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Regional Meeting on Management of  
Industrial Waste Water

CP

Paris, France, 10-14 December 1990

# REPORT\*

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\* This document has not been edited.

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## INTRODUCTION

1. A Regional Meeting on the Management of Industrial Wastewater was held in Paris, France, from 10-14 December 1990. The Meeting was attended by representatives from seven developing African countries (Botswana, Ethiopia, Lesotho, Uganda, United Republic of Tanzania, Zambia and Zimbabwe), from the host country, and by international and national observers. A list of participants has been issued as a separate document.

2. The objectives of the Meeting were as follows:

(a) To provide a forum for discussion of the findings of the national experts from the seven African countries, and of UNIDO consultants, concerning investigations into management of industrial wastewaters carried out during 1990 as part of a Phase 1 UNIDO project.

(b) To formulate recommendations and possible project concepts for development in the second phase of the project.

## ORGANIZATION OF THE MEETING

3. The Meeting was formally opened by the Chief of the Environment Coordination Unit, Special Measures and Activities Division, UNIDO, on Monday, 10 December 1990. He welcomed Ms. J. Aloisi de Larderel, Director, Industry and Environment Office, UNEP, which had collaborated with UNIDO in preparing the Meeting.

4. The Chief of the Environment Coordination Unit emphasised that water supply and quality were matters of particular importance to participating countries, but at the same time they involved complicated issues. He mentioned the approval given by UNIDO's Industrial Development Board to a comprehensive UNIDO Environment Programme earlier this year - including the provision of advisory services to participating countries' governments in integrating environmental factors into industrialisation programmes; the transfer of environmentally-sound technology; and assistance in pollution abatement.

5. He emphasised that UNIDO is committed to developing less polluting industrial operations which utilise renewable resources and minimise the adverse human health and environmental impacts of industrialisation, and that the programme in question had focussed on five industrial sectors - abattoir, brewery, sugar processing, tannery and textile industries.

6. He praised the work of the national experts who had reviewed the experience of the five industrial sectors in their own countries, covering technical, educational, legal and institutional aspects. He concluded by regretting that he could not remain for the entire week but expressed confidence that the Meeting would yield the desired results, leading to a series of project proposals for Phase 2 of the programme.

7. Ms. Aloisi de Larderel then addressed the conference. She expressed pleasure on behalf of UNEP in being able to participate in the Meeting and expressed confidence in increased UNEP/UNIDO cooperation in the future. She pointed out that the current conference stressed the importance of wastewater treatment technology. However, prevention was better than cure and much less expensive. Hence, there was a need to promote much cleaner industrial production. She explained that UNEP believed that environmental protection, with respect to both waste prevention and treatment, was a question of management, not just of technology - an aspect which would be highlighted during the week's discussions.

8. The Meeting opened under the Chairmanship of Mr. B. Khupe, Deputy Director, Department of Water Affairs, Botswana. Mr. D Assefa, Department Head (Environment Issues), Ministry of Industry, Ethiopia, was rapporteur of the plenary sessions, with Ms. Cohen, Environmental Officer, Department of Natural Resources, Zambia fulfilling this role on the final day.

9. The provisional agenda was adopted (annex 1).

## **REPORT ON PRESENTATION AND DISCUSSION OF NATIONAL REPORTS**

10. The Chairman invited the national experts to present their reports which were dealt with in the following order - Botswana, Ethiopia, Lesotho, Uganda, United Republic of Tanzania, Zambia and Zimbabwe.

11. It was noted that a number of factors were common to several of the reports as follows:

- a) the absence of up-to-date technology in many instances;
- b) lack of effluent treatment facilities;
- c) malfunctioning of such pretreatment facilities, where they exist, for one or more of the following reasons:
  - inappropriate choice of treatment process(es);
  - poor design of treatment plant;
  - overloading;
  - lack of operator training;
  - considered too expensive to operate.
- d) almost total absence of adequate flow and/or water quality monitoring;
- e) lack of sufficient supporting analytical facilities;
- f) insufficient legislative and/or regulatory support;
- g) failure to implement and enforce laws and regulations where they had been enacted.

