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**STRENGTHENING URBAN ENVIRONMENTAL MANAGEMENT  
IN THE ESCWA REGION**

**ENVIRONMENT MANAGEMENT SCHEME FOR  
AMMAN, JORDAN**

**PRELIMINARY REPORT OF THE JOINT ESCWA/FRANCE  
MISSION TO AMMAN FROM 8 TO 19 MAY 1985**

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## BACKGROUND

In view of the deteriorating quality of the environment in many large cities in the ESCWA region, planning strategy must provide for the incorporation of environmental elements in every single development programme, if a desired form of integrated economic and social progress is to be achieved, namely, one combining both the protection of the environment and the improvement of living conditions.

To assist governments and local authorities in their endeavours to achieve that goal, the United Nations Economic and Social Commission for Western Asia (ESCWA) and the French Government have launched a joint project which aims at investigating suitable means of improving environmental management in a selected number of large cities in the ESCWA region.

Within the framework of the joint project, a team of experts visited the city of Amman from 8 to 19 May 1985. The team, which represented both ESCWA and France, consisted of the following:

- Mr. A. H. Abdallah, Human Settlements Division, ESCWA;
- Mr. Ahmed Hamza, Environment Co-ordination Unit, ESCWA;
- Mr. Georges Laparade, Ministry of Environment, France;
- Mr. Louis Gertoux, Municipality of Bordeaux, France.

An interpreter was provided to the mission courtesy of the French Embassy in Amman.

### Objectives

The objectives of the mission were to:

- To assess the existing environmental conditions in Greater Amman;
- To evaluate the administrative and management structures and procedures, including legislation related to matters of environmental concern, such as drinking water, sewerage, solid waste, atmospheric pollution, urban development, etc.;
- To discuss with the local authorities concerned the various problems and constraints and identify ways and means of improving the management situation;

- To propose a preliminary action plan that would lead to better planning, implementation, monitoring and management of environmental programmes.

### Activities

The mission met and held intensive discussions with the officials concerned in accordance with the schedule of meetings in annex II. The names of institutions visited and the personalities with whom discussions were held are mentioned in annex III. Visits were made to the various parts of the city where activities having an environmental impact were being carried out.

### The report

Based on discussions with officials concerned and examination of official documents as well as field observations, the joint mission submits the present report for the consideration of the concerned government authorities. The report encompasses two parts.

Part one consists of two sections. The first section constitutes a brief presentation of the scope and pattern of the priority environmental problems in the Greater Amman Area and an assessment of organizational functions and structures of existing environmental institutions. The second section encompasses the main proposal of the mission, which relates to the development of an institutional set-up for environmental monitoring and management in Greater Amman. The objectives, functions and structural components of the set-up are given in some detail; an outline of evaluation forms for waste treatment facilities is attached in annex I.

Part two of the report is an overview of the urban and regional development activities in Greater Amman, with emphasis on environmental aspects of low-income group settlements that merit special attention. The report includes proposals for utilizing solar energy for domestic water heating in future urban development projects and for initiating a pilot project for the investigation of thermal performance of an existing low-cost housing scheme in order to evaluate consequences of design on thermal behaviour, to propose alternative architectural designs for rectification and/or rehabilitation of existing schemes and to prepare guidelines for adoption at the Greater Amman regional level. Moreover, the pilot project may become the subject for local, regional and interregional training seminars and workshops for planners, architectures and managers of urban and peri-urban settlements.

## PART ONE

### Introduction

The Greater Amman Area (GAA) encompasses all communities within a 30 kilometre radius of the centre of Amman. GAA comprises the municipalities of Amman (Amanat Al Asima), Wadi el Sir, Suweileh, Baqa'a Camp and the suburban ring. The GAA boundaries are defined in figure 1.

GAA has experienced rapid growth in the past 30 years due to rapid urbanization, large-scale economic and industrial development, mass migration of the rural population to metropolitan Amman, coupled with waves of explosive increase in population following the wars of 1948 and 1967.

The population of GAA is expected to increase from its current level of 1.5 million to 2.1 and 3.0 million in the years 1990 and 2000 respectively. Amman will reach a population saturation within 10 years while saturation of the suburban municipalities is expected to occur beyond the year 2000. The impact of population control policies is not likely to be felt in an easing of present environmental problems; nor is it likely that the pursuance of a rural development policy and emphasis on the establishment of new smaller towns in the kingdom will cause an appreciable deceleration of urban population growth in GAA in the foreseeable future.

Problems of urban congestion, inadequacy of shelter and the accompanying infrastructure of public services, as well as the inadequacy of the transport and recreational facilities, have raised serious problems of public health, and led to appreciable environmental deterioration. A substantial proportion of the refugee camps and surrounding areas is made up of constructions which are permanent but meet only low standards of living and sanitation. These slums are an inevitable by-product of rapid urban development which spread outwards from the city centre to create a source of physical and social deterioration in the urban environment.

Figure 1. Greater Amman Area

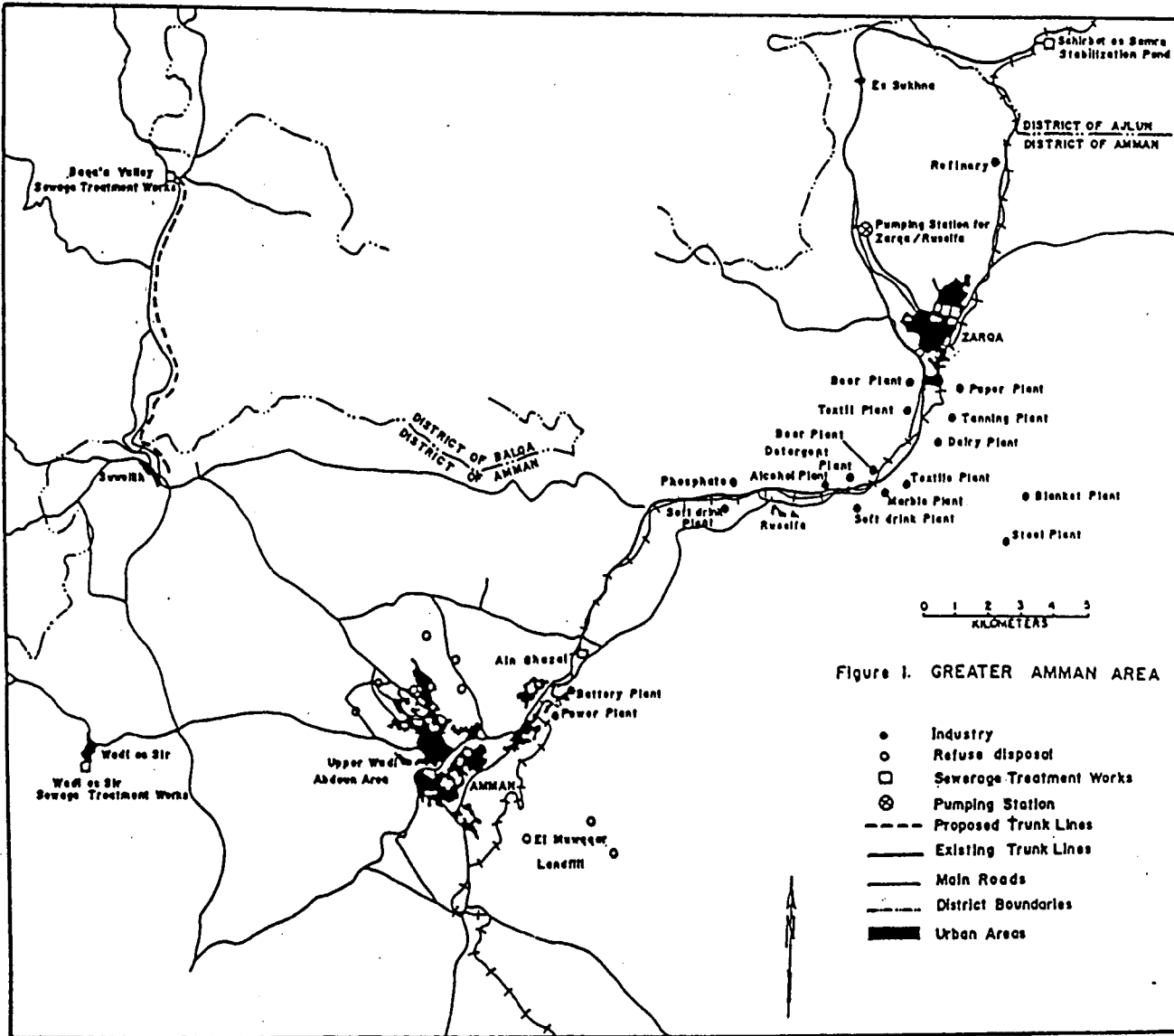


Figure 1. GREATER AMMAN AREA



Most environmental programmes in GAA tend to be ad hoc in terms of conception, resources support and management. Managerial policies and procedures are not compatible with the need for closer collaboration and co-ordination among environmental institutions in GAA. As a result, there are many gaps between programmes and noticeable overlapping of programme activities. This is attributed to lack of recognition that physical, social, economic and environmental aspects in metropolitan Amman are so closely interrelated that programmes can only succeed if they are well co-ordinated and integrated within a framework of a long-term development plan.

To consider the future of environmental management as it has a bearing on urban development in GAA, it is evident that improvements will be needed in the administration as well as the performance of all environmental activities. Part of what lies in store may depend on better utilization of existing resources, as well as upgrading present management procedures in order to achieve the goal of enhancing the environmental quality of Amman.

## I. PROFILE OF THE GREATER AMMAN AREA

### A. Physical, climatic and hydrological features of GAA

GAA lies in central Jordan and consists mainly of a mountainous region with an elevation ranging from sea level to 1,100 metres above sea level. The morphology of the western part is rugged and slopes are steep while the eastern part is characterized by more landscape and less precipitous inclines. The western highlands drain to the Jordan valley via wadis with steep gradient slopes. All other areas are drained mainly by the Zerka river which originates in Amman and flows towards the northeast passing the towns of Ruseifa and Zerka. Downstream from Zerka the river twists to the west until reaching the King Talal Dam, then the wadi runs westerly until it joins the Jordan valley.

The urban area of Amman-Zerka occupies the upper watershed of the Zerka river. The underlying area is the extensive Wadi El Sir aquifer which is still underexploited. The aquifer consists of an unconfined limestone upper zone and a confined highly fractured, dolomitic limestone lower zone. The waters in both aquifers are connected via faults.

