:           - 2 chemists  
                      1 pharmacologist  
                      1 botanist

### 2. Centre for the assessment of bituminous sandstones

The laboratory is part of the chemistry service; the Dean is its direct head.

Staff:           - 3 chemists  
                      3 technicians

Apparatus:       One distillation apparatus  
                      Gas chromatograph

VI. TanzaniaTropical Pesticide Research Institute, Arusha : TANZANIA

Objectives: To carry out research on pesticides under tropical conditions

Aim: To find out the efficacy and same use of pesticides in agriculture and public health

Projects: - Screening of new pesticides for both agriculture and public health use under tropical conditions

- Monitoring of pesticides in environment e.g. food, rivers, soil vegetables, and domestic animals and non-target biota on the environment.

Instruments GLC, UV, IR, Atomic Absorption, TLC

Future Objectives Training of technicians in pesticide residue analysis

Training of farmers on safe use and application of pesticides

VII. BurundiFaculty of Science, University of Burundi, B.P. 2700, Bujumbura

Equipment: Spectrograph - visible infra-red  
Perkin Elmer

Absorption spectrophotometer Hilofer

Staff: An organic chemist, specialist in biological analytic techniques.

Current Research (research undertaken jointly by laboratories of chemistry, zoology, agronomy and fisheries services)

Research on Lake Tanganyika, especially on water contamination caused by agricultural insecticides and pesticides and the possible effects on aquatic fauna, particularly on fish which are exploited industrially.

Possible collaboration with geological services and with ISABU - Burundi Institute of Agronomic Science.

VIII. Ivory CoastStudies on Environmental Chemistry in Ivory Coast  
National University, Faculty of Science

Two programmes focus on this problem:

- i. Study of agents of atmospheric, lagoon and marine pollution, using specific electrodes. The relationship of such agents

with corrosion phenomena is also dealt with.

This study should lead to development of methods of protecting lagoon, marine, and atmospheric milieux.

- ii. Studies on atmospheric physics. This programme studies the nature, generation and fallout of aerosols in West Africa. A network of aerosol sampling has been set up. After chemical analysis and calculation of the results by computer, it has been possible to define the characteristics of the main aerosol sources.

Within the various sources, we have been mainly concerned with the presence and evaluation of a chemical element of great agricultural importance - potassium.

We also study the evolution of the quantities of atmospheric sulphur.

12 research workers.

## IX Tanzania

### Chemistry Department, University of Dar-es-Salaam, Tanzania

#### Projects in Progress

1. Research in medicinal chemistry of local plants.
2. Research on the chemistry of oils and fats as raw materials for the paint and varnish industries.

#### Instruments available

1. I.R. Spectrophotometer (operational)
2. U.V. Spectrophotometer (operational)
3. Atomic Absorption (operational)
4. N.M.R. Spectrophotometer (non-operational)
5. Elemental Analyses (being installed)
6. Thermal balance (delivery expected soon)
7. X-ray machine (operational)

#### X. The International Centre of Insect Physiology and Ecology (ICIPE), Nairobi, Kenya

In our search for compounds from insects and plants which can be used to control the behaviour and ecology of pests which are menaces to man and animals as an alternative to use of synthetic pesticides, we have developed and found :

1. Natural insecticides and repellants, for mosquitoes, ticks, etc.
2. Antifeedants which deter insects from breeding
3. Juvenile hormones and ecdysomes which disrupt the morphogenesis of insects.
4. Compounds which render resistance of plants to insects
5. Enzymes from termite colonies which could be of use to degrade cellulose.
6. Sex pheromones which act selectively to attract or aggregate insects.
7. Defensive secretions from insects which could be used to deter other insects.
8. We are setting up bioassay units to screen organic compounds for various physiological activities.

In our laboratory we have:

- a) Hitachi and Perkin Elmer 60 MHz NMR
- b) Gas chromatograph/mass spectrometer - Electron Impact
- c) High-pressure liquid chromatographs - with variable  $\lambda$  detectors
- d) UV and IR Spectrophotometers
- e) Gas liquid chromatograph with flame ionic detector
- f) Incubators, etc. for analysis.