12. Each national report raised particular points which, in several instances, were amplified during the subsequent discussions. In his presentation, the national expert of Botswana mentioned the current review both of the Water Act and also the evolution of a National Conservation Strategy for Botswana. Under the revised Water Act it had been proposed to give effluent discharge standards (currently only guidelines) legal status. He explained that, where possible, Botswana preferred to see effluents discharged to the sewer network with the aim of achieving better control and minimising the number of final discharge points.

13. In the discussion following the presentation by the national expert of Ethiopia, it was explained that the Ethiopian Valleys Development Studies Authority's recent introduction of a master plan had strengthened the government's ability to control the pollution of natural resources. It was emphasised that there was a need to mobilise existing resources; to initiate a comprehensive programme of environmental audits in existing factories; and to introduce strict controls from the initial planning stage for new factories.

14. The national expert of Lesotho emphasised the role of the traditional land tenure system in determining land use, which he indicated was a key element in Lesotho's industrialisation. Land was sometimes allocated for development without advance consultation, adversely affecting both water availability and water quality. He also summarised legislative development in Lesotho, where a rationalisation of water resource development law was underway, and also some immediate benefits arising from Lesotho's participation in this programme. These had included heightened awareness and improved cooperation between government departments responsible for industrial development and control of its associated environmental impact. It was unfortunate that the benefits of the improved laboratory facilities recently provided had not so far been realised because of a shortage of trained manpower.

15. The national expert for the United Republic of Tanzania announced the very recent establishment of a Ministry of Environment in his country, indicating that it had been recommended that an environmental unit be established in the Ministry of Industry and Trade. In addition, he noted the wide variety of industrial plants, from the period 1961-70 with no provision for environmental protection; to those built from 1970 to the early 1980s with non-functioning wastewater treatment plants; to the most recent plants having a high standard of treatment and monitoring.

16. An important facet of sludge treatment was brought out during discussion, particularly the need to allow for the disposal of hazardous waste sludges when planning a pollution control strategy. The national expert also mentioned the use of grants as incentives for industry to build pollution control facilities.

17. The national expert for Uganda compared the pollution arising from the two major breweries involving untreated effluent passing either to Lake Victoria or the River Nile, with no apparent adverse impact noted to date - with the discharges of effluent from the sugar processing plants involving large volumes of untreated effluent entering small streams, where the majority of the downstream flow consisted of effluent contributions. He also mentioned the problems of improving pollution control where the factory plant was often up to 50 years old. Legislative developments in Uganda included the introduction of a new act giving the Ministry of Environmental Protection a role in the Industrial Licensing Board; a proposal for the introduction of BOD-related discharge fees (implying a need for further monitoring resources); and the introduction of a wetlands programme.

18. The national expert for Zambia outlined the current state of pollution control in his country. He noted the difficulties of formulating and implementing appropriate policies in an information vacuum; the difficulties of monitoring pollution without adequate laboratories; and the presence of an excessive legislative burden. From a positive viewpoint, he noted the establishment of a multi-ministerial Environment Council, and the requirement for industries to bring their effluent discharges within limits (yet to be established) inside a one year grace period in order to continue operating. He explained that this would be a prerequisite to obtaining an effluent discharge licence and hence would be required from factories discharging effluent.

19. The presentation of the country report for Zimbabwe by the national expert was given at the start of the second day's plenary proceedings. Some of the conclusions in this paper were similar to those of the other countries, for example, lack of sufficient legislation to support authorities in their pollution prevention activities. Other comments were specific to Zimbabwe and concerned - the existing water monitoring system covering the major waters of the country; and the fact that pollution from agro-based industry was not judged to be severe compared with pollution caused by non-agro based industry such as steel, mining, and fertilizer operations.

20. The national expert for Zimbabwe explained that he had thus decided to focus on the above-mentioned industrial sub-sectors and pay less attention to the agro-based industries. A comprehensive study had been made of the Zimphos factory which produces phosphate fertilizers, including an in-depth analysis of water and wastewater flows. This was presented together with a brief overview of other plants which had been found to be relevant.

## **PRESENTATION OF INDUSTRIAL WASTE PREDICTION METHODS**

21. Between the presentations of the country reports by the national experts of Uganda and Zambia, a presentation was made by Mr. F. Balkau, Industry and Environment Office, UNEP, concerning the estimation of industrial pollution loads other than by direct measurement. He explained that national or regional pollution loads could be estimated indirectly using data based on other countries' experiences concerning the pollution loads per unit of production of final product or materials proposed, or per 1000 employees in an industry.