The climate of GAA is predominantly of the Mediterranean type with relatively warm dry summers and cool wet winters. The temperature rarely falls more than a few degrees below freezing in winter and seldom exceeds 33°C in summer. The rainy season starts in late October and continues through March and April and the prevailing westerly winds get their moisture from the Mediterranean and deposit it over the western uplands. The winter winds are mainly south-westerly with average speeds of 20-30 km/hr. Occasional south-westerly or westerly gales are experienced. Calm conditions prevail for between 20 and 30 per cent of this period, especially at night and in the early morning. The summer winds are mainly south-westerly with speeds of 15-30 km/hr. Khamsinic south-easterly winds occur during the early summer.

GAA occupies an area of 2,828 sq. km, or 3.2 per cent of the nation's area. About 60 per cent of the population lives in GAA while 76 per cent of the industrial establishments and 87 per cent of the workforce are located in the metropolitan area. It is obvious that GAA is the prime urban region in Jordan and as such a primary locus of many of its developmental and environmental problems.

#### B. Water supply

The water consumption of the connected supply averages 85 litres per capita per day (l/c/d). About 85 per cent of the population is connected to the public water network, the remainder being served by tanks and public taps. The present water sources of about 39 million cubic metres per year (MCM/Y) come from local wells (20 MCM/Y), from the Azrak well field located some 85 km east of Amman (12 MCM/Y) and from the Qastal and Siwaqa well fields located south of Amman (7 MCM/Y). The level of water unaccounted for is about 44 per cent which is quite abnormal and attributed to leakages in the old distribution system. The losses are being steadily reduced through an ongoing project for rehabilitation of the outdated water mains.

The East Ghor Canal project which has been recently commissioned has a capacity of 45 MCM/Y and is expected to increase the water supply to the GAA to 85 MCM/Y. Water demands will increase to 101 MCM/Y in 1990 and to 172 MCM/Y in 2005; existing water resources and those under development would be sufficient till about the mid-1990s.

### C. Sewage disposal

In GAA there are four sewage treatment works:

1. Ain Ghazal Treatment Plant (AGTP) which incorporates an active sludge process and anaerobic sludge digestion. The plant was designed to treat 60,000 m<sup>3</sup>/d at a biological loading of 15,000 kg/d. However, AGTP is presently treating 50,000 m<sup>3</sup>/d servicing a population of about 600,000. The plant performance has been adversely affected by the high strength sewage (influent biochemical oxygen demand BOD 550 mg/l and effluent BOD "Biochemical Oxygen Demand" 100 mg/l). AGTP was temporarily shut off on 12 May 1985 and the raw sewage was switched to the newly constructed stabilization ponds;

2. To overcome operational troubles of AGTP and to extend sewage disposal facilities, a new stabilization pond facility was commissioned in the area of Scherbet el Samra in May 1985. Sewage is currently conveyed from the city of Amman to the stabilization ponds by gravity in a transmission main with a length of about 40 km to treat an average flow of 68,000 m<sup>3</sup>/d (35,750 kg BOD/d), or a maximum of 148,000 m<sup>3</sup>/d. The facility is expected to provide satisfactory treatment (BOD 30 mg/l, SS "Suspended Solids" 30 mg/l) to enable effluent reuse for irrigation purposes. Both AGTP and the stabilization ponds are expected to provide sufficient capacity for treatment of sewage from Amman's draining zone up to the early 1990s;

3. The city of Salt has about 30,000 inhabitants and is situated about 30 km northwest of Amman. The sewage treatment works comprises extended aeration and effluent chlorination; surplus sludge is dried in drying beds. About 90 per cent of the population is connected to the sewer system of Salt;

4. The treatment plant at King Hussein Medical Centre treats an average of 1,200 m<sup>3</sup>/d. The effluent BOD varies from 30 to 70 mg/l and the effectiveness of chlorination had diminished owing to the absence of a contact basin.

The Sewerage and Sewage Disposal Master Plant of GAA comprises the following:

(a) Extension of sewerage services to cover 94 per cent of the Amman population by 1989 from the current level of 75 per cent;

(b) Reduction of ground-water pollution by decreasing the infiltration of cesspool effluents;

(c) Adoption of the sewage treatment requirements to effluent reuse for agricultural purposes.

The first phase of the Master Plan which covers the period up to 1990 will include: (i) extension of the sewage treatment systems in Amman and Upper Wadi Abdoun (suburban ring, the eastern Wadi El Sir and southern Suweilah; and (ii) extension of sewage treatment and sewerage in the Baqa'a Valley and Wadi El Sir drainage area.

#### D. Management of water and sewage

The Water Authority (WA) created in December 1983 has taken over the Amman Water and Sewerage Authority (AWSA), the Water Supply Co-operation, previously responsible for bulk water supply, the water resources division of the Natural Resources Authority and the Municipal Water Supply Departments within GAA. The WA is autonomous, enjoying independent financial and administrative status.

Discussions with the President and officials of the WA revealed the following management and operation difficulties of the water and wastewater systems in GAA:

1. Manpower throughout the Authority is not adequately prepared either by education or by previous experience for technical and managerial positions. Institutional assistance is being provided to WA by the World Bank and USAID to assist in developing an appropriate organizational structure, establish staffing and training needs, develop a management information system and propose a personnel policy. A technical advisor is engaged in setting up a data collection system, in proposing measures to improve operating and maintenance practices and to assist in preparing major projects;

2. Tariff structure is not geared to the needs for generating adequate revenues to permit financial viability of WA and to encourage water conservation. A study is currently under way to devise appropriate tariff structures for WA;

3. There is a considerable shortage of well-trained operators for the package water and wastewater treatment facilities. In view of the numerous package units which will be commissioned in small suburban communities in GAA in the near future, there is a need to develop on-the-job training programmes for the operators of small-scale treatment facilities. Several institutions may help in the development

and execution of these programmes - the Amman Polytechnic Institute, the University of Jordan, the Vocational Training Corporation and the WA Training Centre.

4. Measurement errors are significant which affects reliability of planning demands, costing and measurement of efficiency; on the other hand, appreciable water losses lead to wastage of scarce water resources. Ongoing rehabilitation programmes aim at reducing losses and eliminating measurement errors;

5. Delinquent or delayed payments by large users present a problem to WA. The WA management is devising systems to provide incentives for improvements in bill collection and reducing the proportion of outstanding receivables;

6. Inadequate water supply is the single most important constraint to GAA's socio-economic development. Demand continues to increase at a vast rate for domestic, industrial and agricultural uses. The rapid rate of urbanization and population growth are outpacing projects directed at meeting water demand. The current trend towards reuse of treated effluents in irrigation, enforcing measures for water conservation in industrial and domestic uses and reducing network losses will eventually lead to substantial saving in water to meet the growing water demands for future agriculture and industrial development projects;

7. Water resources identification and use information is not yet adequate to permit effective water use planning and management;

8. As the stabilization ponds have just been commissioned, no information is available concerning their long-term environmental impact. There is a need to monitor the aquifers at the site, the receiving stream and the water quality at the downstream reservoir. Releasing future effluent for irrigation should be assessed carefully;

9. Emptying cesspools from Amman and surrounding areas at the existing Marka dump site present a serious health hazard to the nearby residential communities. This problem will be gradually alleviated upon completion of the sewerage network in 1989. Meanwhile, it is recommended to use septic effluents from cesspools for land reclamation projects in remote areas or to provide treatment of septic effluents in package units before disposal.

### E. Refuse collection and disposal in GAA

The vast economic and population growth of GAA has contributed to the generation of enormous amounts of solid wastes; approximately 200,000 tons of solid wastes were collected during 1984.

The recently established Solid Waste Management Department (SWMD) of Amman Municipality is responsible for formulating a refuse management policy, identifying manpower and equipment needs, supervising operation of landfills and co-ordinating activities of refuse collection and sanitation at the district level. The sanitation units attached to the nine Amman municipal districts are responsible for refuse collection and street cleaning.

Plastic sacks are provided to most residential areas and property owners are responsible for their dumping in big containers which are emptied periodically and compacted in special vehicles before ultimate disposal in the Marka tip. In substandard areas and refugee camps the refuse is usually brought to the compactors in wheelbarrows to be tipped on the ground before loading by shovel into the compactors; this is a dirty and laborious job.

GAA refuse is currently disposed of at the Marka site and partially burned in open pits. This landfilling method is environmentally unacceptable. A field visit to the site indicated inadequate sanitary conditions, as flies were abundant due to the presence of putrescent foods.

The refuse is low in calorific value (1,300-1,500 kilo cal/kg.) and contains appreciable amounts of putrescent matter (vegetables 87 per cent; paper 10 per cent; glass, plastics and metals 3 per cent). The refuse is difficult to burn owing to its high moisture content and requires a very expensive incinerator for proper burning.

Old cars, lorries and inoperable machinery are dumped near the Marka site. Fragmentation of these discarded cars and machinery can produce high quality scrap.

It is recommended to go ahead with the plan to close the Marka site and open another sanitary landfill at Muwaqqar which is located 40 km from Amman. Meanwhile, burning of refuse should be abolished at the existing site as it creates serious air pollution problems. The present fleet operated by the

municipality should be supplemented with modern compactors to meet the rapidly increasing loads of GAA.

The existing refuse collection system appears inadequate and the service should be improved and expand to include suburban areas of GAA which have not yet been provided with regular collection service. The new landfill site should be equipped with sufficient earth-moving equipment and operators to ensure proper sanitary landfilling. The discussion with the municipality officials revealed no plans for considering waste recycling or composting in the near future due to technical and economic constraints.

#### F. Air pollution

In the past decade Amman has experienced a rapid rate of development and witnessed feverish construction and industrial activities which in turn increased the occupational hazards and air pollution problems in GAA.

Low-income housing and commercial development in dense configurations exist in some areas within the city of Amman. People living in these densely populated areas are subjecting their respiratory systems to severe strains by concentrating themselves, their activities and their airborne wastes in such congested localities.

A preliminary survey of the Amman area indicates that the most prevalent air pollutants are sulphur dioxide, carbon monoxide, oxides of nitrogen and suspended particulates. Other pollutants such as hydrogen sulphide, hydro-carbons, ozone, fluorides and lead aerosols are considered less important due to their presence in low concentrations.

