

PN-ABQ-118



**Project in Development and the Environment**

# **Report on the National Seminar on Egypt Water Quality Assessment and Management Plan**

**The Water Research Center/MPWWR**



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**Report on the National Seminar  
on Egypt Water Quality Assessment  
and Management Plan**

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## TABLE OF CONTENTS

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	<u>Page</u>
Foreword	
Acknowledgements	
I. Overall Seminar Summary and Recommendations	1
II. Opening Speeches	3
A. Dr. Mahmoud Abu-Zeid, Chairman, Water Research Center	3
B. H. E. Eng. Esam Rady, Minister of Public Works and Water Resources	7
C. Douglas J. Clark, Acting Director, USAID/Egypt	9
III. Session #1: Findings of Studies and Issues for Strengthening Water Quality Management	11
Summaries of Presentations:	
A. <i>Assessment of Nile Water Quality</i> : Mrs. Amal El-Sherbini	11
B. <i>Drainage Water Quality Assessment</i> : Dr. Shaden Abdel-Gawad	13
C. <i>Groundwater Quality</i> : Dr. Fatma Abdel Rahman	15
D. <i>Institutional Framework of Water Quality Control</i> : Dr. Safwat Abdel-Dayem	17
E. <i>Water Quality Management Plan</i> : Dr. Shaden Abdel-Gawad	19
F. <i>Why Water Quality Management?</i> Dr. Robert Kelly	21
G. <i>Issues for Strengthening Water Quality Management</i> , Dr. Khalil H. Mancy	23
IV. Summary of Lunch Presentation: <i>Overview of Water Quality Environmental Concerns</i> , Dr. Mohamed Fawzey	25
V. Session #2: Water Quality Data--Collection, Sharing, and Cooperation	27
A. Summary of Presentation: <i>The Importance of Water Quality Data</i> , Dr. Khalil H. Mancy	27
B. Working Group Discussion	27
1. Issues	
2. Findings	
3. Analysis and Recommendations	

---

**TABLE OF CONTENTS**  
(continued)

---

	<u>Page</u>
VI. Session #3: Achieving Compliance of Industry--Government Entities and Private Sector	31
A. Summary of Presentation: <i>Industrial Wastewater Management in Egypt</i> , Dr. Fatma El Gohary	31
B. Working Group Discussion	
1. Issues	
2. Findings	
3. Analysis and Recommendations	
VII. Summary of Lunch Presentation: <i>USAID Environmental Strategy</i> : Dr. Richard Rhoda	35
VIII. Session #4: Water Quality Concerns in Rural and Urban Areas Summaries of Presentations:	
A. <i>Wastewater and Sanitation</i> : Eng. Mohamed Negm El Din Mohamed	37
B. <i>Water Quality Monitoring Programs, 1955-1993</i> : Dr. Nabil El Molhey	40
C. Working Group Discussion	40
1. Issues	
2. Findings	
3. Analysis and Recommendations	
IX. Closing Comments: Dr. Mahmoud Abu-Zeid	45
Annex A: Seminar Agenda	47
Annex B: Participant List	51

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## FOREWORD

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The Government of Egypt faces increasing challenges in the effective management of water resources. Water for irrigation, a significant concern for agricultural self sufficiency, is rapidly approaching maximum utilization levels. The supply of additional water of quality suitable for use in cultivating more land is extremely limited. Yet Egypt's population is growing at a rate that requires conversion of additional land to agricultural use in the near future.

The reasons for the limited water resources relate to the overuse of water in irrigating crops with high water requirements, industrial and sanitary waste contamination of water that could be used for agriculture, and the wasteful use of water by municipalities and industries. In any case, the net result is an unnecessary degradation of water quality--a problem that must be addressed.

The National Seminar on Egypt Water Quality Assessment and Management Plan was organized to present the current state of knowledge about water quality and water quality management in Egypt and to discuss key water quality management issues. This seminar report is a useful mechanism for sharing information on these issues and providing contact points for further information.

*Dr. Mahmoud Abu-Zeid, Chairman*  
Water Research Center  
Ministry of Public Works and  
Water Resources

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## ACKNOWLEDGEMENTS

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To plan and conduct a national seminar requires the creative talents and hard work of many people. The WRC/PRIDE National Seminar on Egypt Water Quality Assessment and Management Plan, held July 21-22, 1993, was no exception. The seminar took almost nine months to plan following the completion of the *Egypt Water Quality Impact Assessment and Egypt Water Quality Management Action Plan*.

The planning, selection of speakers, logistical support, and venue were all important in this seminar. However, in the end, the key to its success rested with the active participation of the more than 50 participants who are listed in Annex B. To them, a hearty thanks. Mechanisms must be found to ensure that this group gets together repeatedly to discuss Egypt's water quality management issues.

Dr. Mahmoud Abu-Zeid served as chairman of the seminar and provided the leadership in planning the workshop and extending invitations to the participants. Annex B lists the speakers who represented MPWWR, WRC, EEAA, NRC, NOPWASD, MOA, USAID, and PRIDE. H.E. Eng. Esam Rady, Minister MPWWR, and Mr. Douglas Clark, Acting Director, USAID Mission, provided opening comments for the seminar.

Mr. Farouk Abdel Aal provided leadership in the logistical support with able assistance from WRC secretaries, drivers and others. Mr. Alaa Shcreibah, PRIDE, helped with the logistical support in Cairo and provided the leadership in preparing this report. Ms. Paula Hirschhoff oversaw the editing and printing of this report with assistance from Mr. John Hansen.

Dr. Robert Kelly and Dr. Khalil H. Mancy, PRIDE, working with Dr. Abu-Zeid and others, provided the technical leadership for the seminar. Dr. Kelly prepared the guidelines for the discussion groups and worked with Dr. Mancy and the speakers in summarizing the recommendations from the discussion groups. Dr. John Woods, PRIDE, served as the workshop facilitator.

The person who served as the behind-the-scenes guiding light, for the seminar and the earlier studies, was Mr. Flynn Fuller, USAID/Egypt. Flynn served as the link between WRC, PRIDE and other involved groups and ensured that actions were taken to move toward a successful seminar.

Unfortunately, space does not allow us to give credit to all who contributed to the seminar. To these persons, please accept our apologies.

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## OVERALL SEMINAR RECOMMENDATIONS

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This WRC/PRIDE National Seminar on Egypt Water Quality Assessment and Management Plan, held July 21 and 22, 1993, is the culmination of collaborative work by WRC and PRIDE which started in February 1992 when a team began work on the *Egypt Water Quality Assessment* study. Beginning in May 1992, another WRC/PRIDE team began work on the *Egypt Water Quality Management Action Plan* study. The decision was then made that these two studies would be used as the base for a national seminar involving the Higher Committee for the Nile, other senior officials representing Government of Egypt agencies involved in water quality management, and donor agency representatives. In March 1993 WRC and PRIDE conducted a one-day briefing seminar for MPWWR and USAID officials summarizing the two studies and outlining issues which could be included in the national seminar.

The objective of the seminar was to solicit the high-level support and commitment of ministries needed to address the increased pollution caused by population increases and industrial and agricultural expansion.

The seminar was designed to actively involve all participants in discussing water quality management issues and provide recommendations on improving water quality in Egypt in the future. The findings of the two studies were summarized at the first half-day session. The second, third, and fourth sessions each focused on a specific issue for intense discussion and formulation of recommendations. Small groups provided the basic recommendations, which were reviewed by a panel and summarized at the end of the session. Following is a condensed list of these recommendation summaries.

1. The Government of Egypt should design and implement a National Water Quality Monitoring Program. This program should be carried out by the Water Research Center in the Ministry of Public Works and Water Resources.
2. The Ministry of Public Works and Water Resources should create an oversight committee composed of senior staff of the ministries and agencies with responsibilities in water quality management, and charge it with the responsibility to
  - a. Identify data needs of member ministries and agencies.
  - b. Provide data for incorporation into a national water quality monitoring database.
  - c. Review and comment on plans to create a national water quality monitoring program.
  - d. Monitor progress in creating the National Water Quality Monitoring Program, and review data resulting from such a program
  - e. Adopt standard procedures to collect, preserve, and analyze water quality samples.

3. The Government of Egypt should identify the organization that is responsible for controlling discharges from industry and require it to:
  - a. Identify those industries or categories of industries that are having the greatest adverse effect on human health through their aquatic discharges.
  - b. Identify, for those industries having the greatest adverse effect on human health, the least cost/most effective methods for reducing water pollution from those industries.
  - c. Institute a program of pollution reduction in those industries or industrial categories having the greatest adverse effect on human health that can be controlled for the least cost.
4. A program could be instituted by the Government of Egypt to characterize levels of pesticide residuals in agricultural drains that are reused for other purposes. This program should be conducted by the Ministry of Agriculture in collaboration with the Ministry of Public Works and Water Supply.
5. The Government of Egypt should begin to develop programs to control the discharge of sanitary wastes to the Nile, canals, and drains that are reused for public water supply. The National Organization for Potable Water and Sanitary Drainage should be given the responsibility for implementing the following programs:
  - a. Providing closed sewerage systems for communities in the Delta that are now provided with piped water; and adding treatment to the sewerage systems as time and fund availability allows.
  - b. Educating rural communities in the design, construction, operation, and maintenance of appropriate sanitation devices (pit privies, septic tanks), and educating communities on the adverse health effects associated with the improper disposal of human waste
  - c. Examining ways to recycle or reuse sanitary wastes, after treatment, to reduce contamination of the Nile, canals, or drains whose water is reused.



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**A. OPENING SPEECH:  
DR. MAHMOUD ABU-ZEID, CHAIRMAN,  
WATER RESEARCH CENTER**

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On behalf of the WRC, I would like to welcome you to the National Seminar on Egypt Water Quality Assessment and Management Plan.