22. Mr. Balkau demonstrated the value of this latter approach by using the INVENT model, developed for the World Bank by ASHACT Ltd, Process and Environmental Management Consultants, UK, and modified by the same company into a demonstration package for UNEP. He commented that model's database included a unique 20-character waste coding system which, using the model's 'sort' and 'select' features, enabled predictions of waste arisings per selected waste type to be made for the area under study.

23. Mr. Balkau also mentioned the following publications - 'Industrial Waste Audit and Reduction Manual - A Practical Guide to Conducting an In-Plant Survey for Waste Reduction' published by the Ontario Waste Management Corporation, Canada; and, 'Rapid Evaluation of Sources of Pollution of Air, Water and Soil' published by the World Health Organisation, the latter document comprising data on industrial pollution loads expressed on a unit of production basis.

## **REPORT ON PRESENTATION AND DISCUSSION OF CONSULTANTS' REPORT**

24. The former UNIDO backstopping officer of the project, briefly presented the findings of the consultants' report since the consultants who had originally prepared it were not able to attend the Meeting.

25. A number of conclusions of the situation in the seven African participating countries had been drawn and these were briefly presented. The consultants' report encompassed visits to some 41 industrial plants, to a large extent from the sub-sectors abattoirs, breweries, sugar, tanneries and textile operations. It had been found that these sub-sectors were the most relevant ones and of high interest to all countries (except Zimbabwe, see comment above on presentation of Zimbabwe). 30 of these 41 plants belonged to the five agro-based industrial sectors. All analytical and production data presented in the report had been previously provided to the national experts for almost all countries, by the counterpart organisations or the concerned industry.

26. The summary of the seven countries' industries clearly showed a lack of basic data; BOD and COD analyses were, for example, available at less than half of the plants visited; and pH analyses in one third of the plants visited. The analytical results were also in many cases found to be of uncertain reliability; therefore, some results originally presented in the national reports were not included in the consultants' report.

27. The general situation of existing wastewater treatment facilities was unsatisfactory. Of the 30 plants belonging to the priority sub-sectors, 12 were connected to public sewers. Of these 12, 4 plants had existing pretreatment facilities, but only in a few cases were operating. The identified reason for the malfunctioning was either bad design, lack of maintenance or overloading. In no case had the reason found been associated with bad operation per se.

28. In all cases, where the discharges were passing to a public sewer, municipal treatment works were available. These were in operation in 9 out of 12 cases with the result that severe water pollution occurred in 3 cases. At the 18 plants not connected to public sewers, treatment works existed only in 9 cases - 2 of these were in operation. Here, the reasons for plant malfunctioning were also found to be bad design, lack of maintenance or overloading. In 14 out of 18 cases, discharges passed to a watercourse; in 3 cases, the effluent was used for irrigation and in 2 cases, evaporation ponds were provided.

29. Water pollution had been evident at 15 of 18 industries not discharging their effluent to public sewers and out of 21 existing treatment plants in total, 11 were operational.

30. It was explained that general proposals for treatment of wastewater produced in the five agro-industries of interest had also been outlined in the consultants' report having particular regard to 'minimum treatment' requirements. In particular, four points had been made:

- wastewater, pretreated as appropriate, should be discharged to a public sewer for treatment at municipal works in admixture with domestic sewage;
- where sufficient land, temperature and sunlight are available, pond treatment should be considered.
- treated wastewaters should be used for irrigation as far as possible (special attention being given to residual heavy metal concentrations);
- treatment in evaporation ponds should be considered wherever possible, especially for wastewaters containing heavy metals (in such cases, the remaining solids should be treated as hazardous waste).

31. In addition, a number of sub-sector specific options for wastewater treatment had been indicated in the consultants' report.

32. The Senior Environmental Advisor, UNIDO, then presented a general overview of regulatory measures for wastewater pollution control which could be used in the participating countries. These included standards, guidelines, discharge permits and enforcement, all measures currently used by authorities in developed countries to manage industrial wastewater discharges. In addition, a broad presentation of the current situation in the participating countries was given with an indication that in only a few cases were regulatory measures in use.