Long-term air quality monitoring of data at GAA is necessary to quantify future air pollution levels and to provide a sound basis for a pollution control strategy. Presently, the Royal Scientific Society (RSS) is initiating a programme for establishing a permanent air quality monitoring network in Amman. Comprehensive studies over extended periods of time should be performed, especially in "hot zones" of high pollution levels. These studies would help complete the environmental impact evaluations and would be most useful in implementing effective remedial measures. Present air pollution problems in GAA are compounded by the following factors: (a) lack of machinery or responsibility for strategic

planning for air pollution abatement; (b) complete absence of a monitoring programme and legislation for control of emissions from traffic, industrial and domestic sources; (c) poor siting and environmentally offensive operation of the existing landfill and some industrial facilities; and (d) failure to take full advantage of modern city planning systems to solve traffic congestion in the downtown area.

Efforts must be made to relieve the traffic congestion in Amman. This would lead to reduction of emission loads of airborne pollutants and thereby lower ground level concentration of these pollutants.

All open burning should be stopped whenever feasible or scheduled and conducted in a manner consistent with good air pollution control practices.

#### G. Industrial pollution

During the past decade Jordan's economy grew at a rapid pace. External factors such as private capital inflows, remittances and foreign financial assistance contributed to this remarkable growth. Mining and capital intensive industry benefited from large public sector investments in potash, phosphate, fertilizer and cement. To ensure continued industrial expansion, there is an apparent need for easier access to risk capital, better products and services, more reliance on advanced technology and attracting skilled technical and management personnel now employed in other countries. The rapid industrial expansion has brought an inevitable increase in water requirements and pollution, especially in the GAA which accommodates major industries such as phosphate mining and beneficiation, tanning, yeast, paper, textiles, detergents, beverages and chemical industries. Total effluent flow from the 43 major industrial establishments in the area is estimated at 2.5 MCM/Y, of which 21 per cent is cooling water.

According to the industrial effluents act (202/1980), all industrial establishments are required by law to provide full on-site treatment of their wastewaters before final discharge to the receiving Zerka river, or to one of its tributary wadis. Several industries (yeast, textile, dairy, breweries, distilleries, tanning, paper and food processing) are operating biological units for end-of-pipe treatment of their effluents. However, the results of a recent survey by the water authority laboratories clearly indicate unsatisfactory performance of the



wastewater treatment facilities now in operation as most effluents far exceed the emission limits set by the Jordanian standards for discharge of industrial effluents.

Major pollutants currently discharged to the Zerka river comprise BOD, SS (Suspended Solids), oil and grease, sulphides, chromium from tanning and mercury from the chloralkali plant.

Field observations by the mission demonstrated extensive industrial pollution in the Zerka river. The treated sewage effluent from AGTP which has an offensive odour and contains extensive foam is clear evidence of poor treatment performance. Downstream from the outfall of AGTP, the water is turbid and contains flocky organic materials. The effluent of the yeast factory is rusty brown and appears to contain significant organic loading. The stream in this vicinity becomes brown and heavily polluted. The effluent of the detergent plant forms a high mount at the outlet as the river water is covered with a thick layer of oily matter. Dairy waste discharged in the same vicinity appears to be disposed of without treatment. All downstream industrial establishments discharge polluted effluents. The polluted water of the Zerka river meets a creek coming from the Baqa'a area before reaching the King Talal dam. Studies to date indicate that the water quality at the dam reservoir varies from strong to heavily polluted, which renders it unfit for most agricultural and domestic uses.

Most industries in GAA are low-intensive water users, with the exception of the yeast ( $1,500 \text{ m}^3/\text{d}$ ), phosphate ( $4,630 \text{ m}^3/\text{d}$ ), tannery ( $500 \text{ m}^3/\text{d}$ ) and brewery industries ( $350 \text{ m}^3/\text{d}$ ). Evidence indicates that most industries are lacking experience for proper operation of waste treatment facilities. They also consider pollution abatement costs uneconomical, as they represent investments without a balancing increase in production capacity. However, it is necessary to recognize that the rapid environmental deterioration in GAA affects long-term industrial growth in the region, and it may also endanger human life.

Proper selection of an integrated treatment programme for the effluent from the industries in the Zerka - Rusaifa area must be appropriate to the receiving water and should require a low investment cost. The existing policy that each industrial source is responsible for its pollution and should be compelled to cure it is not practical in GAA as the majority of industrial facilities generate relatively low amounts of

wastewaters (50 to 200 m<sup>3</sup>/d) which would be handled more efficiently in a centralized wastewater treatment plant. Despite the difference in waste characteristics from individual factories, a combined treatment approach could be employed for discharge of wastewater to the Zerka river.

Regardless of whether the treatment strategy consists of end-of-pipe, a joint or centralized approach, the abatement programme should include in-plant control measures to reduce waste generation, conserve water and minimize treatment costs.

In-plant measures considered appropriate for the GAA industries comprise the following:

1. Installation of separate drainage systems for removal of highly polluted effluents such as chrome tanning, fermentation residues, textile, dyes, etc.;
2. Use of surface condensers in place of barometric condensers for vacuum processes;
3. Use of high pressure and steam spray systems for clean-up operations;
4. Adoption of measures to conserve water and operation of recycling systems to replace once-through cooling;
5. Modification of operating conditions to prevent excessive losses (save-all in paper and mercury recovery in chloralkali);
6. Reprocessing of wastes as animal feed such as yeast, edible oil, brewery, etc.;
7. Improvement of existing housekeeping practices.

The basic options for actions to solve the industrial pollution problem in GAA are:

1. In case of low-volume, low-strength wastes from industries close to sewerage networks, effluents can be treated jointly with domestic sewage, while charging polluters for treatment of their effluents. This approach permits relinquishment of individual costly allocations for pretreatment and consequently reduces overall capital and operating costs. In addition, some wastes especially from food industries may add nutrients for biological activity in municipal sewage works;

2. Joint treatment of pretreated effluents in a centralized treatment system.

Since most industries along the Zerka river are already operating either primary or secondary treatment facilities, it is proposed to continue such practice and implement further measures to upgrade the treatment performance to improve effluent characteristics. However, in view of technical and operating deficiencies due to selection of inappropriate treatment technologies for tanning, yeast, dairy and other major industries, it seems appropriate that the partially treated effluents from individual plants should be subjected to combined treatment in a centralized plant to ensure removal of organic loading and hazardous pollutants and to bring the effluent within the Jordanian standards before ultimate disposal in the river. This scheme would provide improved treatability, better monitoring, effective control and operation of the system and potential for water reuse in irrigation purposes in areas close to these industries.

Such an integrated treatment scheme is better managed by WA. However, industries should shoulder the treatment costs to ease the financial burden on WA. A surcharge will be required from participating establishments in proportion to their waste loads based on the actual capital and operating costs for providing industrial waste collection, treatment and disposal services.

#### H. Environmental legislation

A review of environmental legislation in Jordan has revealed several legal instruments which deal directly or indirectly with issues related to protection of the environment. Typical of other countries in the region, this legislation is basically sectoral and does not deal with the emerging problems of environmental pollution. Attention is not given in existing laws to the interdependence of development activities and at best they serve for a piecemeal approach to environmental problems.

Enforcement responsibility is dispersed and frequently shifts from one agency to the other. Unfortunately, laws which deal directly with environmental protection are not strictly enforced because authorities deeming them to be difficult to achieve look for pseudoscientific, social or economic pretexts for granting exceptions or permitting leniency.

The following laws and regulations have relevance to the environment:

1. Water Authority Law No. 34/1983. Under this law WA is entrusted with management of water and sewerage systems all over Jordan with the following specific tasks:

- (a) Setting up a water policy;
- (b) Survey and development of water resources;
- (c) Design, construction and operation of sewerage and sewage networks;
- (d) Drawing up of terms and development plans for protection against pollution;
- (e) Carrying out of research and the establishment of standards;

(f) Issue of permits and enforcement of restrictions to limit water consumption.

2. Public Health Law 21/1971. It requires that all sewerage systems should conform to the health regulations and gives the Ministry of Health the authority to monitor water quality and forbid distribution of unsafe water;

3. Law of Marine Pollution, article 51/18;

4. Law of abatement of pollution in the cities, 15/68;

5. Law governing the quality of drinking water, 1/6/65;

6. Law for the general protection of water resources, 16/8/66;

7. Act for compulsory reforestation, 35/1958;

8. Code of Agriculture 20/1973 which related to protection, conservation, development of natural resources, use of fertilizers, pesticides, etc.;

9. Law for protection of game, 8/1966;

10. Prime Ministerial Order of 1982 dealing with reuse of wastewater effluents for agricultural purposes;

11. Standards for water supply issued in 1982;

12. Standards for industrial liquid emissions 202/1981.

At present Jordan does not have regulations, codes of practice, or standards for air pollution, traffic emissions, solid waste, domestic effluents, noise, and hazardous wastes. Developing regulatory and control limits of these pollution sources will assist in preventing further decline in environmental quality and ensure proper abatement of pollution.

The environmental legislation currently in force does not specify practical and adequate penalties for violators. The procedures for issuing permits for discharge of pollutants are assigned to various authorities which inevitably results in delays and conflicting instructions.

The following are major points of concern regarding environmental legislation in its current format:

1. Industrial emission limitations are not geared to the economic and technical capabilities of the country. Enforceable standards should be based on national capabilities and needs. Factors such as cost, industrialization, economic resources, current and future water uses and environmental assimilation must be considered while establishing environmental standards;

2. Present regulation of industrial effluents emphasizes allowable maximum concentration of pollutants and fails to recognize loading, a crucial factor for design of waste treatment facilities and for determination of the assimilative capacity of the receiving streams;

3. Some limits are either inadequate or unrealistic, while other important pollutants have no limits at all i.e. PCBs and organic phosphates;

4. Ineffectiveness of the legislative instruments is attributed to the following:

- (a) Lack of public awareness and co-operation;
- (b) Inadequacy of pollution monitoring programmes;
- (c) Shortage of manpower available to enforcing agencies.