## XI Nigeria

### Chemistry Department, University of Lagos

#### Equipments in the Department

1. Colorimetric apparatus
2. Spectrophotometers - IR, UV, Visible
3. Gas Liquid Chromatograph
4. Electro-analytical equipment
5. Atomic absorption spectrometer (arriving soon)
6. F - 60 NMR machine
7. GC - Mass Spectrometer (in the Chemical Engineering Department but available to us)

Research Projects planned for the Department  
in Environmental Chemistry

1. Water pollutants in our lagoons and rivers
2. Air pollutants in Lagos due to dense population and heavy traffic
3. Carcinogenic substances and occupational health hazards in Lagos industrial houses

XII Mauritius

Research activities in Chemistry at the  
University of Mauritius (A.S. Kasenally)

1. Chemistry of medicinal plants
2. Coordination chemistry. Synthetics and reactions of metal complexes with potential fungicidal properties

XIII Sudan

Research related to Environmental Chemistry  
at the University of Khartoum

1. Natural products chemistry (4 members of staff)
2. Medicinal plants (1 member of staff)
3. Water pollution and its effect on marine life (two members of staff, one from chemistry and one from zoology)
4. One member of staff is working with others in the Hydrobiological unit - which is a unit of the Faculty of Science. They study the effect of various chemicals in water hygiene.
5. One member of staff is undertaking a project with the National Research Council of the Sudan to study air pollution in Khartoum.

New Courses

1. Three years ago the Chemistry Department started giving analytical chemistry as a separate branch of chemistry. This year two of the honour graduates registered for an M.Sc. degree in the subject. This is a new line and much help is needed - and expected - to bring it up to the international standard.
2. Starting next academic session, the Faculty of Science is offering a degree in "Environmental Science" to include unit courses for specialisation in Environmental Chemistry, Zoology, Botany, Medicine and Agriculture.



XIV KenyaEnvironmental Chemistry Research Areas  
University of Nairobi

The relation of the  $\text{CH}_4$  concentration with seasons of high forest and shrubs burning need to be examined. The interactions of  $\text{CH}_4$  with  $\text{Cl}$ ,  $\text{OH}$ ,  $\text{H}$ ,  $\text{NO}$ , etc. need examining.

Effect of  $\text{CFC}_3$  and  $\text{CF}_2\text{Cl}_2$  ozone depletion in high attitudes and tropical conditions need thorough examination.

Monitoring of chemical pollutants in rivers, soil, wildlife.

Chemical interaction of pesticides, herbicides under tropical conditions need thorough investigation.

Conversion of raw waste materials into useful chemicals under tropical conditions need immediate research.

Conversion of wood and other forest products into industrial products.

Isolation and synthetic utility of various natural products.

Research on energy sources.

(Antipollution surveillance unit (in the Ministry of Tourism)  
in water, lake and ocean)

XV RwandaNational University of Rwanda:

- a) Pollution Chemistry: for the moment our university has no programme in this field.
- b) Medicinal Plants: The University has a research group on medicinal plants. It includes:
- 2 biochemists
  - 2 chemists
  - 1 pharmacist
  - 1 technician-chemist

Instruments: Spectrograph - Infra-red  
Visible and ultra violet  
Gas chromatograph

XVI MalawiChemistry Department, Chancellor College  
University of MalawiProjects on Environmental Chemistry

1. Water quality and industrial waste analysis

2. Insect-pesticide pollution in tobacco.
3. To be proposed by Dr. Mjojo : Air pollution due to automobiles (i.e. O<sub>3</sub> and CO monitoring) in the urban air masses of Blantyre and Lilongwe.

XVII Lesotho

National University of Lesotho  
(to be included in the Eastern Network)

Manpower

Chemistry Department: Establishment of five  
plus two teaching assistants  
One technician

Minés and Geological	)	
Laboratory, Ministry of	)	There is some collaboration with these labs
Agriculture Laboratory	)	

Equipment:

- Atomic Absorption
- 2 UV-visible spectrophotometers
- IR
- NMR
- Gas chromatograph
- X-Ray diffraction (powder camera)
- HP computer for data processing

Programme of work:

Mainly on soils

- clay analysis for agricultural processes
- clay analysis for ceramic and pottery
- fertilizers

New Courses:

B.Sc. in Applied Environmental Science offered by the Geography Department.

XVIII Ghana

University of Science and Technology, Kumasi:  
Environmental Chemistry

Projects at the Chemistry Department of the University of Science and Technology, Kumasi.

1. Pollution in the gold-mining areas in Ghana.

6. Correlation of the physical nature and chemical constitution of soils with the manner and mechanisms of the uptake and release of fertilizer  
(Professor E.H.M. Wright)
7. Systematic survey of the level of pesticide residues in species of the fish, shell fish and oysters regularly consumed in Sierra Leone (Dr. N. C. Pratt)

XXI International Institute of Tropical  
Agriculture (I. I. T. A.)