33. Five main areas for training had been identified by the former UNIDO consultants:

- promotion of public awareness;
- basic education;

- integrated training of governmental and industry officers in industrial processes and pollution control;
- training of officers in industrial pollution control, including laboratory analyses and computer-aided data handling;
- formal training of wastewater treatment plant operators, including sampling, monitoring, maintenance, etc.

34. Management of waste originating from the five priority industrial sub-sectors had also been presented in the consultants' report. Generally, it had been found that solid organic substances of innocuous character were not always recycled, and that wastes such as those generated from chrome-containing effluent from tanneries were in most cases not given appropriate attention. The following measures to improve waste management had been given:

- hazardous and innocuous wastes should be kept separate;
- innocuous (organic) waste could be treated by composting;
- an authority in each country should be responsible for handling hazardous waste, including collection and transport;
- a treatment plant should be established in each country for classification, treatment, storage and final disposal;
- chrome from tannery operations should be recycled.

35. Finally, a summary of the recommendations outlined in the report were presented. These included both technical and non-technical issues outlining activities to be initiated later at plant level and by government authorities.

## PRESENTATION OF COUNTRY EXPERIENCES

36. It was indicated that, in Botswana, a computerised database for wastewater management had recently been set up. The Botswana national expert, explained the software which included four files with relevant data on the industrial plants in the country, including general information on location, type of industry, etc. It was indicated that the database encompassed a number of chemical and physical parameters relating to the wastewaters and was updated on an annual basis.

37. The National Water and Sewerage Corporation Training Facility in Kampala was described by Uganda's national expert. This institution, which was established a few years ago, trains technicians from industry in various tasks concerning operation of wastewater treatment plants. To date, some 2000 people had been trained and the programme will be expanded in the future.

## PRESENTATION OF ICPIIC

38. Since the International Cleaner Production Information Clearing House (ICPIC) was considered to be relevant to the proposed working group discussions, details of this were presented by Mr. Balkau, UNEP/IEO and Ms. Clarke, US EPA. It was explained that ICPIIC contained a number of fields, among others a calendar of events, case studies, documentary of contents, etc, all information useful for organisations involved in industrial and environmental activities, particularly when planning for an environmentally-sound industry.

## SUMMARIES OF THE WORKING GROUP DISCUSSIONS

### A. Working Group I: Wastewater Technology

Chairman: D. W. Hayward

39. Discussions within Working Group 1 were initiated concerning production technology used in the industrial sub-sectors studied during the Phase 1 project, particular attention being paid to water use and options for improvement, including possibilities for reuse/recycling of water, chemicals and allied raw materials. The discussions developed to cover the examples of wastewater treatment processes currently in operation and included comments on their applicability/efficiency.

40. A key factor which emerged was a need to generate training programmes (training of trainers) covering waste audit procedures with a view to achieving waste minimisation. Mismanagement of



industrial wastewater operations was much in evidence and it was felt that there was considerable scope for reducing the magnitude of wastewater treatment and disposal problem by improved controls at source. Mr. Hayward, group leader, illustrated this concept by reference to his experience in two industrial sectors - tanneries and breweries.

41. A need for additional training facilities to meet the requirements of pollution control officers at both the professional and technician levels was also identified. Discussions developed to cover appropriate treatment process scenarios for the principal agro-industries of interest. Consideration of solid and hazardous waste treatment and disposal practices and requirements was also given.

42. Working Group I discussed the recommendations and project concepts suggested in the UNIDO consultants' Phase 1 report. The applicability of these to each country situation was reviewed, and the most applicable of these modified and detailed further in line with the comments of the participants from the seven countries. A number of recommendations were formulated for discussion at the final plenary session.

### B. Working Group II: Monitoring

Chairman: J. Butlin

43. Working Group II adopted an agenda for discussion covering:

(i) Fundamental Considerations - what is monitoring?, purposes of monitoring, and approaches to monitoring.

(ii) Sector Monitoring Possibilities and Responsibilities - voluntary and mandatory in the industrial sector; and monitoring roles, responsibilities and water quality standards in the public sector.

(iii) Monitoring Requirements - personnel; equipment and facilities; interpretation and use of monitoring results; and training and equipment upgrading.