This seminar is the fourth phase of a study program funded by USAID that started in early 1992 with technical assistance from the U.S. Project for Development and the Environment known as PRIDE. The three previous phases were as follows:

First: A Study on "Egypt Water Quality Impact Assessment" early 1992

Second: A Study on "Egypt Water Quality Management Action Plan" June 1992

Third: An in-house Ministry of Public Works and Water Resources (MPWWR) workshop organized by the Water Research Center (WRC) and PRIDE to present and discuss the findings of Phase I and Phase II and prepare for the National Seminar on Egypt Water Quality Assessment and Management Plan, March 8, 1993.

We hope that by completing this fourth phase priority actions for implementation of the management plan will be clearly identified.

Present with us today are members of the High Committee of the Nile, senior officials from concerned ministries and institutions, and representatives of some donor countries and agencies concerned with water quality and environmental matters.

The major objectives we hope to achieve today and tomorrow are three. First, to brief you on the findings of studies from Phase I and Phase II. Second, to discuss major issues that could face the implementation of a water quality management plan, and third, to solicit your support and commitment to address those issues.

The seminar will proceed in three parts. The first, to be completed before lunch, is where most of the briefings will take place; the second will cover discussions of issues and will continue until after lunch tomorrow; and the third is the closing session which will start around 4 pm tomorrow.

Ladies and Gentlemen, early in 1991, it was decided to prepare an Environmental Action Plan for Egypt to protect the environment. It is well known that environmental management is complex and multi sectorial in nature and requires a coordinated national effort.

At that time 10 interdisciplinary working groups of experts were drawn from different ministries and agencies to draw up high priority environmental action programs. The country, through the Egyptian Environmental Affairs Agency (EEAA), has requested the World Bank to lead a team of experts sponsored by several donors.

One of the working groups was assigned to water quality issues and the Water Research Center with representatives from EEAA, Industry, Agriculture, National Organization for Potable Water and Sanitary Drainage (NOPWASD) worked together with a Dutch team to prepare proposals concerning water quality.

Several discussion sessions took place, leading to the approval of the Environment Action Plan in May 1992.

The next logical step was to prepare detailed programs for the implementation of the Action Plan and to discuss them with potential donor countries and agencies.

The following preparatory steps were taken:

1. The proposed priority investment programs were discussed within the Higher Committee for the Nile, headed by the Minister of Public Works and Water Resources, with representatives from involved agencies and ministries. Members of this committee present with us today recall that each minister's program was discussed in general.
2. The Project Preparation unit of the MPWWR was charged with preparing feasibility studies for certain priority actions related to the role of the Ministry.
3. Due to the major responsibility of the WRC in monitoring water quality in the Nile, canals, drains and groundwater, the Center has taken several steps toward implementing projects with the assistance of several friendly countries including the U.S., Canada, and the Netherlands.

The major studies conducted so far are as followed:

1. A study to establish a central laboratory for the analysis of data collected and the establishment of a national data collection network (river, canals, drains, groundwater) (USAID, CIDA-Canada).
2. A study to support the data collection program from drains, canals, and groundwater (the Netherlands).
3. A study on the impact of re-use of agricultural drainage water on soils, plants, and human health (African Development Bank) (negotiations taking place).
4. Egypt water quality assessment and management plan (USAID) (first four phases are funded).

With this brief introduction, I do not see a need to stress the importance of a national water quality management plan to assure the availability and the sustainability of an acceptable water resource to ensure decent life for the people of Egypt.

I need not overemphasize the threat that Egypt will face regarding the future of long-term water demands and the importance of water management from the quantity and the quality point of view. The degradation of water quality that may soon take place will be much harder and more costly to reverse if allowed to continue.

Finally, I must say that the MPWWR is not a water user -- it is the only government body responsible for planning and management for water resource development and use. This task requires not only planning and management but also ensuring that protective measures are undertaken to preserve water resource quantity and quality. With this, I am sure that we all realize how important this seminar is, and I hope that we can come out of it with recommendations.

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**B. OPENING SPEECH: H. E. ENG. ESAM RADY,  
MINISTER OF PUBLIC WORKS AND WATER RESOURCES**

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I am pleased to have the opportunity of speaking with you on this occasion, the opening of your National Seminar on Egypt Water Quality Assessment and Management Plan, which has been made possible by the intense efforts expended by the Ministry of Public Works and Water Resources and its various departments, to manage and develop our country's water resources and to preserve them in both quantitative and qualitative terms. This is the sacred mission to which Egyptians have been dedicated ever since humans first set foot on this hallowed ground and built upon it one of the most ancient civilizations known to history, inspired by the challenge of the Nile waters, which turn the desert into lush greenery and its barren sands into fertile fields.

Throughout history Egyptians have proven themselves capable of meeting the challenge of the Nile. They straightened its course and controlled its flooding; they increased the benefits of its flow by constructing aqueducts and dams, and by digging canals to bring water to as many areas as possible throughout Egypt. They also strove to preserve the Nile's water through careful and organized management and programs for developing, maintaining, and reutilizing water resources.

Increasing development and population pressures have made water more important than ever. Expanded industry and agriculture, together with increased population, place great demands upon our limited water resources, which consist of Egypt's share of the Nile flow, small ground water reserves in the Western Desert, and the scarce rainfall that occurs on our northern shore and in the Sinai. The per capita share of water resources in Egypt is in continuous decline, and is expected to reach 500 cubic meters by the year 2010. The situation is aggravated by the fact that these resources are subject to pollution caused by the waste produced in residential, industrial, and agricultural areas. The Ministry has been aware of this problem for some time and has issued laws and regulations to protect the Nile and its branches, as well as other surface and ground water resources, from pollution. The most recent was Law No. 48 of 1982, but laws alone cannot prevent pollution. A number of Ministry organizations, including the institutes of the Water Research Center, have begun implementing programs to monitor pollution of the Nile's water, wastewater, and ground water, although these programs are not yet as complete and effective as we would like them to be.

The Ministry of Public Works was one of the first government agencies to assist the Department of Environmental Affairs in conducting special studies to assess pollution in Egypt, and in devising a national plan to control it.

A study prepared on this subject by experts at the Ministry stressed the importance of taking responsibility for implementing a program to protect water quality, and thus

protecting the safety of the inhabitants and environment of Egypt.

The Ministry has also cooperated with a number of countries and international organizations to study the dimensions and causes of water pollution problems and the requirements for controlling them, by implementing the necessary monitoring programs, creating the technical skills, and providing the resources required. It has designed a number of programs and prepared the outlines for projects that are ready to be financed or about to begin work on monitoring the water quality of the Nile, wastewater, and ground water. These projects are part of a program designed to build complete national databases that will provide decision makers with needed information on levels and sources of pollution, and help them take the appropriate action to protect the environment from pollution.

It is clear that this job can only be accomplished with the assistance of many national and governmental organizations, but every person in Egypt has a role to play in protecting our water resources from pollution. Links of understanding and cooperation have been established among the Ministries of Agriculture, Housing, Health, and Industry, and research centers and universities. These links must be supported by joint coordination to determine the role each entity can play in preventing the pollution of our waters and stopping the flow of waste into them. We should not forget in this connection the important role of the Ministry of the Interior, represented by the work of the Waterways Police in enforcing anti-pollution laws. The Department of Environmental Affairs also has an important role to play in coordinating the efforts of all these agencies and organizations.

In conclusion, I would like to thank the United States Agency for International Development (USAID), which responded to the request made several years ago to support the protection of water quality in Egypt by providing technical assistance in two stages. This has enabled us to define the dimensions of the problem and determine the kinds of action and programs that are needed, as will become evident from the documents presented in the seminar. We hope that this seminar will be able to convey a clear picture of the current situation to all persons responsible for or interested in protecting our waters from pollution. We expect to benefit from their views and opinions on developing a plan for water quality assessment and management in Egypt, and to achieve greater levels of cooperation and coordination.

I would also like to thank the members of PRIDE for their participation in the study and for making the arrangements for this seminar.

I wish the participants in this seminar much success in working for the health and safety of our nation, to protect the most important element of life on this planet—our water resources.

Thank you very much.

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**C. OPENING SPEECH:  
DOUGLAS J. CLARK, ACTING DIRECTOR, USAID/CAIRO**

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I have long been waiting for this important event to occur and thank WRC and PRIDE for their hard work and dedication and I thank Dr. Abu-Zeid for his unflinching leadership.

1. USAID has been working with the Ministry of Public Works and Water Resources (MPWWR) since 1977, mainly (but not exclusively) in support of the ministry's efforts in the irrigation sector. Our involvement in water quality was therefore limited mostly to concerns regarding salinity of the irrigation water and its effects on crop production.
2. While stuck in traffic during a field trip to the Water Research Center (WRC) at the Delta Barrage in October 1990, I asked Dr. Abu Zeid what critical issues the WRC should focus on in addition to water efficiency and he said the other side of the issue: water quality. Shortly thereafter, and as a result of Government of Egypt (GOE) concerns regarding the use of herbicides for the control of aquatic weeds, which came to a head back in late 1990, the Minister requested that USAID assist the WRC to take a broad look at water quality concerns in general. The Water Quality Assessment and Action Plan, which you will hear about a little later, are the results of that WRC/USAID effort.
3. Through USAID's involvement with this assessment/action plan, and in other efforts such as the "Roundtable on Egyptian Water Policy," the "Conference on Sustainability of Egyptian Agriculture in the 1990's and Beyond," the "Nile 2000 and subsequent 2002 Conferences," USAID has become increasingly aware of:
  - the link between water quality and water quantity;
  - the effects of population growth (expected to reach 70 million by the year 2000) on the quality/quantity issue;
  - the effects the major users (municipal, agriculture and industry) are having on the quality and hence the quantity of the water available; and
  - the limited means in which to increase Egypt's available water resources (55.5 billion cubic meters from the Nile each year, all of which originates from outside Egypt's borders).