#### I. Research and training

##### 1. Research

Applied environmental research in Jordan should be geared towards promoting sound application of relevant waste control technologies and appropriate means to control pollution at source. To this end, a strong emphasis should be placed on waste abatement methods that take into account economic reasonableness and feasibility. Environmental research institutions identified in GAA are as follows:

##### (a) Royal Scientific Society (RSS)

Aims at conducting scientific and technological research related to the development needs of the country. The Industrial Chemistry Department is currently engaged in the following research programmes:

- (i) Industrial Waste Surveys: assessment of air pollution in and around a battery plant, mercury pollution from the chloralkali plant; monitoring of effluents from sewage treatment works;
- (ii) Sewer pipe - unloaded glazing;
- (iii) Air pollution monitoring in Amman;
- (iv) Monitoring of the King Talal Dam water quality in co-operation with the Ministry of Health and the University of Jordan;
- (v) A three-year monitoring programme has been submitted to the Ministry of Municipal and Rural Affairs and Environment (MMRE) to monitor liquid, air and noise pollution in the country at a total cost of \$452 million.

The Department seems to be adequately staffed and well equipped for research related to water and air pollution.

(b) University of Jordan

- (i) The Faculty of Engineering and Technology has established a post-graduate programme in environmental engineering;
- (ii) The Water Research Centre is monitoring pollution of the waters of the Amman-Zerka area, and is involved in research projects for assessment of wastewater reuse, protection of groundwater and water quality studies. A regional conference on "Arid Zone Hydrology" is planned for the spring of 1986.

The University also has a training programme for laboratory technicians and a well-equipped centre for maintenance of analytical instruments. Available equipment for water analysis at the University seems adequate.

Research needs of GAA comprise the following:

(a) Water

- (i) Use of non-conventional water resources and control of water losses during distribution;

- (ii) Water recycling in industry as well as the reuse of successive and concurrent water within the same industry;
  - (iii) Occurrence of nitrate in groundwaters; causes, effects and removal;
  - (iv) Water quality changes during storage and distribution.
- (b) Wastewater
- (i) Reuse of treated sewage for irrigation;
  - (ii) Treatment and disposal of seepage;
  - (iii) Appropriate industrial waste treatment technologies;
  - (iv) Impact of oxidation ponds on pollution of groundwater;
  - (v) Low-cost package treatment systems for small communities.
- (c) Air pollution
- (i) Survey of emission sources and the mechanisms of transport and dispersion in urban centres of GAA;
  - (ii) Dynamic stochastic forecasting of motion systems and development of prediction models based on meteorological parameters;
  - (iii) Control of industrial air emissions;
  - (iv) Regulations and control of vehicle emissions.
- (d) Solid wastes
- (i) Collection, disposal and reuse of refuse;
  - (ii) By-product recovery and reuse of industrial wastes;
  - (iii) Handling of hazardous wastes.



## 2. Training

Proper environmental management requires adequate training of both managers and operators as they both can make significant contributions to the identification of targets and to the development and implementation of environmental programmes. To this end, concerned local and national agencies should intensify efforts with a view to enhancing existing training programmes and creating new ones as deemed appropriate.

There is an apparent need for pragmatic training in various environmental fields that would be job-oriented, competency-based and cost-effective. Mid-level managers and others who can be trained as trainers should receive priority.

The following are topics suggested for short training courses to be organized by the Municipality of Amman (MA) in co-operation with the Ministry of Health, the University of Jordan and RSS.

- (a) Subject: Short training course on environmental management (two weeks)

### Topics:

- (i) Environmental pollution;
- (ii) Planning for environmental protection;
- (iii) Impact of pollution on public health;
- (iv) National organizations;
- (v) Environmental monitoring;
- (vi) Water treatment processes;
- (vii) Rural water supplies;
- (viii) Wastewater treatment;
- (ix) Rural sanitation;
- (x) Water recycling in industry;
- (xi) Industrial waste problems;
- (xii) Treatment of industrial effluents;
- (xiii) Air pollution;
- (xiv) Abatement of air pollution;
- (xv) Stream sanitation;
- (xvi) River basin management;
- (xvii) Economic of environmental pollution;
- (xviii) Legislation.

- (b) Subject: Training course on industrial pollution (two weeks)

Topics

- (i) Scope of industrial pollution;
- (ii) Industrial waste survey;
- (iii) In-plant monitoring systems;
- (iv) Treatment technologies;
- (v) Toxic waste handling;
- (vi) In-plant waste control;
- (vii) Effect of industrial wastes on public health;
- (viii) Water reuse and recycling;
- (ix) Management of water in industry;
- (x) Upgrading waste treatment facilities;
- (xi) Flow measuring;
- (xii) Corrosion problems;
- (xiii) Plant maintenance;
- (xiv) Industrial solid wastes;
- (xv) Analytical quality control;
- (xvi) Air pollution control;
- (xvii) Standards and guidelines;
- (xviii) Economics of industrial pollution control.

- (c) Subject: Training course on water and wastewater monitoring (two weeks)

Topics

- (i) Parameters of water pollution;

- (ii) Trace metal analyses;
- (iii) Analysis of trace organics;
- (iv) Methods of sampling and preservation;
- (v) Data interpretation and reporting;
- (vi) Statistical analysis of data;
- (vii) Laboratory management;
- (viii) Instrumental analysis;
- (ix) Field analysis;
- (x) Inter-calibration and quality assurance;
- (xi) Planning survey studies.

#### J. Transportation

Queen Alia International Airport (QAIA) has been in operation since April 1983. QAIA lies some 32 km south of Amman and handles international services where internal flights are serviced by Amman (Marka) Airport. The forecasts for the number of arriving passengers for 1986 and 1990 are 2.08 and 2.80 million respectively. The location of QAIA poses neither an air nor a noise pollution problem to Amman city.

The Public Transport Company (PTC) was established in 1975 to provide bus services to MA and to places outside Amman as authorized by the Cabinet. The vehicle fleet comprises 249 new MAN buses and 188 Mercedes. A recent development in public transport has been the large number of mini-buses; service taxis are also very popular. The main problems of bus and service taxis are the use of street rather than off-street terminuses, poor surface conditions, traffic congestion, especially in the downtown area, and lack of shelter. The municipality is taking appropriate measures to overcome these problems.

According to 1982 statistics, the rate of private cars in Amman was 45 per thousand and the forecast for the registered fleet in Jordan in the year 2000 is 318,000. At present, 58 per cent of passenger vehicles are private cars, 28 per cent taxis, 11 per cent mini-buses and about 4 per cent buses.

Responsibility for the planning, operations and control of the transport system in GAA is dispersed between the Ministries of Transport (highways), Interior (traffic control), MMRE (pollution), and transport agencies such as the Civil Aviation Authority and PTC (operation).

In consequence, there are apparent difficulties in ensuring cohesion in policy planning, decision-making and management control of transport systems in GAA. It is recommended that the Ministry of Transport should be represented in local traffic committees and to go ahead with the plan to establish a higher council for transport to co-ordinate Jordan's transport policy.

## II. ENVIRONMENTAL MANAGEMENT

### A. Overall perspective

The most common cause of environmental problems in GAA derives from the unco-ordinated sectoral character of planning and management of environmental services. Agencies responsible for environmental services in GAA often have appreciable overlapping in functions and authority, which creates confusion among the various sectors regarding their role and that of others. Expansion of many public services has not been accompanied by a well-conceived delegation of responsibility.

Although co-ordination is promoted or even mandated in the management of central and local agencies, there is an apparent lack of a proper mechanism to regulate and enforce this co-ordination. Some public service agencies are reluctant to share with others experience of budgetary resources to co-ordinate implementation of programmes of mutual concern. The problem is compounded by interdepartmental competition, vagueness of sphere of responsibility and lack of proper communication.

It is imperative that MA should establish and implement an administrative machinery for environmental management in GAA that would assume and enhance inter-sectoral collaboration at all levels while eliminating any legislative or administrative impediment.

A multi-disciplinary environmental management organ should be instituted in GAA with clearly defined duties, functions and

administrative authority to ensure proper advising, planning, monitoring and evaluating of environmental programmes in the region. The basic role of this organ is to re-examine and redefine the environmental tasks of all public service agencies including identification of overlapping and complementary responsibilities of each sector and to suggest measures to improve communication, prompt collaborative actions and reduce overlapping. In that regard, it is advisable to use joint sectoral budgeting whenever feasible for specific environmental projects of common concern to various sectors as a means of strengthening joint problem-solving and optimizing efforts and resources.

B. Review of organizational structure in GAA

1. A National Committee for the Environment was created in 1980, headed by the Minister of MMRE, and comprising the representatives of the following ministers and institutions:

- (a) Director of Environment Department, MMRE;
- (b) The Lord Mayor of Amman;
- (c) Officer-in-charge of the Ministry of Agriculture;
- (d) Officer-in-charge of the Ministry of Industry;
- (e) Officer-in-charge of the Ministry of Health;
- (f) Officer-in-Charge of the Ministry of Planning;
- (g) Deputy Director of the Natural Resources Authority;
- (h) Director of Tourism and Archaeology;
- (i) President of RSS;
- (j) President of the Royal Society for the Conservation of Nature (RSCN), plus a representative of the administration of RSCN;
- (k) A representative of Jordan University;
- (l) A representative of Yarmouk University.

The Committee for the Environment is attached to the Office of Minister of MMRE. The functions of the Committee for the Environment are as follows:

(a) To define the main goals and principles for planning environmental development and to indicate its main elements;

(b) To decide and confirm strategies for environmental development and pursue programmes for its implementation;

(c) To review and confirm the essential amendments to environmental planning;

(d) To ensure the promulgation of the appropriate environmental legislation, as well as the establishment of standards and measurements and toxic substances and other pollutants.

The decisions of the Committee are implemented by the Environment Department under the auspices of the minister.

The Committee has an advisory capacity but represents a forum for concerned officials to discuss environmental issues and recommend actions to the government related to environment protection.

2. The Environment Department of MMRE is comprised of five divisions, namely: Division of Environmental Pollution; Division of Planning and Co-ordination; Division of Environmental Studies and Information; Division of Environmental Health; and, in addition, a secretariat.

The functions of these divisions are defined as follows:

(a) Land conservation studies which deal basically with land use planning and soil conservation;

(b) Protection of the air, dealing mainly with air pollution and therefore with the setting of rules, standards for the location of industries and pollution abatement measures in addition to monitoring of air emissions;

(c) Protection of water, functions similar to those stated for air protection;

(d) Protection of nature, dealing mainly with nature conservation, including forests and the creation of reserves and national parks;

(e) Environmental education, responsible for co-ordination activities with the Ministry of Education to include environment at all levels of education; training of professionals and technicians; and strengthening of environmental awareness in the general population.