Some aspects of Environmental Studies  
at the IITA, Ibadan, Nigeria

- A. Progress to date.
- B. Areas for future work and collaboration with African Regional Network for Environmental Chemistry

A. Pesticide Residue Studies

Introductory

Work started as a cooperative research project between IITA and the UK Ministry for Overseas Development in 1973 has been continued during 1976 at a reduced intensity as part of the Farming Systems Programme. The main objectives of the project have been to establish whether the organochlorine pesticide DDT could, with sustained use for pest control on cowpea produce long term deterioration of soil productivity through effects on the soil population and to investigate patterns of distribution and degradation of the pesticide in a tropical crop ecosystem. Studies have been conducted on experimental plots in Block N involving three treatments : no DDT application (untreated), and DDT application in alternate growing seasons (contaminated). Experimental design and methodology are documented in previous reports. In 1976 investigations have been confined to a continuation of yield studies, a single population sample in July and a programme of soil respiration and organic matter decomposition studies. Sampling of soil and vegetation for DDT residues and a study of pesticide translocation have also been conducted.

Decomposition studies

The major undertaking of the project this year has been a comprehensive experiment carried out during the second growing season on decomposition of cowpea stem and leave material, incorporating elements of previous studies which have shown significant effects of DDT in reducing decomposition rates.

This project has been going on for about six years and concerns pollution in 3 mining areas in Ghana. The work is led by one member of staff who is assisted by students. The main analytical method involves activation analysis and therefore much of the analyses is done overseas.

## 2. Water Pollution

Work involves study of levels of pollution in rivers, streams and lakes (natural and artificial)

One member of staff is engaged on this work and is assisted by students. The analytical tools necessary to carry out the work are available in the Department.

## XVII Nigeria

### University of Benin

Projects being carried out or to be carried out in Environmental Chemistry:

1. Water pollution
2. Food contamination

### Equipment Available

1. Spectrophotometers
2. Atomic Absorption
3. Gas Liquid Chromatograph
4. Polarograph
5. Atomic Absorption Spectrophotometer

## XVIII Sierra Leone

### University of Sierra Leone Fourah Bay College, Freetown

### Research Projects in Environmental Chemistry

1. Analytical studies on commonly and less-commonly eaten foods with emphasis on nutritional values and the effect of environmental factors on the food values (Dr. H. F. Jackson)
2. Systematic survey of the level of pesticide residues in food crops in Sierra Leone (Dr. N. C. Pratt)
3. Chemical Effects of the Harmattan - Dr. V. C. Patel
4. Studies related to photogalvanic cells - Dr. D. J. Baldry
5. The quality of Sierra Leone river and well waters - Dr. N. C. Pratt

Population Studies

Population of total microarthropods continued to be significantly reduced in soil containing DDT.

Table 1. Mean numbers of soil microarthropods SE. July 1976  
Nos/m<sup>2</sup> x 1000

Depth	Treatment		Contaminated
	Untreated		
0-50 mm	34.49 ± 2.35a	20.65 ± 5.60b	14.91 ± 2.58b
50-100 mm	13.12 ± 9.40a	10.29 ± 1.74a	10.39 ± 2.79a

Means followed by same letter do not differ significantly (p 0.05).

Crop Studies

In the second season of 1976 the eighth consecutive crop of cowpea was grown on the experimental plots. Seed yield for the entire period is shown in table 2.

Table 2. Seed yield from cowpea var. Prima SE. kg/ha

Season	Treatment		Contaminated	Treated
	Untreated			
73/1	209.0 ± 67.9a		758.5 ± 23.7b <sup>+</sup>	401.2 ± 63.4ab
73/2	116.3 ± 6.6a		164.1 ± 23.4a	628.8 ± 17.9b <sup>+</sup>
74/1	108.6 ± 60.0a		488.6 ± 3.8b <sup>+</sup>	539.2 ± 46.8b <sup>+</sup>
74/2	80.5 ± 28.8a		94.7 ± 21.9a	375.2 ± 20.5b <sup>+</sup>
75/1	290.8 ± 66.1a		480.0 ± 21.9a	386.3 ± 51.8a <sup>+</sup>
75/2	42.0 ± 16.7a		16.7 ± 1.6b	280.5 ± 22.1c
76/1	550.6 ± 95.6a		620.8 ± 110.8a <sup>+</sup>	613.0 ± 98.7a <sup>+</sup>
76/2	46.8 ± 15.3a		17.0 ± 12.6a	198.2 ± 47.7b <sup>+</sup>

Means followed by same letter do not differ significantly (p 0.05)  
<sup>+</sup> denotes crop sprayed with DDT.