4. Because of this awareness, due to our close partnership with both the MPWWR and the Ministry of Agriculture (MOA), we are intensifying our efforts to support programs in addressing water use efficiency, which will include support for a water quality monitoring program.
5. Water quality in Egypt is an issue that needs attention from several other sectors as well, especially the major users (agriculture, municipal, tourism, and industry), in addition to health and the Egyptian Environmental Affairs Agency (EEAA), and others. This will require individual efforts on everyone's part to, once used, return water to the system in a form that can be used again and again. It will also require a cooperative effort, assumingly coordinated by the EEAA, with a free flow of information from and among the various parties mentioned above to manage the resource in such a way as to maximize the utility of water in Egypt.
6. USAID, outside the Agriculture Sector, has assisted the Government of Egypt in the development of both urban and rural sewage treatment facilities (LD II, Cairo and Alexandria Waste Water projects).
7. As new programs are developed and begin, we will be giving increasing attention to pollution prevention in industry, and assisting in developing opportunities for the reuse of sanitary and industrial wastewaters.
8. AID will continue to support this effort by providing assistance to the MPWWR (WRC) and the EEAA to integrate water quality monitoring activities into the emerging management framework, ensuring that data is freely available and accessible to the GOE decision-makers within the various ministries to insure appropriate policies are set, monitored and enforced.

This conference is an important step towards strengthening water quality management. Action steps to strengthen water quality management will be based on the assessment and analyses that will be presented at this conference, and most importantly, the recommendations that will be developed by you over the next two days.

Thank you. I wish you a successful conference.

**SECTION III**

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**SESSION 1: FINDINGS OF STUDIES AND ISSUES FOR  
STRENGTHENING WATER QUALITY MANAGEMENT**



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## A. ASSESSMENT OF NILE WATER QUALITY

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Programs for monitoring the quality of Egyptian water resources were described by Mrs. Amal El-Sherbini, an engineer with the Nile Research Institute, Water Research Center. The Institute's program aims to detect violations of stream standards and maintain effluent standards as well as to quantify seasonal variations. The program conducted a new sampling campaign in August 1993. It also conducted special studies along the Damietta Branch in January 1993 for an environmental impact assessment study; along the river in July 1991, April and December 1992; and along the Rosetta Branch in 1990-91.

The Institute, in conjunction with the Ministry of Health, conducted a program from 1976-86 to determine the effects of pollutants on Nile water quality for various uses. From 1987-89, the Institute, in conjunction with Alexandria University, monitored water quality changes in the branches during the winter closure period, particularly for pesticides and heavy metals. The Institute also monitored water quality in the HAD reservoir, both the Egyptian and Sudanese parts, at nine sites in November 1991 and April/May 1992.

El-Sherbini cited Nile pollution sources as follows: agricultural drainage water containing industrial wastes, chemical fertilizers, and pesticides; industrial wastes containing heavy metals, organic matter, organic micropollutants, and toxic organic chemicals; untreated domestic wastes; and other sources, including chemicals used to control weeds in drains.

The Academy of Scientific Research and Technology (ASRT) and the University of Michigan monitored water quality from 1975-78 and 1978-82, informing policy makers of conditions, predicting future trends, and suggesting strategies for lake and river management.

The Inland Fisheries and Oceanography Institute conducted water quality investigations as part of broader limnological studies of Egyptian waters. One investigation was conducted monthly in 1991 between Esna and the Delta Barrage for nine sites, monitoring the same stations and parameters that the ASRT and the University had followed.

The Ministry of Health, Environmental Health Department, sampled and analyzed regularly at sites of intake for drinking water treatment plants and municipal and industrial discharge to ensure compliance with Law 48/1982.

The Environmental and Occupational Health Center monitored water quality changes in the Nile, its branches, and main canals from 1988-90 at 83 points along the main channel and 87 points along the main canals monthly, and 90 point sources of pollution quarterly. A total of 24 parameters were included. The Ministry of Public Works and Water Resources regularly monitors locations of supply and intake for drinking water treatment plants and municipal and industrial discharges to protect against pollution and enforce Law 48.

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## B. DRAINAGE WATER QUALITY ASSESSMENT

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The Drainage Research Institute (DRI) has been monitoring the quantity and quality of drainage water in the Nile system since 1980, providing the Ministry of Public Works and Water Resources (MPWWR) with data on availability and suitability of water for land reclamation projects, said Dr. Shaden Abdel-Gawad, head of the DRI's Open Drainage Division.

Samples are taken every three weeks at 93 open locations and pump stations in the Eastern Delta, Middle Delta, Western Delta, and Fayoum. The parameters analyzed included chemical composition, bacteriology, heavy metals, organic matter, and nutrients.

The DRI's work has produced an integrated network for measuring drainage water quantity and quality, a computerized database system, annual comprehensive yearbooks with detailed results of the monitoring, classification of available drainage water according to its salinity and chemical composition, criteria on the mixing ratio of fresh and drainage water, and updated rating curves.

According to Dr. Abdel-Gawad, the pollution sources for the drainage system are municipal and rural domestic wastes, industrial wastes, salinity, pesticides, fertilizers, and solid wastes.

Rural domestic wastes comes from the 95 percent of Egypt's 31 million rural residents who have no access to sewer systems or wastewater treatment facilities. Wastes are commonly deposited directly to the ground, drains, canals, or shallow pits with subsequent discharge to drains and canals. Large cities usually have sewer systems to collect wastes, but many are overloaded or broken, causing discharge to streets or infiltration to groundwater.

Industrial discharges come from Egypt's 20,000 industrial facilities, including food, textile, chemical, and heavy manufacturing plants. Greater Cairo has 35 percent or 250 of the major plants, contributing 40 percent of the heavy metals; these drain to sewers or drains and the Nile. Alexandria has 25 percent or 175 of the major plants, contributing 20 percent of the heavy metals draining to drains and Lake Mariut. The Delta has 22 percent of 150 major plants, contributing 25 percent of heavy metals draining to drains and the Nile branches. The Nile Valley has 18 percent of 125 major plants, contributing 15 percent of the heavy metals; 30 drain to the Nile, 60 to canals and drains, and 35 to sewers or land.

The most severely polluted areas include Lake Mariut, Lake Manzala, and the drains of Bahr El Baqar, Mohit, and Gharbia.

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## C. GROUNDWATER QUALITY

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The presentation on groundwater quality by Dr. Fatma Abdel-Rahman, Deputy Director, Groundwater Research Institute, began by identifying the five principal aquifer systems in Egypt: 1) the Nile Valley and Delta; 2) the Nubian sandstone; 3) the Moghra; 4) the coastal; 5) the carbonate; and 6) the fractured rock aquifer systems.

Next a series of charts and maps described the groundwater potential in terms of land use, type of aquifer, depth to groundwater, quality, and productivity. Figures were provided on present and future extraction for various localities within each province, and on total groundwater potential. The physical setting of the Nile aquifer system was described in detail, in terms of geology, areal extent, groundwater flow, and recharge/discharge.

The presentation also described the groundwater monitoring system, the purpose of which is to measure fluctuations with respect to other water systems and activities; to monitor groundwater quality, mainly for irrigation; to determine groundwater potential and plan for future development. The components monitored are mostly chemical, along with some biological and trace elements for specific studies. Data processing involves data books, GIS maps, hydrographs, and piper diagrams, used to evaluate groundwater vulnerability and predict long-term sustainability.

Areas of high vulnerability include the transition zone, with its sandy soils and shallow groundwater. The reclaimed desert areas have high infiltration rates and low absorption capacity, but deep groundwater, and therefore have moderate to high vulnerability. Traditionally cultivated areas, with their clay cap, are considered to have moderate to low vulnerability. Finally, the northern coast shows a clay cap and upward groundwater leakage, which produces low vulnerability.

Major sources of groundwater pollution are agriculture (diffuse), domestic water (septic tanks, leaking sewers), industry, and construction. The main pollutants include:

- fecal coliforms (found at shallow depths in regions with highly vulnerable groundwater)
- nitrates (in areas with highly vulnerable groundwater, concentration decreases with depth)
- phosphates (normally retained by the upper soil levels)
- ammonium (limited to very localized areas)
- organo-phosphorus and carbamates (at shallow depths only)
- chlorinated pesticides (in highly vulnerable groundwater)
- iron and manganese (very low concentrations, at depth)
- high salinity (north Delta and desert fringes)

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## D. INSTITUTIONAL FRAMEWORK OF WATER QUALITY CONTROL

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The presentation by Dr. Safwat Abdel-Dayem, Director, Drainage Research Institute, gave an overview of the institutional framework and the agencies involved in water quality control in Egypt.

The first chart described six environmental laws in terms of the specific areas they govern, from protecting the environment against industrial pollution to bathing and washing in streams. This was followed by a list of responsibilities and functions related to water quality, including: setting policies and standards, collecting samples and data, enforcing laws and regulations, dissemination of information, and public awareness.

Next the seven main organizations involved in water quality management in Egypt were listed, along with their subsidiary agencies. The legal responsibilities and institutional problems and constraints faced by each the following organizations were presented:

1. Ministry of Public Works and Water Resources (MPWWR)
2. Ministry of Health (MOH)
3. Egyptian Environmental Affairs Agency (EEAA)
4. Ministry of Housing and New Communities (MHNC)
5. Ministry of Industry (MOI)
6. Ministry of Interior (MI)
7. Ministry of Agriculture (MOA)

In addition to the specific constraints facing each of the above organization, there are several general constraints facing the country as a whole, including the lack of a strong central coordinating body to evaluate progress, identify problems, propose solutions, recommend revisions to laws and institutions, and manage a central information system.