3. The Department of Environmental Health in the Ministry of Health comprises three divisions:

(a) Environmental monitoring: monitoring of drinking water quality, waste disposal, insect and rodent control and noise and air emissions;

(b) Public health engineering;

(c) Occupational health.

The Central Public Health Laboratory performs bacteriological examinations of water and wastewater. The laboratory has also limited equipment for chemical analysis of water which is performed only occasionally.

4. The Royal Society for the Conservation of Nature is entrusted with the implementation of articles in agricultural law No. 20/1973 that pertain to regulatory functions regarding hunting and protection of wildlife. It is also entrusted with management of the National Reserves of Shoumari and the Azrak Oasis. The Society has recently initiated an environmental awareness programme aimed at enhancing public interest in environmental protection.

5. In the Municipality of Amman (MA), environmental services are managed largely through the Health Affairs Department (HAD). The functions and duties of HAD are carried out through the following two sections:

(a) Community Health Section (CHS): The activities of CHS are executed by three units, namely, food control, environmental health and laboratories. The Food Control Unit is responsible for food inspection, issuing permits and licensing of food handlers. The environmental health unit monitors a drinking water distribution system, emissions from industrial establishments and performance of sewage treatment works in GAA; it also conducts community-oriented environmental awareness programmes, issuing permits to workshops and commercial establishments, operation of MA clinics, and supervising markets, slaughterhouses and other municipal

operations. The MA laboratories are responsible for food analysis and bacteriological examination of water from the Amman water distribution system. The mission was not able to visit the laboratories. However, discussions revealed limited monitoring activities due to shortage of staff and inadequate analytical capacity;

(b) Solid Waste Management section: functions and activities were discussed previously.

The Insect and Rodent Control Department executes programmes directed towards control of insects, rodents and rabies in GAA.

C. Assessment of environmental activities and programme components in GAA

Environmental planning and implementation in GAA need to be strengthened, albeit within the overall context of the national development plan. Improvement of the environment cannot be viewed as one process standing alone but rather as a priority activity that must be part of an integrated development plan carried out for enhancing the welfare and the quality of life of the community. Environmental policies and their implementation in various spheres of MA activities must reflect the attention and efforts given to proper management of natural resources and the environment in GAA. Based on mission observations, it was noted that environmental concerns were rarely explicitly built into various development programmes in GAA.

The need for rational environmental management and impact assessment of development activities can be justified on both economic and social grounds. It also stems from the keen desire to avoid destruction of existing scarce resources which are needed for future development, or which are required for subsistence or protection.

A comprehensive programme of environmental management in GAA requires information on activities (public services and environmental quality) and programme components (master plans, manpower, management, etc.).

1. Master plan: A comprehensive master plan for GAA has not been developed yet; though efforts are under way to develop such a plan in the near future. No specific master plans for public services in GAA were available, though some GAA services



were considered in master plans developed by central authorities (WA., electricity, transport, etc.).

2. Regulation and enforcement: Most of the environmental laws, rules and regulations have focussed primarily upon pollution control as the way to achieve better environmental quality. Seldom have the laws focussed upon prevention. Additional regulatory barriers include piecemeal coverage, fragmented jurisdictions and inconsistent enforcement. It is essential that environment legislation should be drawn up and enforced in such a way that if violations occur effective sanctions can be imposed. The competent authorities, whether local or central, should be authorized to take immediate action in case of need. Regulations of contaminants and product standards should be enforced on substances which pose a risk to the environment (pesticide, hazardous chemicals, etc.), in order to allow a safe and economic use of resources and to prevent detrimental effects on people and the environment.

Environmental legislation should be amended with regulations concerning implementation and with clear working directives. Legislation concerning environmental planning, implementation and monitoring procedures needs to be enacted in order to eliminate the present vagueness concerning authority and responsibility for managing the environment.

3. Assessment of environmental effect: By and large, the assessment of environmental effects has not been taken into consideration in major development activities in GAA. Technical feasibility studies are not usually complemented by assessment of effects on the environment to identify pollution hazards, ecological contingencies and possible social consequences. New industrial development projects should address the following issues: (a) the quantity and quality of needed natural resources; (b) the suitability of alternative sites; (c) added loads of water and air pollution; (d) the opportunities for waste disposal and for recycling of materials; and (e) anticipated health impacts. However, caution must be exercised for development of environmental guidelines for project appraisal so that they do not become bottlenecks in the environment in GAA. It is advisable that concerned local and national environmental authorities should undertake their own experimentation and improvisations in devising appropriate guidelines for environmental impact assessment in the light of their own specific needs as they emerge in the course of development.

4. Manpower development: Training and management development have received low priority in almost all environmental activities in GAA. This and the continuous draining of expertise to private enterprises and rich Arab countries have led to an extreme shortage of manpower for the key technical and managerial positions as well as operators of public services. Due consideration should be given to strengthening labour skills through apprenticeships and on-the-job training.

5. Monitoring: In-house monitoring is carried out as a complementary activity of major public service institutions. However, their monitoring programmes are, by and large, designed to meet specific operational requirements rather than satisfying the needs for integrated environmental surveillance in GAA. Monitoring should be regarded as an essential tool for feedback, control and problem evaluation. Monitoring also contributes to technical information that constitutes the scientific base for development of suitable environmental criteria in GAA.

6. Management: Arrangements and institutional set-up for control, planning and communication constitute the corner-stone of an integrated environmental programme. This component generates, mobilizes, procures and develops most of the others. The quality of the managerial staff, which represents a crucial element for effective implementation of environmental activities, is still lacking in GAA. Channelling of feedback information from operator to supervisors is inadequate. This in turns affects the response to public demands and reduces effectiveness of resources utilization. Other environmental management constraints in GAA are the following:

(a) The centralized management in most environmental institutions has to deal with issues through the headquarters. Such a situation places a heavy burden on the top management. It also acts as a retarding factor and a disincentive and often has an undesirable impact on day-to-day operations, especially when the responsibility of the institution increases.

(b) The growth of municipal and central government responsibilities and sophistication has led to compartmentalization, thereby increasing the number of sectors and subunits within them, producing a situation which is physically difficult to co-ordinate.

(c) Information exchange is lacking among public service institutions; inavailability of detailed information makes it

difficult to establish proper avenues for interdepartmental collaboration;

(d) The operation and maintenance of some environmental services is not satisfactory due to lack of proper management and adequate monitoring and consequently the huge investment in such services is not producing a full measure of expected benefits. Management and operation shortcomings, maintenance problems and manpower shortages represent major impediments to proper implementation of environmental programmes in GAA.

(e) Personnel administration in public service institutions is controlled by national regulations which seldom consider the special nature and the unique expertise required for certain environmental activities.

7. Implementation: Implementation of environmental activities involves establishment and mobilization of the resources needed to achieve programme objectives. Implementation of public service maintenance and expansion schemes in GAA face severe constraints. It has been noted that resources and time factors involved in programme implementation are not interconnected, which leads to ad hoc emergency action, wastage of resources and dissatisfaction among idle staff. It is recommended that administrators should address this critical problem through development and use of a Programme Planning and Implementation Scheme (PPIS) which involves co-ordination of actions in order to initiate various programme elements according to an appropriate schedule. The use of PPIS will enable the managers to concentrate on priority activities and accept some delays for non-critical activities to minimize wasted expenditures and maximize utilization of equipment and manpower.

8. Research: There is an apparent need to strengthen and promote applied research and field studies in areas of water supply, appropriate sewage treatment and disposal technologies, refuse management, abatement of industrial pollution, transport and food hygiene. Research programmes should be co-ordinated among existing institutions (University of Jordan, RSS, WA, MMRE/DE, etc.) to avoid overlapping and to meet emerging research needs of various environmental activities in GAA.

9. Public awareness: A strong community spirit is emerging in GAA. This spirit is essential to formulate goals, develop tactics and enforce implementation of appropriate measures to enhance environmental quality. The Royal Society for the

Conservation of Nature (RSCN) has been actively engaged in promoting environmental awareness through the Jordanian press, radio and TV and through preparation of simple booklets on various environmental issues. RSCN should receive adequate government and community support to strengthen its vital role in identifying environmental threats and educating citizens to improve standards of civil hygiene in GAA.

### III. DEVELOPMENT OF INSTITUTIONAL SET-UP FOR ENVIRONMENTAL MANAGEMENT IN GAA

Urban environmental management includes activities that support proper management and co-ordination of public services and environmental resources. The objective of a functional management system is to harmonize and make compatible the complexities and interdependencies in relationships between services and the quality of the environment. The process includes the interacting functions of goal-setting, planning, development of standards, monitoring and implementation to ensure effective environmental management. Execution of an action plan for urban environmental management would be largely possible through the programmes and activities of an existing municipal institutional set-up, although expansion of some capabilities is required. However, there is a need for the establishment of new machinery within the city administration to provide a central point of leadership and co-ordination of environmental activities on the regional level and which would also complement ongoing national programmes of monitoring and management of the environment.

In examining the status and prospects of environmental management in major urban centres in Western Asia, the mission found striking similarities of environmental problems, management constraints and perspective solutions in both Amman and Alexandria. The local administration in both ESCWA urban centres needs to establish a clear environmental policy regarding its role in regional development as well as the roles of its own institutions responsible for infrastructural projects and public services. The Municipality of Amman, like administrations of urban centres elsewhere in the region, must set up an administrative organ to deal with management of the environment. The body dealing with environmental matters should be part of the local administrative machinery, with clear-cut responsibility for environmental quality and with adequate staff and financial autonomy. Though the following

action plan is the same for Alexandria and Amman, it is recognized that, within a framework appropriate to its unique situation, each city may ascertain the nature of its environmental problems and introduce modifications to the proposed management set-up as needed.

The plan does not call for centralized management of environmental activities but for a co-ordinated approach to those co-operative measures that can be undertaken by existing institutions and the proposed environment department to complement and supplement local and national actions and permit the most effective use of the limited resources in GAA. The plan is neither complete nor exhaustive; it is only an invitation to further work and thought.

The proposed organization of the environmental management set up in GAA is shown in figure 2.

A. Amman Environmental Protection Committee (AEPC)

AEPC shall be formed and chaired by the Lord Mayor with membership of representatives of the concerned agencies, the rank of which will not be lower than Director or the equivalent. Members would include:

- Under Secretary, Municipality of Amman;
- Legal Advisor of the Municipality;
- Department of Public Health;
- Department of Urban Development;
- OIC - Water Authority;
- OIC - Public Transport Company;
- OIC - Ministry of Municipal, Rural Affairs and Environment;
- Royal Scientific Society;
- University of Jordan.