Future Work

Studies in 1976 have continued to show effects of DDT on soil populations and processes important in nutrient cycling. In the short term these do not appear to have produced serious consequences though it is clear that the soil ecosystem has been significantly disrupted.

The experiment was designed to investigate long term effects and it is envisaged that in 1977 an alternative crop such as maize, should be grown in the first season to serve as a further indicator of soil productivity in the three treatments and the plots subsequently allowed to regenerate under fallow. It is hoped to assess the ability of the soils to recover from pesticide effects by annual sampling and further cultivation after the fallow period.

## B. AREAS FOR FURTHER WORK AND COLLABORATION

### 1.0 Chemical Control

- 1.1 Pesticides and Herbicides Residues in food crops
- 1.2 Same in soils and their effects on soil fertility and soil eco-biosystems in various soil types.

### 2.0 Fertilizers and other Chemicals

- 2.1 Translocation of fertilizer components (e.g. nitrates and their derivatives, such as nitrosamines) from fields into rivers and lakes.
- 2.2 Disposal of laboratory chemicals e.g. heavy metals and cyanides.

### 3.0 Phytotoxins

- 3.1 Phytotoxins in foods
- 3.2 Phytotoxins in biodegrading plant materials
- 3.3 Mycotoxins and their control

### 4.0 Social

#### 4.1 IITA as a Conference Centre:

The Institute has good conference facilities; and may be prepared to offer such facilities to "Network" conferences and workshops.

## XXII

Contents of a letter from Dr. P. J. Madati, Chief Chemist  
Government Chemical Laboratory, P.O. Box 164, Dar-es-Salaam  
to the UNESCO Regional Office in Nairobi.

This is to acknowledge receipt of a copy of the report prepared under contract for UNESCO by Drs. S. Jensen and D. Odhiambo entitled: Mission Report on problems, interests and capabilities for the training and research in Environmental Chemistry in selected African Countries.

I wish to record my appreciation at being copied a report of one of the many discussions I held with teams of international experts like Dr. Jensen and Professor Odhiambo. I also wish to supplement this excellent report with a piece of information or two, to make the report even more perfect.

To emphasize Tanzania's awareness and involvement in environmental chemistry in its broadest sense, I am enclosing a self-explanatory "Report of the Effluent Standards Committee - CL 1/77", which Committee I steered with effect from early January 1977. The picture on the Report's cover depict, and its Swahili slogans "Mazingara Bora in Afya Bora" proclaim "A clean environment leads to optimal health". As a follow up of my Committee's work, I was asked and have recommended strongly that a whole Ministry or Sub-Ministry had better be set up for this preferably under a strong umbrella of the President's office or the office of the Prime Minister. This Ministry's preoccupation should be not only the pollution of waters by domestic and industrial effluents, but pollution of air, soil, foods and drugs, as well as the prevention of soil erosion, and reafforestation, etc. etc.

This 45 years old laboratory has until now been the main centre of activities pertaining to environmental pollution control, including occupational health function. We therefore screen workers who handle pesticides, e.g. Methyl bromide, organo-phosphorus and chlorine, etc. or those who handle lead compounds in petroleum industries. It is by virtue of these multidisciplinary duties that WHO selected me to its Expert Advisory Panel on Vector Biology and Control and in the WHO Expert Committee on Chemistry and Specification of Insecticides, not to mention my memberships on the East African Pesticide Control Organisation's Advisory Technical Committee on Pesticide Approval and Registration, and the East African Natural Resources Research Council's Research Appraisal Board on Acaricides and other pesticides. I and my colleagues (who now number about 20 graduate analysts and 40 technicians, and we are still recruiting and training) have attended several courses, seminars, workshops, etc. on environmental contaminants control, particularly pesticides and drugs. I have personally also been deeply involved in investigations of traditional systems of therapeutics and medicine, and from September 26 to 28, 1977, I am hosting the more or less executive "5th Meeting of the Inter-African Committee on African Medicinal Plants and Traditional Pharmacopeia, Dar-es-Salaam, 26-28 September 1977" which the OAU/STRC based in Lagos is convening. In all these courses and conferences, I and my colleagues have invariably read a paper or two, apart from participating in practical and theoretical aspects of environmental chemistry in its various aspects.