Recommendations for addressing these constraints include:

- Improving data management to ensure widespread information sharing.
- Assigning a single agency or ministry to manage water quality, making it responsible for setting objectives, developing action plans, overseeing plan implementation, and evaluating progress.
- Taking action to enforce water quality standards, including improved licensing and penalty mechanisms, and requiring full compliance with standards.

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## E. WATER QUALITY MANAGEMENT PLAN

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Dr. Shaden Abdel-Gawad, Head of the Open Drainage Division, Drainage Research Institute, presented the Water Quality Management Plan, the basic approach of which is to define a set or specific problems, develop alternate solutions to each problem, and finally either to choose one of the alternatives or decide to make no change in the current policy or action.

In discussing the overall status of water quality, Dr. Abdel-Gawad first described the sources of water quality problems, which include sanitary discharge (treated and untreated), industrial discharges, agricultural drainage, and salt water intrusion. In order to rank water pollutants by importance, one has to consider how dangerous they are to the ecosystem in general and to humans in particular, how widespread they are, whether or not they easily decompose into relatively harmless materials, and whether or not they accumulate in fish and other foods. The relative risk rankings by decreasing order of concern are as follows: pathogens and parasites, b) pesticides, c) heavy metals, and d) salinity.

The plan next addresses five major areas of concern in water quality management and lists a number of specific problems, along with a set of alternative solutions for each:

- Specific pollutant problems
- Water quality management process
- Water quality monitoring
- Institutional aspects of water quality management
- Legislative aspects of water quality management

**Specific pollutant problems.** This section considers what the strategy to control each of the four main pollutants should be:—pathogens and parasites, pesticides, heavy metals, and salinity. Alternative solutions include public media campaigns, enforcement of anti-pollution laws, construction and repair of sewers and sewage treatment facilities, licensing pesticide use, and policies to eliminate subsidies and rationalize water pricing.

**Water quality management process.** The three problems identified are: 1) there is no defined or implied process for water quality management in Egypt; 2) water quality data management and monitoring programs in the country are poor; and 3) there is no effective mechanism to ensure compliance among government-owned facilities. Proposed solutions include setting up working groups composed of Egyptian and expatriate experts, developing comprehensive databases and developing data management teams, and enforcing standards for government-owned facilities.

**Water quality monitoring.** The single problem raised under this category is that current monitoring programs are not providing enough appropriate information for effective water quality management. Alternative solutions include the assigning of monitoring

responsibilities to staff in one or more ministries and allocation of sufficient resources to do the job, and hiring expatriate consultants to design a detailed monitoring program.

**Institutional aspects of water quality management.** Two problems were identified under this category: 1) no single agency or ministry is charged with managing the water quality management program; and 2) there is a general lack of expertise in Egypt for implementing the water quality management program. Alternative solutions to the first problem call for creating a new organization and giving it overall administrative responsibility, or granting it to an existing ministry or agency. The second problem could be remedied by relying heavily on expatriate expertise, developing training programs for all levels of staff, and aggressively hiring qualified Egyptians while assessing current staff to determine how they could best be utilized.

**Legislative aspects of water quality management.** This category lists nine specific problems related to specific degrees that are overly restrictive, too lax, or inappropriate. In some cases, such as for herbicides, pesticides, and toxic organic compounds, there are no standards at all. Proposed solutions call for more specific language, reevaluation of fines and penalties, and developing documents that explain how to interpret various aspects of the law.

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## F. WHY WATER QUALITY MANAGEMENT?

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This presentation by Dr. Robert Kelly showed how water quality management can serve to maximize the availability of usable water for domestic, irrigation, and industrial uses. In order to obtain sufficient water of suitable quality, it is necessary both to minimize water use and maximize its reuse.

Water use can be minimized by: 1) optimizing water use for agriculture; 2) reducing water loss in distribution systems; 3) reducing water consumption in individual households; and 4) reducing consumptive/degrading industrial water use.

It is possible to maximize water reuse by: 1) maximizing the quality of agricultural return flows; 2) treating sanitary wastes before discharge to drains and the Nile; 3) reusing sanitary effluents directly after treatment (without mixing with fresh water); 4) reducing or eliminating discharge of sanitary wastes where community waste treatment is not feasible; and 5) reusing industrial effluents directly for other industrial processes or for other unrelated purposes.

Major oversights or inefficiencies that interfere with the above efforts include: 1) uncontrolled discharge of sanitary waste in locations where treatment is not feasible; 2) lack of control of agricultural return flows; and 3) a focus on controls with relatively little effect on public health, which should be given low priority.

The report states that progress in pollution control has been slow due to lack of public understanding of its importance, the lack of funds, the low priority assigned to pollution control by the government, and the lack of flexibility in priority setting for dealing with most significant problems.

A number of legal issues are also involved, such as inappropriate or too stringent standards for some industrial discharges and the equal treatment of all pollutants under the law, regardless of their impact on human health and the environment. Lack of flexibility in requirements for secondary treatment of wastes is also cited, as well as the lack of economic incentives for pollution control in industry.

The availability of data and information is often restricted, and the focus should be on the following areas: the overall quality of Egyptian waterways, and the suitability of water usage for various purposes; the location of pollution sources and "hot spots"; and the suitability of fish at various locations for human consumption.

The industrial sector provides much employment to urban Egypt, and pollution control is poor because of marginal economic performance and a lack of resources to deal with problems other than production efficiency and economic vitality. Some industries are causing long-term environmental damage and reduced public health; low-cost and effective

methods must be found and implemented to substantially reduce the long-term adverse effects of industrial pollution.

Pollution-causing activities in rural Egypt have long been ignored, with much more attention being given to urban areas. The problems are primarily related to human and agricultural wastes. The problems can be controlled only by changing the behavior of a large number of individuals, as technological solutions provided by Government are generally not effective.

A description of the seminar's focus and methodology was also presented:

- Focus on various aspects of all the above issues during seminar sessions.
- Break up into small groups to discuss activities that required priority attention.
- Present findings of small groups at plenary session.
- Discuss differences in findings among different groups to develop consensus on approaches.



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**G. ISSUES FOR STRENGTHENING  
WATER QUALITY MANAGEMENT**  
by Dr. Khalil H. Mancy

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The stark dependence of the desert nation of Egypt on the availability of an adequate supply of usable fresh water is clear. Water is Egypt's limit to growth, and as such is a resource that must be well managed. With careful planning and innovation, Egypt has the ability to sustain not only enough water to meet its needs, but perhaps even more importantly, water of sufficient quality to ensure the health and prosperity of her people. While the traditional concern with securing sufficient Nile water cannot be overemphasized, unchecked water quality is posing significant risks to the country's aquatic resources, public health, and economic growth.

By definition, the management of Egypt's water resources entails sustaining fresh water supplies of adequate quantity and quality to satisfy the needs of domestic water supply and sanitation services, agriculture, industry, fisheries, and river navigation. It is obvious that water quality management is an inherent component of any water resources management program. This includes an effective water quality monitoring and information system. The Ministry of Public Works and Water Resources (MPWWR) has the mandate to develop and manage Egypt's fresh water resources. In order to respond effectively to present and future environmental challenges, the MPWWR needs to strengthen its capabilities in water quality assessment and control, and establish multidisciplinary management teams.

Based on previous experience in Egypt and other regions of the world, the development of water quality management programs should take into account the following.

- a. The management of the quantity and the quality of water resources are inseparable and should be centered within the MPWWR.
- b. Egypt's stark dependence on the Nile, coupled with its position as the most downstream country in the river basin, require a careful account of pollution at upstream locations which may necessitate the establishment of an international water quality agreement with upstream countries.

- c. The Aswan High Dam Reservoir (AHDR) is the immediate source of the Nile in Egypt and it will continue to have significant impacts on downstream water quality and river conditions. Emphasis should be given to the management of the water quality and the living resources of the AHDR, as an integral part of an overall national program.
- d. The major constraints for the development of a sustainable water quality management program will be neither the lack of technology nor the limits of financial resources. Rather, this development will depend on MPWWR's capacity and the suitability of the policy environment. Capacity building must come from within, which entails the ability to develop, utilize, and sustain available resources.

**SECTION IV**

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**SUMMARY OF LUNCH PRESENTATION**

74a

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## OVERVIEW OF WATER QUALITY ENVIRONMENTAL CONCERNS

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This presentation by Dr. Mohamed Fawzey, Undersecretary, EEAA, gave an overview of environmental protection in Egypt based on the three main elements of environmental legislation, environmental institutions, and the national environmental action plan. The main components of the master plan include:

- Land management, including afforestation and public gardens
- Water resources management
- Control of air and noise pollution
- Natural and cultural heritage
- Marine pollution and coastal zone management
- Solid waste management
- Role of education, cultural organizations, NGOs, and public information
- Institutional aspects, management and environmental activities
- Population, environment, and development
- Management of environmental crises in Egypt
- Egypt's regional and international commitments

The draft law for environmental protection is broken down into four chapters:

1. Environmental management (Central Environmental Agency - CEA; Environmental Protection and Development Fund; Development and Environment; management of hazardous substances and wastes).
2. Prevention of air and noise pollution.
3. Marine environment protection (pollution from ships, land-based sources, international certificates, administrative and legal procedures, shore protection).
4. Penalties or sanctions.

The role and functions of the proposed CEA are discussed in detail, broken down into 14 points covering policymaking, establishing norms, collecting information, planning and monitoring, coordination among agencies, and follow-up with regional and international bodies.

Next the main features of chapter one (environmental management) from the draft law for environmental protection are presented, which include enhancing the role of the national environmental protection institution, establishing an environmental fund, requiring

environmental impact assessments, developing a national environmental monitoring network, contingency disaster plans, and rules for handling hazardous substances and wastes.