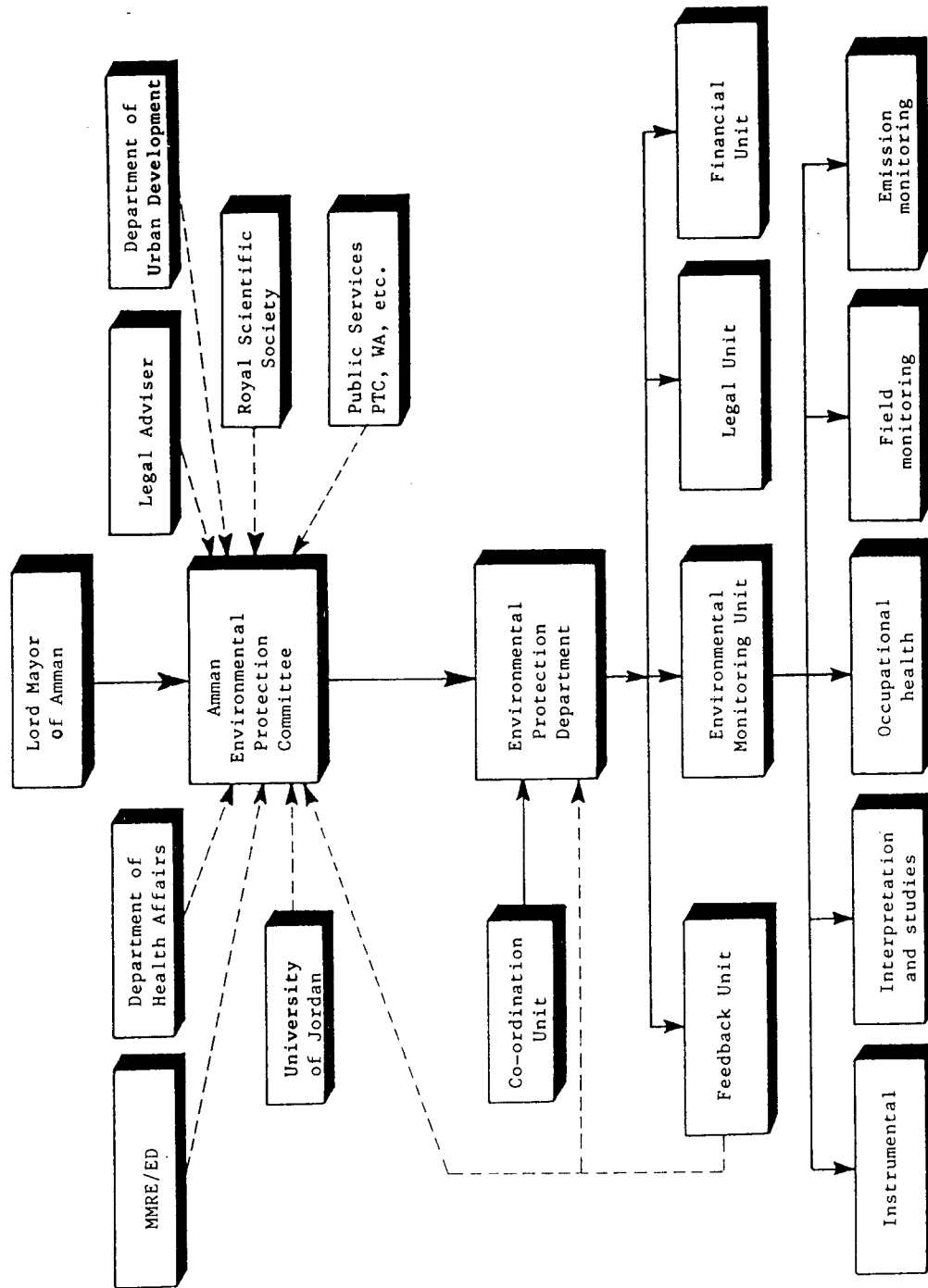


Figure 2. Proposed environmental management set up for Greater Amman Area

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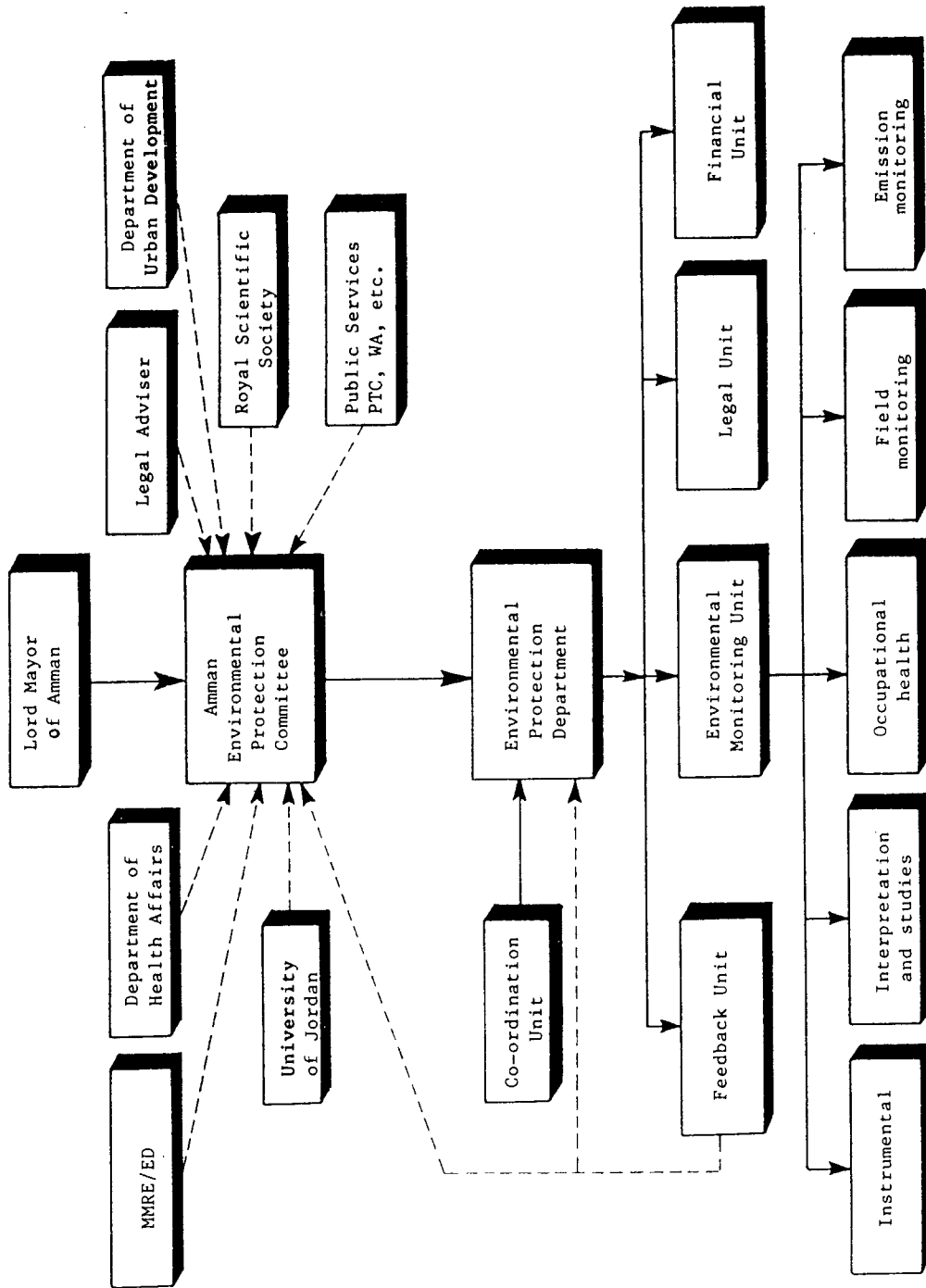


Figure 2. Proposed environmental management set up for Greater Amman Area



AEPC shall issue the necessary regulations for the organization and implementation of its activities and will form permanent subcommittees or task-forces to study subjects within its jurisdiction or seek the advice of local and national experts.

1. Goals of AEPC

It is the responsibility of AEPC to use all practicable means consistent with the national environmental policy to co-ordinate and strengthen local plans, functions, programmes and resources to achieve the following broad goals:

- (i) Secure for all citizens a safe, productive and esthetically and culturally pleasing environment;
- (ii) Optimize beneficial uses of the environment without health risks or other undesirable consequences;
- (iii) Achieve a balance between people, resources, development and the environment to improve standards of living and amenities;
- (iv) Explore to the widest extent possible renewable resources and recycling of depletable resources;
- (v) Maintain historic, cultural and natural assets of GAA.

2. Functions and duties of AEPC

The functions and duties of AEPC include inter alia:

- (i) Review and appraisal of the various programmes and activities of the Municipality, public organizations, industry and enterprises in the light of AEPC goals set forth for the purpose of determining the extent to which such programmes and activities are contributing to the achievement of the goals and to make necessary recommendations to the concerned agencies in that regard;
- (ii) Development and implementation of a comprehensive strategy to foster and promote the environmental quality to meet the socio-economic, health, conservation and development needs of GAA;
- (iii) Proposal of investigations, studies, surveys, research and analysis relating to environment and ecosystem;

- (iv) Utilization to the fullest extent possible of the existing services, facilities and environmental data of public and private organizations for maximum use of resources to avoid duplications of efforts, and overlapping or conflict with activities authorized by law and executed by existing agencies;
- (v) Development and implementation of a collective programme to reduce pollution and minimize its adverse environmental impacts with emphasis on enforcing measures so that costs associated with pollutants discharge would be reflected in the waste disposal decisions of the polluters;
- (vi) Study, development and description of appropriate alternatives to proposed courses of actions for major projects which involve unresolved conflicts concerning alternative uses of available resources;
- (vii) Making available to local organizations, institutions and industry advice and information aimed at restoring and enhancing environmental quality;
- (viii) Development of plans for environmental education, public awareness and development of manpower;
- (ix) Proposal of regulations and orders for environmental protection and follow-up of their enforcement.

B. Environmental Protection Department (EPD)

AEPC shall establish an environmental protection department to implement environmental programmes. EPD shall discharge its duties under the supervision of a technical director who reports to AEPC.