44. This activity led to a number of recommendations for comparison both with those outlined in the consultants' report and the discussion topics issued with the Meeting agenda. The recommendations made were written up to present to the final plenary session.

### C. Working Group III: Policy and Regulatory Aspects

Chairman: R. Luken

45. Working Group III adopted a similar approach to that followed by Working Group I, leading to recommendations being developed for later discussion with the remaining Meeting participants.

### **FIELD VISIT**

46. The Valenton municipal sewage treatment works was described as one of three major works in the Paris area, currently having a capacity of 150,000 m<sup>3</sup>/d. The treatment capacity will be doubled by 1992 and flows up to 600,000 m<sup>3</sup>/d will eventually be handled.

47. The tour of the works was led by Mr. Christian Vernay, Service Engineer, assisted by three colleagues. A video of the treatment facilities was shown as an introduction. This preview, together with the subsequent tour of the works, illustrated the principal treatment stages: 2-stage screening, aerated grit removal, primary sedimentation and biological (activated sludge) treatment - including nitrification/denitrification. Combined primary and surplus secondary sludges were being dewatered by filter-plate pressing prior to fluidised-bed incineration. The tour included a visit to the works' laboratory and the control room.

48. Overall, the Valenton plant proved to be well worth visiting in the context of the UNIDO project, being a good example of a modern wastewater treatment works.

## RECOMMENDATIONS

49. On the basis of the joint work carried out by the participants, the final plenary session of the Meeting discussed the recommendations presented by the working groups.
50. It was pointed out that the recommendations put forward fell into two groups - those which could be acted upon by the national Governments immediately and those which required UNIDO support. An open discussion then took place, with group leaders and participants responding to various queries raised.
51. It was noted that the recommendations in the UNIDO consultants' Phase 1 report had referred to rehabilitation works being carried out at the Ethiopian tannery before the existing wastewater treatment facilities could be used for demonstration purposes during a training programme. It was pointed out, however, that remedial works at this and other potential demonstration plants could be costly relative to the likely Phase 2 budget available. Nevertheless, such plants in need of upgrading would still form a very useful part of any training programme in as much as outline process designs could still be prepared; in this way, the objectives of the training programme would still be fulfilled.
52. Mr. Balkau mentioned that UNEP organises one-week workshops concerning hazardous waste management. It was proposed to hold one in Mauritius in 1991 to serve east African countries.
53. As regards the reasons why existing wastewater treatment plants were so often not working satisfactorily, if at all, UNIDO invited the national experts to investigate this further within the next three months and to notify UNIDO through him of their findings. He would then undertake to collate and disseminate this information to all countries represented as a positive, immediate step forward.
54. Other points raised by several of the participants led to amendments to some of the wording of the proposed working group recommendations being suggested. Following further discussion, it was unanimously agreed to adopt formally the recommendations and draft project concepts, with amendments as agreed. The agreed recommendations may be summarised as follows:

### **Working Group I: Wastewater Production and Technology**

#### **Recommendations Not Requiring Support**

55. Identify industries, having adequate laboratory facilities, where detailed flow monitoring and waste stream characteristics could begin to be monitored with a long term aim of reducing waste production, increasing factory efficiency and reducing costs.
56. Encourage the abattoir industry to seek actively local markets for disposal of the wastes as by-products. This could then generate revenue for the companies as well as improve overall pollution control.
57. Adopt the recommendations presented in the consultants' report concerning wastewater treatment requirements with particular regard to the minimum treatment requirements proposed. Particularly attention is also drawn to the importance of handling tannery alkaline sulphide liquors separately from the waste streams in order to minimize health and odour risk associated with release of potentially toxic hydrogen sulphide.

#### **Recommendations Requiring Support**

58. Prepare training manuals in factory production technology, waste treatment technology and waste audits for use in the subsequent workshops including reference to wastewater treatment technology. Conduct a series of workshops, designed for specific industrial sectors, to train selected people in efficient production, waste minimization, waste audits and waste treatment techniques.
59. Establish a regional workshop for training of pollution control officers.
60. Increase awareness of proper solid and hazardous waste management practices.

61. Not to give priority to composting of abattoir solid wastes even where such solids are currently discharged to drain, because local outlets could generally be found (as animal feed or fertilizer), and in many cases this is already practised.