The Environmental Protection and Development Fund will be financed by fines, state budget allocations, and grants from national and foreign agencies. Among its objectives are protecting the environment, dealing with natural disasters, financing studies to establish norms and standards, covering the clean-up costs of unknown sources of pollution, and organizing pertinent conferences.

Finally, existing environmental laws (no. 48 of 1982 and no. 93 of 1962) should be reviewed to accommodate the following objectives:

- Improving implementation of both laws
- Defining clearly the roles of relevant ministries with respect to licensing procedure
- Amending discharge standards to a more realistic level
- Gradually enforcing set standards for better compliance and efficient enforcement

**SECTION V**

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**SESSION 2: WATER QUALITY DATA--  
COLLECTION, SHARING, AND COOPERATION**

*26a*

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## THE IMPORTANCE OF WATER QUALITY DATA

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### A. Summary of Presentation

The following is a general outline of the presentation by Dr. Khalil Mancy on the importance of water quality data.

Water resources management requires data on both water quantity and water quality.

The effectiveness of water resource management programs depend on availability and reliability of needed data.

Water quality data are required in order to provide water for specific uses.

Water quality information needs for MPWWR should take into account:

- Egypt's location: most downstream country in the Nile Basin
- Aswan High Dam reservoir
- Water use/reuse

Institutional linkages

Water quality monitoring:

- Why
- What
- How
- Data assimilation
- Information dissemination/optimization/techniques

Conclusions

### B. Working Group Discussion

#### 1. Issues

Each agency needs information for its own purposes.

Each agency collects information relating to its own mandate.

Some of the information required by an agency is also being collected by another agency, a duplication of effort.

Some of the information required but not collected by a given agency is available from another agency.

The sharing of information is required to avoid two situations:

- Decision making without all readily available relevant information
- Obtaining information that is already available from another source

Activities that could facilitate cooperation and data sharing among agencies:

- Developing computerized data management systems within agencies, including methods of sharing data electronically among agencies
- Adopting standards for sampling and analysis
- Enhancing use of automated (versus manual) measurement methods, including data capture
- Adopting standard measurement procedures
- Developing quality assurance and intercalibration procedures
- Institutionalizing data sharing
- Developing bilateral agreements between agencies on guidelines for data sharing covering issues such as:
  - Restrictions on publication/release of data
  - Identification of sensitive data
  - Publication rights for scientific journals
  - Acknowledgment of data sources
  - Procedures for identifying gaps and redundancies of information
  - Appropriate interpretation and use of data
  - Identification of sampling sites and methods of analysis
  - Publishing, by each agency, its data needs with periodic updates of data available
  - Creation of an Interagency Oversight Committee

**Exercise.** These activities could each lead, under appropriate circumstances, to greater cooperation for improving the suitability of water for use and re-use

Please evaluate this list, and add to it as appropriate.

List the four most important activities, in priority order, that would lead most quickly to greater cooperation and more effective water quality management.

Be prepared to explain the reasons for your selection and their priority ranking.

## 2. Findings

### Group 1

- 1 Identify agencies involved in the field of water quality management.
  - Type of data
  - Mandate of agencies
  - Additional information required
- 2 Create an interagency oversight committee.
- 3 Develop multi- and bilateral agreements among agencies on guidelines for data sharing.
  - Set guidelines to develop computerized system.
  - Communication regulations (initial stage manual).
- 4a Adopt standards of sampling and analysis.



- 4b Designate institutions responsible for collection of water quality data and their roles in the new law's executive regulations.

Group 2

- 1 Identify and strengthen existing institutions in the field of water quality.
- 2 Adopt standards of sampling and analysis.
- 3 Develop computerized data management systems within agencies.
- 4 Develop bilateral or multilateral agreements among agencies on guidelines for data sharing.

Group 3

- 1 Adopt standards of sampling and analysis for specific data uses.
- 2 Create an interagency oversight committee.
- 3 Develop computerized data management systems within agencies.
- 4 Institutionalize data sharing — put restrictions on publication or release of data.

Group 4

- 1 Adopt standards of sampling, analysis, and develop computerized data management systems in agencies.
- 2 Institutionalize data sharing and develop bilateral agreements among agencies.
- 3 Publish data needs for each agency with periodic updates of data available.
- 4 Create an interagency oversight committee.

Group 5

- 1 Standardize the monitoring function:
  - Quality assurance through central agency oversight.
  - Separate research from ongoing public domain monitoring.
- 2 Establish a legal basis for a central water quality management data base.
- 3 Provide incentives for data sharing
  - Quick publication/wide dissemination.
  - Computerization of data and analyses.
- 4 Encourage ongoing group activities to discuss problems and possible solutions and to coordinate cooperative actions.

**3. Analysis and Recommendations**

- Four of the five groups ranked “standard procedures” as the first or second activity requiring priority attention. The “institutionalization of data collection” or the “development bilateral/multilateral agreements” on data collection were listed as one of the top four priorities by four of the five groups
- The development of an “oversight committee” was listed as one of the four top priorities by three of the five groups.
- Two groups listed “identifying the organizations who have data relevant to water quality management” as the high priority item.
- Two groups identified “the development of computer resources within agencies” as a priority item.

- Two groups identified “publishing the data” as being important. However, during the discussion, several groups said the publishing was an activity that must be done.

There is a strong need for coordination of data collection activities, but there is some disagreement on the mechanism to be employed. The panel believed that the “Oversight Committee” approach was more appropriate than the “Institutionalization” approach for two reasons: First, an oversight committee implies a continuous effort to identify data needs and data availability. This is extremely important. If attention given to monitoring activities is allowed to fade, then monitoring is likely to stop. This is not desirable in the longer term. Second, responsibility for data collection is already institutionalized in Law 48, and this has apparently made no difference in the availability of data in Egypt. Data gaps are still extensive, particularly with regard to sources of pollution. Setting up new institutions, or requiring existing institutions to provide services that they are incapable of, would not be a positive step. It is better to strengthen the capabilities of those who already have extensive, effective programs. If bilateral or multilateral agreements among agencies are used to complement the oversight committee, a flexible mechanism for data sharing and cooperation can result. It would be easier, with this approach, to change monitoring agreements as the needs for data and information change.

Although standards were emphasized by most of the groups, the fact that only one or two agencies have significant roles in long-term monitoring leads to the conclusion that this is a desirable, but not critical, step. The organizations involved are capable of developing these standards among themselves (perhaps with limited technical assistance), and this should be done as part of the bilateral/multilateral agreement negotiations.

Two groups indicated the evaluation of data holdings of other agencies as an important activity. The panel agrees with this recommendation. There is no reason for one agency to collect the same data for the same purpose as another agency. Economies of scale can sometimes be achieved if the data obtained for one purpose can be used for another purpose, but often, sampling and analysis programs generate data that is of little relevance for other groups.

**SECTION VI**

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**SESSION 3: ACHIEVING COMPLIANCE OF INDUSTRY--  
GOVERNMENT ENTITIES AND PRIVATE SECTOR**

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## INDUSTRIAL WASTEWATER MANAGEMENT IN EGYPT

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### A. Summary of Presentation

Professor Fatma El-Gohary, from the Water Pollution Control Department of the National Research Center, presented an overview of industrial waste management in Egypt. She began by briefly discussing the history of Egyptian industry, in particular the rapid industrialization that occurred after World War I and has led to serious environmental degradation. Egypt now faces the need to invest in this sector to clean up the environment.

New industries have been concentrated in the metropolitan areas along the Nile Delta, north and south of Cairo, and in the Alexandria metropolitan area. The Ministry of Industry owns 72 percent of the 367 public industries, while the remaining industries are split among other ministries. In 1956 all major industries were nationalized with the goal of rapid returns on investment, with little attention paid to the long-term issue of environmental deterioration. Although "Law 93" on wastewater disposal was issued in 1962, it was never enforced, and as a result untreated wastewater has been continuously discharged.

In 1983 an urgent plan of action was adopted to control pollution of the Nile from industrial waste, but once again, very little has been implemented. It is estimated that wastewater from 350 industries is discharged directly into the Nile or through municipal systems that discharge into the river. In the Alexandria area, industrial wastewater is discharged into the Mediterranean Sea directly, or via Lake Mariut.

Because no central agency in Egypt is responsible for waste management, there is little coordination among agencies, insufficient strategic planning, and inadequate monitoring. Environmental laws are not enforced and efficient non-polluting technologies are not sufficiently promoted. To correct this situation, the following conclusions and recommendations were presented:

- Top priority should be given to industrial pollution control programs.
- Water pollution control is most effective at the source.
- Environment impact assessments are needed to develop policies and programs
- Industrial facilities must be modernized with non-polluting technology.
- Detailed studies should be carried out for each industry to minimize the quantity and improve the quality of wastewater discharged.
- Toxicological research must be done on new compounds.
- An effective monitoring program must be developed and linked to the enforcement mechanism and environmental legislation.

The presentation was supported by a number of tables and diagrams showing the quantity of wastewater discharged by factories at various locations, the distribution of industries in Egypt, and wastewater/pollutants discharged by different industrial sectors.

## **B. Working Group Discussion**

### **1. Issues**

Funds are insufficient to bring all facilities into compliance with Law 48 (or modifications to be issued within the next few months) within the time limit likely to be specified by the upcoming environmental law (three years).

There are not sufficient human resources with the appropriate expertise to bring all industrial facilities into compliance within three years, even if funds were available.