1. EPD functions

- (i) Co-ordination of environmental activities of all local organizations and institutions and review of their present statutory authority, administrative regulations and implementation procedures for the purpose of eliminating inconsistencies and overcoming constraints which prohibit full compliance with the regulations and propose measures as may be necessary to bring their authority and procedures into

conformity with the intent of strengthening environment in GAA:

- (ii) Development and implementation of a system for environmental impact assessment. A detailed statement concerning legislation, government actions and major development projects which may affect the quality of the human environment should be reviewed by EPD. The statement should include information on impacts of the proposed actions, unavoidable adverse environmental effects, alternatives to the proposed action, and irreversible or irretrievable commitment of resources;
- (iii) EPD shall take measures, provided that they do not infringe on laws and regulations, in line with the policy of AEPC and shall also implement measures for pollution control which take into account the unique nature and social conditions of GAA;
- (iv) EPD shall endeavour to disseminate knowledge and information concerning environmental pollution and also make the community more conscious of the need to maintain and enhance the environmental quality, in accordance with the policy guidelines set forth by AEPC;
- (v) In order to control environmental pollution, EPD shall propose measures with regard to land use and shall, in areas where environmental pollution is serious, also take measures to control the installation of facilities which cause environmental pollution;
- (vi) EPD shall establish a comprehensive system for surveillance, monitoring, measurement, examination and inspection in order to ascertain what the situation with regard to sources of pollution is, and to ensure enforcement of measures to combat environmental degradation;
- (vii) In order that industrial facilities shall bear all or part of the necessary cost of the works carried out by WA to control pollution arising from such enterprises, EPD will propose and enforce such system and taxation and incentive measures as to encourage the installation and improvement of facilities for prevention of pollution;

- (viii) With regard to environmental quality standards, EPD shall establish criteria for the region based on national standards whenever feasible to maintain human health and conserve national environment. Due scientific, technical and socio-economic considerations shall be given and criteria shall be revised whenever needed to ensure adequate enforcement.

## 2. Responsibilities of EPD

The director of EPD shall submit to AEPC an annual state of the environment report which includes, inter alia:

- (i) Current and foreseeable trends in the quality, management and utilization of the environment and the effects of those trends on the social, economic and development activities;
- (ii) Review of regulatory, monitoring and enforcement measures to combat pollution with particular reference to their impact on the environment, conservation and development of natural resources;
- (iii) Proposed remedial measures for the deficiencies and constraints of present programmes and activities including proposed regulatory actions;
- (iv) Appraisal of level of co-ordination among agencies and entities concerned with the environment and proposed measures to enhance co-ordination and environmental management.

## 3. Financing Environmental Management Programme

The institution of a system of charges to be levied on polluters provides vital financial resources to supplement those of the central government's budget. These funds would enable investing in and operating of pollution control facilities, where no source of finance currently exists. Depending on the case, pollution can be assessed by direct measurement of loads of heavy polluting industries or imposing a flat-rate approach based on the number of persons working or the volume of manufactured goods produced by small enterprises. Levying charges does not imply the right to pollute since emission standards would remain enforceable; however, the charges provide an "acceptable mechanism" to

ensure compliance with the standards. The financial resources generated through the charges enable enforcement of emission standards, as in cases where through lack of money the polluters are unable to comply with them without this entailing the ceasing of operations, a situation widely encountered in several industries in the Amman Zerka area.

Water pollution can be expressed in terms of SS, BOD, nitrogenous substances, toxic substances, etc. By means of weighing coefficients it is possible to determine the higher cost of removing some pollutants or the threat they present for the receptor medium's waste assimilative capacity.

Oxidizable organics (BOD) will thus be assigned a heavier weighing coefficient than SS, and toxic substances one greater than BOD, etc. As the charges are quantities expressed in absolute terms (monetary units), the bases of the charges must be calculated in terms of pollution loads rather than concentrations of polluting substances.

The following charges scheme is proposed for GAA industries whose contribution of compatible pollutants creates treatment costs in excess of those necessitated by domestic waste:

$$\text{Cost} = Q[C_1 + C_2(\text{BOD} - X_1) + C_3(\text{SS} - X_2) + C_4(\text{B} - X_3) + C_5P]$$

Where:

$C_1$  = Cost of flow to treatment works

$Q$  = Annual average flow

$X_1, X_2, X_3$  = Non-chargeable BOD, SS and N, respectively

$C_2, C_3, C_4$  = Unit treatment cost of BOD, SS, and N, respectively

$P, C_5$  = Concentration and cost of treatment of hazardous constituents (cyanides, phenol, etc.).

If the pollutor chooses to treat the waste on-site at levels lower than the specific X values, the Financial Unit (FU) of the EPD should refund to the industry an equivalent "waste treatment bonus". The principle behind this aid is to relieve polluters of some of the operating costs they have to bear.

The economic justification for these subsidies is that they provide an incentive for industry to control pollution at source.

The flat-rate assessment is recommended for small industries and small commercial enterprises. The scale for charges should be drawn in agreement with the trade associations and industries concerned.

#### 4. Information feedback

The feedback is an essential management tool for organization of the diverse activities of EPD. Information from all units should be compiled in standard format for easy retrieval (examples are given in annex I). The proposed sequence of the system is as follows:

- (i) Identification of existing and future sources of pollution;
- (ii) Proposing corrective course of action;
- (iii) Ranking of the problems (minor problems to be tabled until further action is deemed necessary); satisfactory status, subject to annual review; conditional acceptance, subject to quarterly review to check compliance; unsatisfactory environmental impact and reluctance or constraints which hinder compliance, initiating of actions; proposal of control measures and setting grace period with monthly or bimonthly follow-up; any hazardous situation involving serious environmental impact and or imminent health hazards should necessitate an environmental impact report by EPD and notification of AEPC and other concerned parties.

The system provides the following:

- (i) Organized flow of information;
- (ii) Identification of sequences of action;
- (iii) Encouragement of objective decision-making;
- (iv) Definition of interdisciplinary responsibilities;
- (v) Making possible systematic follow-up of environmental protection measures.

5. Emergency measures

AEPC shall order the suspension of work in any institution or ban the use of material and equipment if their use involves hazards to the environment or AEPC shall allow a "grace period" to correct or eliminate the pollution source. Violations by government institutions and public industries shall be considered by an expert committee which shall propose short and long-term courses of action and follow-up implementation.

6. Environmental inspectors

The Lord Mayor shall designate "environmental inspectors" required for enforcement and field activities. The inspectors shall have the right to enter into any violating institutions, make legal suits, take specimens and conduct studies and measurements to specify the extent of environmental pollution, identify the source of pollution and ensure the application of regulations and conditions regarding environmental protection.

7. Acquisition of environmental information

EPD shall have the right to request any information it may deem necessary from any institution which is polluting or expected to pollute the environment.

IV. PROPOSED PLAN FOR ENVIRONMENTAL MONITORING IN GAA

A. Overview of existing environmental monitoring activities

The successful planning and implementation of an environmental monitoring plan is a considerable undertaking requiring the integration of a broad range of diverse and complementary resources and skills.

At present the tasks of environmental monitoring in GAA are assigned to different organizations.

Many of the procedures for environmental monitoring in GAA are merely designed to quantitate pollution problems and monitor operational performance. This type of methodology within the existing institutional set-up has tended to compartmentalize and obscure the larger view of environmental monitoring as it evolves within a comprehensive scheme of urban environmental management.

Owing to lack of co-ordination among concerned institutions, there is a tendency to limit the scope of work to specific routine tasks and there is a failure to use appropriate sampling and analytical techniques. To fill these gaps it is proposed to establish a new environmental monitoring unit.

#### B. Environmental Monitoring Unit (EMU)

The complexity and importance of environmental monitoring requires formulation and execution of a reactive strategy which entails the establishment of an Environmental Monitoring Unit within the administrative system of EPD. The Unit's mandate is to monitor and control environmental quality according to the objectives and criteria set by State laws and local directives.

The scope of activities and performance level of EMU depend on available resources and co-operation among concerned agencies. A tentative strategy to be implemented in three phases is suggested.

##### 1. Phase I (one year)

This phase encompasses:

- (i) Collection and analysis of data to provide a critical assessment of environmental quality in GAA. Data resources include laboratories of WA, Department of Health Affairs, RSS and the University of Jordan;
- (ii) Design and implementation of short-term monitoring scheme in co-operation with existing laboratories;
- (iii) Proposal of priority remedial and control measures;
- (iv) Formulation of outlines of the long-term monitoring and abatement strategy.

##### 2. Phase II (two years)

Basic activities of this phase include:

- (i) Commissioning of first-priority remedial and control measures;
- (ii) Formulation of a comprehensive plan for pollution abatement and environmental monitoring system in GAA;



- (iii) Initiation of activities and commissioning of environmental monitoring laboratory to incorporate advanced analytical instruments for monitoring micro-pollutants and hazardous emissions; data acquisition, processing and interpretation system; specialized and consultancy service facilities. Field monitoring would develop in co-operation with RSS and University of Jordan. The monitoring scheme would involve monitoring of air, water quality, industrial and domestic effluents, solid waste and occupational exposure.

3. Phase III (two years)

- (i) Continued progress of the priority remedial and control measures;
- (ii) Expansion of the laboratory activities to cover environmental noise and radiation;
- (iii) Assessment of the effectiveness of the abatement schemes and EIS (environmental impact statement) prepared by other agencies.

4. Output

The purpose of EMU is to acquire data and assess on a quantitative basis the pollutants level and consequently develop and implement the necessary measures for control of environmental quality. Specific outputs of EMU include, inter alia:

- (i) Monitoring compliance with environmental quality criteria and proposing amendments to existing regulation, control and enforcement legislation;
- (ii) Evaluating the overall effectiveness of the abatement strategy;
- (iii) Advising on industrial siting and urban expansion;
- (iv) Observing and predicting pollution trends related to emission variations;
- (v) Co-ordinating and implementing inter-laboratory quality control schemes and standardizing analytical techniques among co-operating monitoring laboratories.