## **Working Group II: Monitoring**

### **Recommendations Not Requiring Support**

62. Identify, utilize and develop existing local reporting networks on water abstraction to report also on water quality.

63. Encourage industry to monitor voluntarily by:

- (i) acknowledging, publicly and systematically, factories who voluntarily monitor their effluent;
- (ii) allowing tax-free importation of monitoring equipment;
- (iii) subsidizing effluent monitoring by the private sector.

64. Introduce a mandatory requirement for new industrial licences to contain a requirement to monitor solid, gaseous or liquid discharge, and introduce legislation which:  
(i) requires existing factories to monitor their own pollutant output;  
(ii) provides for the public service to monitor otherwise, and to charge the factory at commercial rates for the analyses.

65. Ensure country participation in existing regional and global water quality monitoring initiatives to which each country is a signatory.

66. Systematically identify technical staff whose abilities merit their being considered for further training/upgrading.

67. Ensure the approach chosen for storing monitoring data is as far as possible compatible with other participating countries and with established international agencies. Where possible, tap into existing regional initiatives on harmonising data storage and retrieval (e.g. SADCC initiatives on meteorological data and hydrological data (HYDAT))

### **Recommendations Requiring Support**

68. Provide resources for a directed environmental monitoring awareness campaign for senior managers in the industrial and public sectors and in vocational education.

69. Contribute to the funding of ZACPROS under EMINWA/ZACPLAN which have a monitoring element.

70. Identify sources of funding for scholarships to upgrade 'fast-track' technical laboratory staff to professional grade.

71. Provide regional training to train national trainers capable of delivering short-term 'skills improving' training on water quality monitoring for public and private sector laboratory technicians and public sector inspectors.

72. Provide support (in equipment or operating cost assistance) to enable private sector laboratories to undertake the results of training identified in recommendation no. 17.

73. Provide support to ensure provincial laboratories always have reagents and consumable equipment to undertake basic analyses, and transport to reach sampling locations with sufficient frequency.

74. Establish a system of national reference laboratories; provide a regional inspector to ensure the protocols and analyses of these laboratories; establish a regional reference laboratory if required.

### **Working Group III: Policy and Regulatory Aspects**

#### **Recommendations Not Requiring Support**

75. Ensure that legislation (a) requires operating plants obtain discharge permits; (b) establishes formal environmental impact assessment requirements; and (c) authorizes the establishment of strong technical/environmental units. This should be directed particularly to small and medium size plants. This should facilitate industrial zoning decisions.
76. Require legally that waste and environmental audits be undertaken, in order to reduce the generation of excess pollutant loadings.
77. Document and clarify the present enforcement activities underway in the participating countries. Collect additional information about the effectiveness of various enforcement activities.
78. Clarify the role of newly established environmental councils/agencies as well as the role of other government agencies in approving new industrial developments. These councils/agencies should issue guidelines on their procedures and the information required from applicants.
79. Reflect through industrial policies the importance of sustainable development. It is recommended that such a policy for industrial rehabilitation be based on the potential for environmental improvement as well as increased production and job creation.
80. Investigate the reasons why existing wastewater treatment plants are not meeting norms and ways in which these deficiencies could be overcome if these plants were rehabilitated. These results should be shared with countries participating in this Meeting.
81. Ensure that sludges from industrial and municipal sewage plants which are hazardous wastes are treated as such.

#### **Recommendations Requiring Support**

82. Define effluent standards, including minimum interim standards, for each industrial subsector.
83. Establish new or strengthen existing inspectorates for industrial discharges and units to monitor in-stream water quality. Monitoring units should also document adverse health and welfare effects that result from industrial pollution.
84. Document effectiveness of charge systems levied on industries discharging into public sewers and into receiving waters and the extent to which they are currently used. This investigation should be the basis for formulating a pretreatment policy which would identify the pollutants to be included and would develop a charge system based on waste volume and strength.
85. Develop an effluent discharge fee scheme for plants discharging into receiving waters. The scheme should reflect the recent innovations adopted by seven basin authorities in France and the National Rivers Authority, UK. These fees should combine a basic charge to cover the costs of issuing permits and undertaking monitoring and a variable charge based on waste concentrations above the effluent standards.
86. Prepare guidelines for waste audits and training in their application. As a first priority a regional effort to specify effluent standards is included.
87. From these recommendations, possible project concepts were presented by each working group leader for consideration for Phase 2. These are set out in annex 2.