Some industries may not be able to meet standards, no matter how flexible, with all available waste control technology installed and operating effectively

Not all public sector companies will be privatized within the period of time specified under the new environmental law

### **Considerations for Setting Priorities for Industrial Pollution Control:**

- Technological feasibility of achieving compliance with standards
- Effluent reuse options, e.g., using effluent for non-contact irrigation (trees, etc.)
- Socio-political implications. c.g., unemployment if a plant is not able to meet standards and must be shut down
- The quality and intended use of water receiving effluents
- Costs and benefits of environmental control options including
  - End-of-pipe treatment
  - Clean technology/pollution prevention
  - Changes in raw materials
  - Raw material recovery
  - Changes in industrial processes
  - Recycling/in-plant reuse of waste water
- Relative magnitude (load) of discharge
- Relative impacts of contaminants on water receiving effluents and the intended use of the receiving waterbody
- Fate of discharge pollutants (carried downstream, remain in sediments)
- Health effects of effluents
  - Toxicity of effluent
  - Persistence of toxicity
  - Ability to be accumulated in food organisms (fish and crops)

**Exercise.** Each of the above considerations could be used as one criterion for setting priorities for pollution control. Please evaluate this list, and add to it as appropriate. List the four most important activities, in priority order, that should be used in determining the priority for industries to receive attention/assistance in controlling aquatic discharges. In your discussions, please emphasize those considerations that would most quickly create sustainable improvements in water quality that would lead to maximizing water use and reuse.

Be prepared to explain the reasons for your selection and their priority ranking.

## **2. Findings**

### **Group 1**

- 1 Implement a centrally-funded cost-benefit environmental control option assessments program for group/individual industries.
- 2 Review effluent standards considering receiving water quality and intended use.
- 3 Increase public awareness and role of NGOs.
- 4 Review and amend existing laws considering socio-political-technical implications followed by strict enforcement.

### **Group 2**

- 1 Health effects of effluents: relative magnitude and relative impacts.
- 2 Costs and benefits options.
- 3 Effluent reuse options, both within industries and other options.
- 4 Quality and intended use of water receiving effluents.

### **Group 3**

- 1 Technological and economic feasibility of achieving compliance with standards.
- 2 Health effects of effluents' impacts
  - Relative loads of discharge
  - Toxicity
  - Persistence
  - Accumulation
- 3 Quality and intended use of water receiving effluents
- 4 Effluent reuse options, e.g., green areas

### **Group 4**

- 1 Assessment of health effects of effluents — toxicity, persistence of toxicity, and ability to accumulate
- 2 Relative impacts of contaminants — magnitudes of impacts
- 3 Costs and benefits of environmental control options
- 4 Effluent reuse options: irrigation, groundwater recharge, treatment required

### **Group 5**

- 1 Relative impacts of contaminants on use of water with special focus on human health
- 2 Cost-benefit of control options including socio-economic issues (equity)
- 3 Technology choices for implementing compliance; cost effectiveness of "housekeeping measures," etc.

## **Analysis and Recommendations**

- Although this conclusion did not come through in the results presented, almost every group wanted action soon to control pollution from industry.
- Four of five groups indicated that health effects should be the first or second criterion for setting priorities.

- Three of five groups indicated that the costs of pollution control relative to the benefits to be attained were either the first or second criterion for setting priorities; a fourth group listed this as the third criterion.
- Three of five groups indicated that the feasibility of water reuse (rather than discharge) should be considered in priority setting.

There is a pressing need for immediate action to control pollution from industry. Primary attention should be given to those industries having the greatest negative effect on human health. For this to be effective, there must be changes to the current legislative framework (particularly regarding standards — see below), or the existing framework must be enforced in such a way that the worst polluters are required to reduce critical discharges sooner than polluters having only minor effects on water use or reuse. In any case, strict enforcement is required for those industries having large negative impacts on human health.

As a second level consideration, government should focus on those industries that can reduce discharges the most at least cost. This does not imply that facilities that have large negative impacts on human health should be ignored if the cost of reducing discharges is large. Rather, priority attention should be given to those industries having large negative health impacts that can reduce impacts cheaply. This, in effect, achieves the greatest reduction in pollutant loadings within the shortest time. This should also result in the greatest human health gains for least expenditure for pollution control. In the longer term, attention will have to be given to the facilities that are more expensive to clean up, but this can be delayed in order to achieve immediate results.

In deciding how to reduce discharges from particular industries, it is important to consider the direct reuse of water (for other industrial processes or for irrigation) rather than regard discharge back to the Nile system as the only option. There are many opportunities for industrial wastewater reuse, and if these opportunities are evaluated carefully, wastewater reuse may be less costly and more beneficial than treatment and discharge. A useful first step is the development of water quality guidelines for the reuse of water for various crops and other purposes.

Finally, discharge and receiving water standards should be reviewed and revised, taking into account the intended use of the receiving water. This needs to be more comprehensive than the existing provisions in Law 48 and its executive regulations. For example, all drains are not equal — some drains return to the River Nile or canals and the water in some drains is used directly for irrigation. The standards for discharges to these drains should be more stringent than standards for discharges to drains that are not intended for reuse. Similarly, if dischargers are having minimal effects on water reuse (and human health), it is not useful to require them to implement a high level of treatment just to reduce discharges to an arbitrarily high standard. The panel suggests that specific uses be determined for the River Nile at various locations and for each canal and drain, and that the standards for each water body be based on its immediate and longer term intended specific uses.

**SECTION VII**

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**SUMMARY OF LUNCH PRESENTATION**

34a



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## USAID ENVIRONMENTAL STRATEGY

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Dr. Richard Rhoda, Director of USAID/Egypt's Environmental Office, spoke to the workshop about the Agency's approach to environmental issues in Egypt. He said that AID began developing its first Environmental Assistance Strategy for Egypt in 1991, by analyzing the benefits of its ongoing activities in sewage collection and treatment, irrigation management, energy efficiency, family planning, and policy reform.

In early 1992, a PRIDE team including Dr. John Woods went to Egypt to help AID identify major environmental problems and constraints and recommend areas suitable for AID assistance. The major problems identified, ranked in order of importance, were: fresh water, urban air, solid waste, and coastal and marine water. The following major constraints were identified:

- **Inappropriate policies**, such as heavy subsidies on energy, water, fertilizer, and pesticides, which the government has been working to reform.
- **Planning and decision making** in government agencies that often does not address environmental costs and benefits.
- **Implementation of existing laws** has not been carried out effectively.
- **Free flow of information** is limited by the lack of systematic and uniform monitoring systems; since information is not widely shared, decision makers and the general public are not adequately informed of environmental issues.
- **Imbalance between population and physical resources**, particularly arable land and water, which aggravates all environmental pollution problems.
- **Legacy of inefficient and wasteful technology** in industry, which is largely controlled by the public sector, and in agriculture.

Based on an analysis of these problems and constraints and an assessment of the agencies' strengths and weaknesses, in 1992 AID developed its environmental strategy for Egypt, focusing on sewage collection and treatment, irrigation, agriculture, family planning, electricity, and to a limited degree, industry.

Among AID's eight strategic objectives, the one for environment is *enhanced protection of Egypt's fresh water and urban air resources*. Three approaches will be used to achieve this objective:

Environmental policy and institutional reform. AID will support the government's Environmental Action Plan, designed to reduce environmentally detrimental subsidies; it will help build the environmental capabilities of the Ministries of Irrigation, Agriculture, Housing, and Industry; and work to improve the free flow of information.

**Reduced waste discharge into the Nile.** AID's \$2 billion wastewater construction program is helping to halt raw sewage flooding in Cairo and Alexandria, and has installed sewerage systems in Port Said, Ismailia, and scores of other cities and towns. AID is also continuing its irrigation management systems program and placing new emphasis on water quality and policy issues.

**Promotion of improved technologies for environmental protection.** The agency is promoting technologies that are efficient, appropriate, and environmentally sound to reduce fuel consumption and emissions of air pollutants. One important tool used in this effort is the *Comparative Environmental Risk Analysis*, which helps to identify and quantify environmental damage, assess proposed interventions, set priorities, and share information.

**SECTION VIII**

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**SESSION 4: WATER QUALITY CONCERNS  
IN RURAL AND URBAN AREAS**

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## SUMMARIES OF PRESENTATIONS

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### A. Wastewater and Sanitation

This presentation was made by Eng. Mohamed Negm El Din Mohamed, Head of the Central Research at the Department National Organization for Potable Water and Sanitary Drainage (NOPWASD). He opened by stating that the responsibility for managing the water and wastewater sector is divided between local operating agencies and national institutions, as described below.

#### Operating Agencies

The management of water supply and wastewater services is entrusted to local institutions (operating agencies) with widely differing levels of capacity and authority. They can be divided into four main types:

1. Independent public authorities (general organizations) for water supply/wastewater in greater Cairo and Alexandria, serving about 20 percent of the population.
2. Governorate water supply and wastewater companies in the governorates of Beheira, Damietta, Kafr-El-Shiek, serving about 5 percent of the population.
3. The Suez Canal Company, providing water services in the cities of Suez, Port Said and Ismailia, serving about 2 percent of the population.
4. Governorates providing water supply and wastewater services, usually through local housing directorates or municipal departments, in all other areas besides those listed above, serving about 75 percent of the population.

#### National Institutions

On the national level, the following institutions play important roles in the management of the sector:

- The Ministry of Housing, New Communities, and Public Utilities (MHPU), as parent ministry of the sector, has primary responsibility over sector matters. Within MHPU, the Central Department of Public Utilities is in charge of the sector with policy guidelines formulated by the High Policy Committee created by MHPU.
- The National Organization for Potable Water and Sanitary Drainage (NOPWASD), attached to MHPU, is responsible for general sector planning, support and

coordination. It also prepares, designs, and executes investment projects for all water companies and governorates.

- The Ministry of Finance (MOF) is the ultimate provider of domestic investment funds and, in the case of governorates, is the administrator of the budget process.
- The Ministry of Planning (MOP) is responsible for the allocation of domestic resources for sector investments within the context of the Government's five-year planning process for public sector investments.
- The National Investment Bank (NIB), an organization attached to MOP, administers and disburses domestic funds for investment allocated under the five-year plan.
- The Ministry of State for International Cooperation (MISC) coordinates funding from international agencies.
- The Ministry of Health monitors drinking water quality standards.