**Annex I**

**AGENDA**

**Regional Meeting on Management of Industrial Wastewater**

**Paris, France, 10 to 14 December 1990**

1. **Opening of Meeting**
2. **Election of officers of the Meeting**
3. **Adoption of the Agenda**
4. **Presentation of national reports**
5. **Presentation of UNIDO consultants report**
6. **Presentation of country experience**
7. **Working groups:**
  - I **Waste water technology**
  - II **Monitoring systems**
  - III **Policy and regulatory aspects**
8. **Field visit**
9. **Recommendations and conclusions**
10. **Adoption of report**
11. **Closing of the Meeting**

## Annex II

### PROPOSALS

#### 1. Industrial Workshops

Workshops will be conducted in each of the three industrial sectors below: (a) tanning industry; (b) brewing industry; and (c) textile industry.

Each workshop will be of three weeks duration, and three people per country representing each of the three industrial sectors will participate. The people participating must have a thorough technical knowledge of the sector and be capable of conveying the knowledge gained in the workshop to others in their own country, i.e. be capable of acting as trainers.

Using previously prepared training manuals as base-line data, training will be given by UNIDO consultants in factory waste audits with particular regard to waste avoidance and waste minimization and options for wastewater treatment and associated sludge disposal. Consideration will be given to alternative ways of upgrading existing facilities at selected demonstration facilities.

Following the workshop the candidates will return to their own countries and at selected factories carry out hands-on waste audits including flow measurement, sampling and analyses as appropriate. Follow-up visits will be made by UNIDO consultants to review findings and procedures.

The following country locations and alternative venues for the workshops, as well as suggested demonstration factories, have been proposed:

#### 1. Tanning Industry - Suggested host country: ETHIOPIA

##### *Workshop venues*

1. Institute for Disaster and Development Studies (IDDS), Addis Ababa; or
2. Ethiopian Management Institute, Debrezeit (45 km from Addis Ababa).

##### *Factory locations*

1. *Awash Tannery, Addis Ababa*

Waste flow: 1,000 m<sup>3</sup>/day; Non-functioning, overloaded wastewater treatment plant (WTP); Effluent to stream.

2. *Ethiopian Tannery* - as proposed previously by UNIDO consultants. Three separate treatment streams, two to evaporation ponds, one to activated sludge treatment. Flow not available. 80 km from Addis Ababa.

3. *Modjo* - No WTP but one planned based on conventional primary treatment plus activated sludge. Flow not available; 80 km from Addis Ababa.

#### 2. Brewing Industry - Suggested host country: BOTSWANA

##### *Workshop venues*

1. *Department of Water Affairs Training School* (fully equipped laboratory); or
2. *Botswana Polytechnic Institute* (has some laboratory facilities); or
3. *University of Botswana* (laboratory facilities available).

All of these are near brewing factories.

### *Factory Locations*

1. *Kjalagadi Breweries Ltd.*, produces European beer plus carbonated drinks, flow 940m<sup>3</sup>/day; WTP - balancing tank only.

2. *Botswana Breweries Ltd*, produces local beer, Chibuka. Flow 120-240m<sup>3</sup>/day. WTP comprises primary settling tank with sludge centrifugation - sludge cake disposal as pig food. Plant overloaded.

Both breweries are in Gaborone.

### 3. Textile Industry - Suggested host country: TANZANIA

#### *Workshop venues*

1. *University of Dar-es-Salaam*; or
2. *Water Resources Institute*; or
3. *Dar-es-Salaam Technical College*; or
4. *Ardhi Institute*

All have laboratories.

#### *Factory locations*

1. *Friendship Textile Factory*, Dar-es-Salaam, biggest in Tanzania, 4,500m<sup>3</sup>/day; no WTP, processes cotton. Discharges to water-course.

2. *Morogoro Polyester Textiles Ltd.* (200 km from Dar-es-Salaam); 1650 m<sup>3</sup>/week; processes rayon/cotton; WTP: pH control, 2-stage aeration. Inadequate WTP, especially sludge handling. Effluent to watercourse.