The key characteristic common to all operating agencies is that all important utility functions, apart from operation and maintenance, are controlled directly or indirectly by the national government represented by MHPU/NOPWASD for technical matters and MOP/NIB/MISC for financial matters.

All operating agencies and national institutions, with the exception of NIB, are subject to civil service regulations with respect to employment and administrative procedures. Agencies depend on the national government to finance a part of operation and maintenance costs, and all investment expenditures. The national government and city councils control the setting of rates. Likewise, the responsibility for the selection, preparation and execution of investment projects is the domain of national government.

The great variation in performance among operating agencies makes a fair and balanced assessment difficult. However, all of them suffer, in widely varying degrees, from many of the same difficulties. Weak management and overstaffing, lack of adequate administrative and technical skills, and the absence of adequate up-to-date information systems are a few of the pervasive problems. There is a tendency for management to be preoccupied with short-term concerns and daily problems. Operations and maintenance of water and wastewater facilities are often inadequate. Financial inefficiencies result from low tariff levels combined with poor billing and collection practices.

The rapid growth in service levels for water and sewerage and the construction of wastewater treatment facilities has been made possible through enormous investments over the past 15 years. Since 1977 the total investment volume from all sources was about LE 10 billion in current terms. Over the past five years, investments amounted to about LE 1 billion per year. Foreign multilateral or bilateral funding agencies provided about 60 percent of all resources, mostly in the form of grants and soft loans.

USAID has been the largest contributor, with about US \$2 billion already disbursed and about US \$400 million committed. Many of the donors, including the United Kingdom, Japan, Germany, the Netherlands, Denmark, Sweden, and Finland, as well as the World Bank, contributed lesser, but still significant, investment resources. The Egyptian treasury provided the remaining 40 percent of investments.

These investments were distributed among subsectors as follows: 50 percent for water supply; 30 percent for sewerage; and 20 percent for municipal wastewater treatment. Geographically, about 70 percent of all investments were channeled to Cairo and Alexandria, where about 25 percent of Egypt's population is concentrated. Only about 30 percent of the investment went to the rest of the country, where some 75 percent of the population resides. Large-scale foreign financing has clearly been a decisive factor in setting priorities for sector development. The USAID decision to concentrate on improving wastewater collection and wastewater treatment in Cairo and Alexandria is largely responsible for the fact that almost half of all investments in recent years went for wastewater collection and treatment in these two cities.

In the future, even more financial resources than those spent in the past will be needed to expand service coverage, improve quality, rehabilitate and replace deteriorated facilities, and for operation and maintenance. The level of resources needed will depend on the level of service the government intends to achieve in the future. A rough estimate of the financial resources required through the year 2000 for meeting three service coverage scenarios indicates that just to maintain present levels of service, rehabilitate or replace deteriorated facilities and to operate and maintain systems properly (i.e. the low-growth scenario) will require almost 2 billion LE per year (constant 1992 prices). For the medium- and high-growth scenarios, these amounts would increase to about 2.8 billion LE and 4 billion LE, respectively.

The Supreme Committee for Policies and Economic Affairs, headed by the prime minister, approved in May, 1985 the proposal for tariffs to be applied in the governorates for cost recovery of the water works. It gave the governorates the right to raise the tariff gradually. The goal of the proposal was to cover 100 percent of the operation and maintenance costs by the year 1992. Some governorates succeeded in reaching this target even before that date (Cairo and Alexandria).

On the 11th of April, 1993 the Minister of Reconstruction approved a new tariff structure to be applied in the governorates starting from the 1st of July, 1993 until the end of June 1995. The rates given in this structure differ according to the kind of service. It varies (year 1994/95) from 23 piasters/m<sup>3</sup> for low consumption domestic use up to 85 pts/m<sup>3</sup> for production and investment use (hotels, free zones, tourism, investment and private hospitals). A lump sum charge is to be applied to units constructed by the governorates which reach (in year 1994-95) 250 pts for a one room unit up to 500 pts for a unit with three or more rooms. Also a percentage of the water bill is to be added to cover the wastewater services in the areas where this service is available. This percentage is 35 percent for domestic water use and 60 percent for other water uses.

## **B. Water Quality Monitoring Programs**

Dr. Nabil El Molhey, of the Soil and Water Research Institute, presented a series of maps and charts detailing a number of water quality monitoring programs carried out under the direction of the Agriculture Research Center.

Figure 1 was a schematic map of the quality monitoring program for drainage water in the Nile Delta, showing the location of 19 pumping stations with sampling facilities and 100 in-stream sampling locations.

Figure 2 was a more detailed schematic map of sampling locations for the water quality monitoring program, showing the locations and names of pumping stations and sampling locations in the area near Lake Manzala.

The next figure was a large-scale schematic map of program sampling locations for the salinity monitoring program for the Cairo area, the entire Delta and Mediterranean coast from Mariout Lake in the west to the Sinai peninsula, and the Suez Canal south to the Red Sea. This map identifies 45 pumping stations and in-stream sampling locations.

The presentation included a number of tables containing information on the chemical analysis of water quality at various locations in Egypt. The first table showed boron and nitrate levels in parts per million found in different types of water: drainage, ground, sewage, industry, and irrigation water. It also showed ranges within which these levels are considered to be good, moderate, or severe.

Several detailed charts followed which gave a break-down by various chemical constituents of the annual average water quality for eastern and western sources in the Delta drainage system. The chemicals present in parts per million include nitrates, iron, manganese, zinc, copper, lead, cadmium, and lithium.

## **C. Working Group Discussion**

### **1. Issues**

#### **Sanitation**

A sizable portion of the rural population does not have sewerage and treatment facilities (2,000 communities under 10,000 population).

The provision of piped water supply has been given higher priority than sewerage and treatment.

The normal disposal practices for waste are dumping in the Nile, canals, or drains.

Where water supply has been provided, disposal is either through open sewers that lead to the drainage system or to the Nile and canals, or directly to the land around households.

These practices are leading to high levels of endemic parasitism (Schistosomiasis) or disease (diarrhea) and are some of the reasons for low life expectancy and high infant mortality in Egypt.

It would be a challenging task for GOE, even with massive donor support, to provide

sewerage and treatment for these communities.

### **Agricultural pollutants**

Agricultural return flows have elevated pollutant levels, particularly nutrients, and may have high concentrations of pesticides.

Nutrients lead to weed-choked drains and eutrophication in the Northern Lakes making them unacceptable for activities such as fish culture.

Information on pesticide contamination of drainage water that is reused for irrigation (or fish harvesting) is very limited, making the design of an appropriate management program difficult).

### **Activities that Can Help Focus on Needed Actions**

#### **Sanitation**

- Identify appropriate wastewater treatment or control options for small communities.
- Identify wastewater reuse options (non-contact irrigation, fish farming, groundwater recharge) for treated wastewater from small communities.
- Develop regional approaches to wastewater control (Upper Egypt and desert areas; Delta).
- Foster local involvement in the construction and maintenance of low-cost wastewater facilities to encourage long-term sustainability and community responsibility for their operation.
- Identify agency responsible for developing and implementing appropriate disposal methods for sanitary wastes in rural communities.
- Provide covered sewers for communities with piped water supplies.
- Develop methods to determine priorities for developing disposal facilities/treatment facilities/sewers in smaller communities.

#### **Agriculture**

- Identify ways to limit the use of fertilizers on crops to levels where optimum growth is achieved.
- Identify ways for management/control of pesticide application rates in the Delta where drainage water is mixed with canal water for use as water supply.
- Develop extensive education campaign for farmers encouraging the use of appropriate pesticides, application rates, and timing to control specific pests on specific crops.
- Measure pesticide levels in fish and sediments where fish are harvested on a commercial scale to determine health implications of pesticide contamination; use information to limit pesticide applications upstream, if needed.

**Exercise.** Each of the above considerations could lead to the reduction of pollution from rural communities and agriculture, thus maximizing water use and reuse. Please evaluate this list, and add to it as appropriate. List the four most important activities, in priority order, that would lead most quickly to reduction in pollution from rural sources. In your deliberations, please keep in mind the state of knowledge about the issue and any previous activities that have been carried out in this area. Be prepared to explain the reasons for your selection and their priority ranking.



## **2. Findings**

### **Group 1**

#### **Sanitation**

- 1 Identify and develop alternatives: rural low-cost appropriate wastewater facilities. Demonstrate by testing on small scale, then apply the most appropriate (community involvement in all stages).
- 2 Develop public awareness in sanitation (water supply, reuse of wastewater).

### **Group 2**

#### **Sanitation**

- 1 Provide covered sewers for communities with pipe water supplies.
- 2 Foster local involvement in the construction and maintenance of low cost waste water facilities to encourage long-term sustainability.
- 3 Develop regional approaches to wastewater control.
- 4 Develop method to determine priority for developing disposal facilities.

### **Group 3**

#### **Agriculture**

- 1 Determine distribution of pesticides in water bodies.
- 2 Identify ways for management of pesticide application rates.
- 3 Identify ways to limit the use of fertilizers.
- 4 Develop extensive education program for correct use of pesticides and fertilizers.

### **Group 4**

#### **Agriculture**

- 1 Determine distribution of pesticide residues in water bodies associated with drainage water reuse.
- 2 Identify ways for management/control of pesticides application.
- 3 Identify ways to limit/manage/control the use of fertilizers.
- 4 Develop effective education programs for farmers.

## **3. Analysis and Recommendations**

- The two groups that dealt with priority actions for sanitation disagreed on how best to proceed. The first group wanted small-scale demonstration projects to be carried out with extensive local involvement; the second group wanted immediate action in the placement of covered sewers followed by local involvement and local solutions.
- The two groups considering an approach to pesticides were unanimous in their findings to 1) determine the distribution of pesticide residues, 2) identify methods to control pesticide applications, 3) identify methods to control fertilizer applications, and 4) develop educational programs for farmers.