3. *Tanganyika Dyeing and Weaving Mills*, Dar-es-Salaam, 600m<sup>3</sup>/day; WTP very inadequate. Sedimentation only. Effluent to watercourse.

## 2. Training of Pollution Control Officers

A workshop of four weeks duration. The course will be designed to cover Government personnel drawn from both the professional and technical levels, and will include the areas of flow monitoring, sampling, analytical techniques, waste reduction/minimization practices and alternative wastewater treatment technologies.

Suggested host location: Kampala, UGANDA  
(National Water and Sewerage Corporation Training Centre)

This location already conducts training courses and a major laboratory upgrading programme is shortly to be implemented (funded by World Bank/EEC - total funding of US\$118,000,000 including upgrading of sewage treatment facilities). Industry is located nearby for demonstration purposes, especially tanneries, breweries and sugar factories.

Five people from each country will participate.

### 3. Awareness Campaign

A regional meeting at which the national representatives are introduced to the programme, and receive support materials (stickers, leaflets, press releases). High level national meetings presented by expert and national representatives; provincial meetings by national expert. Separate campaigns should be run for the public and private sectors, and particular attention should be given to follow-up and reinforcement.

### 4. Industrial Laboratory Upgrading

- (i) Visit industrial laboratories to identify equipment needs and requirements for skills upgrading;
- (ii) Based on (i) - Develop series of training modules to meet various needs and identification/preparation of support materials; such as text books, self-assessment manuals and software.
- (iii) Delivery of 'training of trainers' package to pre-selected national trainers;
- (iv) Delivery of laboratory upgrading equipment, including chemical reagents;
- (v) Presentation by national trainers of training modules, together with the consultant monitoring performance in the early stages.
- (vi) Post-training laboratory visits by national trainers, quality controlled by expert, to monitor (a) improved skills; and (b) usage of equipment provided.

### 5. Development of National Reference Laboratories

- (i) Visits by specialist to laboratories to make skills, equipment and equipment inventory, and running split sample tests and development of inventory into plan for upgrading laboratory equipment, personnel and protocols where necessary;
- (ii) Intensive upgrading phase for designated national reference laboratories;
- (iii) Development of a National Laboratory Analyses Quality Assurance Programme (NALAQAP) by the expert and representative(s) from each national reference laboratory. This will consist of: split sampling testing between the national laboratory and an international accepted reference laboratory; reviewing of results from both tests; identification of the reasons for divergences between analyses and agreement on the necessary steps to bring the national laboratory into conformity.
- (iv) Phased implementation of NALAQAP, starting with other central public laboratories (including universities), extending to regional laboratories and private sector laboratories;
- (v) Transfer of regional inspector responsibility to a regional professional;
- (vi) Continued quality assurance of national reference laboratories;
- (vii) Consideration of regional reference laboratory.



## 6. Effluent Standards

This project would define acceptable effluent (performance) standards for the five agro-industries covered by Phase I. The concept of Minimum Treatment Standards as presented in the consultants' report needs further elaboration.

This project proposal specifies three levels of discharge limitations both for plants that discharge into receiving waters and plants that discharge into public sewers. The limitations would include minimum, low cost and higher cost levels. The project would identify how these effluent standards should vary with natural conditions.

The steps in this project would be:

- survey of seven countries to determine if there are existing minimum treatment standards;
- review literature on existing effluent standards for these industrial sectors;
- develop rationale for transforming these existing standards (mainly in developed countries) into acceptable standards for the seven countries. The rationale should include technological, cost and geographic factors;
- prepare three levels (degrees of stringency) for each of the five sectors both for plants that discharge to receiving waters and those that discharge into public sewers;
- verify the acceptability of these effluent standards by examining a limited number of plants covered in the first phase;
- develop qualitative/quantitative factors, which would indicate how these standards might vary with natural conditions.

## 7. Environmental Assessment for Small and Medium Size Plants

The project would develop procedures for incorporating environmental considerations into industrial zoning activities. The project would start with a classification of industries according to the nature of their activities and then recommend the appropriate industrial zone for each industry. Each plant in these zones would be required to meet appropriate environmental norms.

- The first step would develop criteria for classification - nature of production process, size, heavy or light industries;
- The second step would classify industries according to these criteria;
- The third step would specify environmental norms. These norms would include requirements to discharge into central treatment facilities.