There are two basic approaches to controlling the discharge of sanitary wastes to receiving waters: installing individual facilities for each household (pit privies, septic tanks), or providing waste collection and treatment. In Upper Egypt, the former is generally

appropriate, in Lower Egypt, only the latter is effective because of the high water table. In either case, however, where water is piped to households, septic tanks or sewers are the only options since excess water will simply be discharged to streets otherwise. The problem is most severe in the Delta, and the provision of covered sewers to remove wastes must therefore be a high priority there.

At the same time, creative ways to remove or reuse sanitary wastewater must be developed. Sanitary wastes can be used with little treatment for irrigation of specific crops provided the local population understands the health risks in doing so (health risks are more related to walking on irrigated land than in eating food from irrigated crops). With treatment, it can be used for irrigating a wide variety of crops and other vegetation. The panel believes that broad scale education on appropriate disposal methods for sanitary wastes must be high priority, and agrees with both groups that community involvement is critical to the success of any sanitary waste control effort. Beyond this, there are many possible solutions that could lead to successful outcomes, and the panel does not have strong opinions on one approach being any better than any other.

For pesticides, the panel fully supports the findings of both of the groups and their priority rankings. Too little is now known about the distribution of pesticides to assess their impacts on human health. So a first priority must be to obtain more information on their distribution. Nevertheless, this should not be done entirely at the expense of other recommended actions. Determining ways to manage pesticide and fertilizer applications must also be of relatively high priority, because even if pesticide residues are of low concentration in waterways, there is a large potential for their increase at a later date.

**SECTION IX**

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**CLOSING COMMENTS: DR. MAHMOUD ABU-ZEID**

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**CLOSING REMARKS:  
DR. MAHMOUD ABU-ZEID**

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- Thanks and appreciation to participants and to USAID & PRIDE.
- Future water supplies and demands.
- Degradation of quality that threatened quantity: requires multi sectoral involvement.
- Many studies have taken place and regulations have been set but still the threat is there--- oversight committee.
- Considerable efforts were put to finalize EAR and details of programs and actions are required.
- This seminar is organized to inform all parties concerned with water quality and to point out the magnitude of the problem and discuss the contribution of each.
- There is a need for a water quality-management plan ; specific actions are needed.
- Presentation of major issues and discussion on these all lead toward implementation of a water quality action plan.
- Where to go from here.

Key terms which were found important during the seminar:

- Water quality data
- National monitory water quality program
- Sharing data
- Raw data
- Standards and laws
- Sources of pollution
- Roles of institutions
- Compliance of industry, government entities and private sector
- Wastewater and sanitation, pesticides and fertilizers, policies-management
- Risk assessment
- Cost effectiveness
- Re-use policy
- Treatment policy
- Site specificity

- Financial capacity of polluters
- Receiving water bodies and intended uses
- Priorities
- Privatization of industries
- Lack of machinery
- Awareness and NGO rules
- Community participation
- Investors do not like uncertainties
- Dilution is not the solution to pollution
- Biodiversity
- Subsidies

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**ANNEX A  
SEMINAR AGENDA**

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**DAY #1--JULY 21, 1993**

**Session #1 -- Findings of the Studies and Issues for Strengthening Water Quality Management**

- 8:30 am      Registration
- 9:00 am      Participant Introductions
- 9:05 am      Welcome, Overview of Seminar, and Introduction of the Minister--Dr. Mahmoud Abu-Zeid, Director, Water Research Center, MPWWR
- 9:15 am      Opening--H.E. Eng. Esam Rady, Minister of Public Works and Water Resources
- 9:20 am      Welcome--Mr. Doug Clark, Acting Deputy Mission Director, USAID/Egypt
- 9:30 am      Summary of Findings Phase I and Phase II Studies-  
-Quality of Nile Water, Mrs. Amai El Shirbiny, Nile Research Institute  
-Quality of Drainage Water, Dr. Shaden Abdel Gawaad, Drainage Research Institute  
-Quality of Ground Water, Dr. Fatma Abdel Rahman, Ground Water Research Institute  
-Ranking of Pollutant Problems, Dr. Shaden Abdel Gawaad, GRI
- 10:30 am     Coffee Break
- 10:45 am     Overview of Institutional Aspects--Dr. Safwat Abdel-Dayem, Drainage Research Institute
- 11:10 am     Introduction of Issues for Strengthening Water Quality Management in Egypt--Dr. Robert Kelly and Dr. Khalil H. Mancy, PRIDE
- Noon          Working Lunch: Overview of Water Quality Environmental Concerns--Dr. Mohamed Fawzey, EEAA

**Session #2 -- Water Quality Data--Collection, Sharing, and Cooperation**

- 1:30 pm The Importance of Water Quality Data--Dr. Khalil H. Mancy, PRIDE
- 2:00 pm Outlining the Issues to be Discussed and Forming Discussion Groups--Dr. Robert Kelly & Mr. Chris Stathes
- 2:15 pm Group Discussion
- 3:15 pm Afternoon Coffee Break
- 3:30 pm Plenary Group Presentations and Discussion
- 5:00 pm Summarizing Recommendations--Dr. Safwat Abdel-Dayem, Dr. Robert Kelly & Mr. Chris Stathes, Dr. Khalil H. Niamey

**DAY #2--JULY 22, 1993**

**Session #3 -- Achieving Compliance of Industry--Government Entities & Private Sector**

- 9:00 am Introduction/Overview--Dr. Fatma El Gohary, National Research Center
- 9:30 am Outlining the Issues to be Discussed and Forming Discussion Groups--Dr. Robert Kelly & Dr. Khalil H. Mancy
- 9:45 am Group Discussion
- 10:30 am Morning Coffee Break
- 10:45 am Plenary Group Presentations and Discussion
- 11:45 am Summarizing Recommendations--Dr. Fatma El Gohary, Dr. Robert Kelly & Dr. Khalil H. Mancy
- Noon Working Lunch: Environmental Overview from Donor Perspective--Dr. Richard Rhoda, Director, Environment Office, USAID/Egypt

**Session #4 -- Water Quality Concerns in Rural and Urban Areas**

- 1:30 pm      Wastewater and Sanitation--Eng. Mohamed Negim El Din Mohamed, National Organization for Potable Water and Sanitary Drainage (NOPWASD)
- 1:45 pm      Agriculture--Dr. Nabil El Molhey, Soil and Water Research Institute
- 2:00 pm      Outlining the Issues to be Discussed and Forming Discussion Groups--Dr. Khalil H. Mancy and Dr. Robert Kelly
- 2:15 pm      Group Discussion
- 3:00 pm      Afternoon Coffee Break
- 3:15 pm      Plenary Group Presentations and Discussion
- 4:15 pm      Summarizing Recommendations--Dr. Mohamed Negim, Dr.Nabil El Molhey, Dr. Khalil H. Mancy, and Dr. Robert Kelly
- 4:45 pm      Seminar Summary and Closing--Dr. Mahmoud Abu-Zeid, WRC



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**ANNEX B  
PARTICIPANT LIST**

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Abdallah, Zakaria Aly  
Chairman, General Authority for Nile Transportation

Abdel-Bar, Mohamed Abdallah  
Chairman, National Authority for Drinking Water

Abdel-Dayera, Safwat  
Director, Drainage Research Institute, Water Research Center

Abdel-Gawad, Shaden  
Head of Open Drainage Division, Drainage Research Institute, Water Research Center

Abdel-Rahman, Fatma  
Deputy Director, Groundwater Research Institute, Water Research Center

Abu-Zeid, Mahmoud  
Chairman, Water Research Center

Awadallah, Reda  
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Badran, Hussein  
Head, Tourism Development Authority

Bakry, Bahaa  
Consultant, Tourism Development Authority

Barakat, Mohamed Sadek  
General Director for Waterways, Ministry of Interior

Dabour, Atef Abdel-Ghaffar  
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National Research Center

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El-Sheikh, Essam

Head, Public Works Sector, Ministry of Public Works and Water Resources

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Nile Research Institute, Water Research Center

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Undersecretary, Egyptian Environmental Affairs Authority

Kotb, Mohamed El-Moattassem  
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Mahmoud, Gamil Mohamed El-Sayed  
Head, Planning Sector, Ministry of Public Works and Water Resources

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National Authority for Drinking Water, NOPWASD

Omar, Khalil  
Head, Irrigation Sector, Ministry of Public Works and Water Resources

Owiss, Mohamed  
General Authority for Industrialization, Ministry of Industry

Rady, Mohamed Abdel-Hady  
Chairman, Egyptian Drainage Authority, Ministry of Public Works and Water Resources

Saad, Bahaa El-Din  
General Secretary, Water Research Center

Sarhan, Ahmed  
General Director, Ministry of Health

Soaida, Farouk  
Head, Irrigation Sector, Ministry of Public Works and Water Resources

Soliman, Mahmoud Hassan  
Head, Public Works Sector, Ministry of Public Works and Water Resources

Soliman, Mohamed Salah El-Din  
First Undersecretary, Ministry of Local Management

Fadl, Osman  
CEDARE

Roshdy, Saleh  
CIDA

Les Breiner  
CIDA

Jewsbury, Catherine  
EPAT

Kelly, Robert  
PRIDE

Mancy, Khalil  
PRIDE

Shoreibah, Alaa  
PRIDE

Stathes, Chris  
PRIDE

Woods, John  
PRIDE

Murad, Tarek  
The Netherlands Embassy

Mercarder, Pedro  
UNDP

Douglas, Clark  
USAID

Fuller, Flynn  
USAID

Guymont, Fred  
USAID

Madland, Marc  
USAID

Rhoda, Richard  
USAID

Mullick, M.A.  
WHO