5. Management of EMU

The functions and duties of EMU are to be undertaken by the following sections:

- (i) Emission monitoring: Monitors liquid effluents, air emission, solid waste from domestic and industrial sources, surveys state of environment in major industrial and residential areas, monitors sea outfalls and pollution of seashore areas;
- (ii) Instrumental and analytical services: Provides essential analytical back-up for monitoring activities, carries out routine and special services. Standardizes methods of sampling and analysis in co-operation with other laboratories;
- (iii) Field monitoring: Periodic monitoring of industrial sources and on-site treatment of industrial emissions to be undertaken by a team of technicians. Monitoring of fresh-water bodies and water intakes at treatment plants. Assesses offending discharges and recommends on-site control measures;
- (iv) Occupational health services: Identifies hazardous sources monitoring exposure levels, proposes controls to reduce exposures below limits set to protect workers' health, evaluates medical surveys to detect unusual effects induced by extended exposure to hazardous environment;
- (v) Interpretation and assessment: Data acquisition from EMU and other laboratories. Processing and interpretation by multi-disciplinary experts. Evaluates EIS submitted by other agencies for major development projects. Assessment of environmental quality for receptors and level of compliance with criteria and standards laid down by the legislation.

EMU is not intended to replace or assume functions assigned to other institutions but should work closely with them to fill gaps; it would undertake specific activities of environmental monitoring currently overlooked or not assigned to existing organizations and, most important, provide back-up and competent advice to AEPC on technological, organizational and operational aspects related to the integrated scheme of urban environmental management in GAA.

C. Amman Environmental Monitoring Scheme (AEMS)

The prime objective of AEMS is to ensure compliance with the national regulations and regional guidelines set forth to promote environmental quality in GAA.

AEMS should be viewed as a dynamic long-term plan for overall monitoring of environmental quality based on flexible criteria to meet the evolving technological, economic and social conditions in GAA. A comprehensive AEMS should consider the attainability and effectiveness of legislation and the cost of environmental monitoring and control to both industries and the community.

Basic components of AEMS are:

1. Permits of industrial emissions

The scheme for issuing permits comprises three essential steps, namely, preliminary review, issuance of clearance certificate and discharge permit:

- (i) Preliminary review: Prior to construction of new facilities or expansion of existing ones, industries will be required to submit a detailed report which would include the following information: description of the process; raw materials and auxiliaries used, especially hazardous and priority pollutants; water balance with schematic for points of use; recycle and discharge; characteristics and loads of pollutants generated in the raw effluents; description of wastewater treatment facilities and the anticipated loads of pollutants discharge with the treated waste; layout of the plant and the waste treatment facility; and the anticipated date of operation. The report should be submitted to EMU 4 months prior to starting construction.
- (ii) Clearance certificate: Upon review of the report, EMU will advise the applicant of one of the following decisions: clearance for starting construction; provisional acceptability pending meeting additional requirements; or refusal to grant clearance based on the submitted information. The receipt of the clearance certificate does not absolve the industry of its responsibility to complete the construction procedures required by the concerned government agencies..

(iii) Discharge permit: The discharge permit will include a description of effluent sources approved for discharge, pollutant parameters and their analysis frequency, applicable discharge standards, method of reporting spills, periodic reporting requirements and the expiration date of the discharge permit. EMU should be authorized to issue provisional permits in special cases. There is growing concern about the economic impacts of enforcing unified standards in GAA. New public industries and those already in operation should be able to comply with tighter standards as they have the resources and capabilities to abate pollution and can easily absorb the cost of pollution control, while the relatively small private industries which generate minor pollution would be required to meet less stringent standards. This decentralized approach based on case by case assessment is appropriate for Amman. This system should replace all existing procedures for issuing permits for discharge of industrial emissions. Concerned central agencies may participate in this unified permits programme.

2. Monitoring quality of receiving water bodies and aquatic environment

Achieving acceptable receiving water quality required industries and WA to face the problem of proper treatment of waste-water effluents to provide high-purity discharge streams. At present, there are difficulties in implementation of this disposal scheme, including high capital cost, shortage of space and lack of operational expertise for treatment facilities. The urgency of the situation requires implementation of a comprehensive water quality monitoring programme for the following sources:

- Drinking water supplies;
- Water quality in lakes, the river Zerka and other bodies not intended for human use;
- Outfalls of major municipal and industrial origins.

The following water quality monitoring programme should be implemented:

- (i) Selection of stations and monitoring procedures: Monitoring stations should be identified with emphasis on locations close to major sources of pollution. The parameters and frequency of analysis for each source can be specified at a larger stage;
- (ii) Monitoring temporary violations: If priority parameters exceed those specified by Jordan Law No. 202/81 by 10 to 30 per cent, this should be regarded as a "temporary event". This may be caused by industrial leaks, excessive "by-passing" of untreated effluents from sewage works or short-term non-point discharge. Identifying causes of temporary violations is difficult due to the transient nature of the source. Temporary violations should not be used as a regulatory tool as they provide only circumstantial evidence of pollution; yet they are valuable for assessing chronic problems of a transitory nature such as deliberate dumping of prohibited wastes and as a cross-check on incidents of major industrial leaks;
- (iii) Persistent violations: The purpose of the monitoring programme is to permit disposal of pollutants within the absorptive capacity of the receiving water bodies. If the receiving water fails consistently to assimilate excessive loads, monitoring would indicate more or less permanent violation of the water quality standards. An overall assessment of the situation may require implementation of one or more of the following measures:
- a. Enforcement of stricter effluent standards or in extreme cases curtailment of industrial activity in zones of acute pollution;
  - b. Limiting industrial and residential developments in the affected areas;
  - c. Diverting municipal effluents or proposing additional treatment;

A chronic violation is defined as a case of more than 30 per cent in excess of the limits on priority pollutants for periods of more than three months. This can be traced through periodic and annual reports to determine if a violation in a certain zone represents a temporary or long-term event. It is

necessary simultaneously to assess the entire aquatic environment when acute violations are detected as a relaxation of the standards might be warranted if violations have negligible effects on aquatic organisms.

An annual report concerning the quality of the receiving water bodies should encompass a summary of monitoring data, projected changes based on statistical analysis, recommendations for a corrective course of action and a summary of location, causes and remedial measures for temporary violations.

### 3. Monitoring air quality

The goals of the air quality surveillance in GAA are summarized as follows:

- Assessment of urban air quality and community health effects and documentation of potential health benefits of environmental control;

- Completion of monographs to describe effects on human health of long-term and short-term exposure of population sub-groups to major pollutants (respirable, particulates, NO<sub>x</sub>, SO<sub>x</sub>, CO and photo-chemical oxidants);

- Potential development of predictive models for air dispersion and other atmospheric processes based on pollutants concentrations; distributions on time-space scales and proposal of optimum inventory procedures and aerometric networks for future model evaluation;

- Evaluation of the contribution of major industrial sources in the GAA (refinery, cement plant, phosphate plant, etc.) to atmospheric pollution and quantitative descriptions of the generation and removal rates associated with major emission sources.

Monitoring must be based on temporal and spatial air quality variations. Temporal variations should consider available meteorological monitoring data of other agencies in addition to continuous air sampling to obtain short-term (up to 24 hours) and annual average concentrations of pollutants. Spatial variations will be tracked by fixed and mobile monitoring units located in various districts of GAA. It is recommended that the monitoring programme should include the following activities:

- (i) Monitoring ambient air quality through data collected from the fixed stations network to establish air pollution index (API), to predict long-term trends and to correlate ambient concentrations with local meteorological data;
- (ii) Mobile monitoring, needed for hot spots (high-impact areas) identified through a community's complaints and not covered by the stationary network, to measure the impact of new activities such as industrial plants and deployment to new areas proposed for coverage by the stationary network to assess the validity of enclosing the new areas in the monitoring network;
- (iii) Data collection and analysis: The generated data from the monitoring network will enable identification of daily excess, API and the projections for short-term potential excess; meteorological and air quality data will be incorporated with wind speed/direction frequency distributions when daily and diurnal summaries are prepared. It is proposed to prepare monthly summaries of major pollutants SO<sub>x</sub>, NO<sub>x</sub>, CO, C<sub>3</sub>, MMHC, H<sub>2</sub>S, particulates, total inhalable and flouride/chloride);
- (iv) Air quality assessment: Classification of air quality status includes: emergency release from malfunctions or deliberate industrial spills of volatiles; temporary emissions from insecticides' spraying, start-up of industrial facilities, asphalt paving, etc.; and long-term impacts from industrial complexes high density commercial areas and down-town area;
- (v) Existing industries will be required to submit to EPD an overall assessment for their incremental impact on ambient air quality, and their proposed plan for abating air emission. Actual or estimated API values above set criteria by EPD will provide guidance for acceptance of proposed additional activities in the monitored areas. Quarterly reports, when feasible, should be submitted to EPD from major industries. The reports will include a summary of excesses and statistical analysis of the emission data.

- (vi) New industries should submit prior to construction a review report covering the following: identification of emission sources (raw materials, fuel, products); characteristics and loads of fugitive emissions; location of stacks associated with point source, type of control equipment and efficiency at full and normal loads; in-house monitoring programme; and expected dates of completing construction and reaching normal operation. One permit will be issued for wastewater and air emission for each industrial application;
- (vii) Emissions inventories are essential for proper analysis of air quality data. Inventories can be used to track quality trends based on sophisticated modelling techniques to project trends based on past ambient levels and allow for cross-checking to determine reliability of instrumental and operational procedures, development of criteria for review and validation of data, and definition of guidelines for calibration and maintenance of monitoring devices.

#### 4. Solid and hazardous wastes monitoring

The plan involves monitoring of compliance with guidelines set forth by EPD for collection, transport, reuse or disposal of refuse and industrial residues. Implementation of the plan consists of the following:

- (i) Setting guidelines for management of solid wastes and codes of practices to evaluate collection and transportation activities undertaken by the municipalities and private contractors and the documentation data of the sanitation directorates (collection schedule, vehicles for pickups, vehicle maintenance, amount of trucked refuse, etc.);
- (ii) New and existing industrial facilities should submit a statement to EPD concerning generated residues which are temporarily contained or disposed of with domestic refuse, and estimates of construction and demolition debris and their disposal method;
- (iii) EPD shall prepare guidelines for siting, design and operation of sanitary landfills. Sanitation directorates will submit for review landfill records (class of waste, quantities and sources; specific



locations of disposal and frequency of cover application and compaction). EPD will undertake spot-inspections of the sites and report on the following: proper grading, maintenance of access roads and ancillary facilities, efficiency of on-site treatment, odour or vector problems, adhesion to safety and contingency procedures;

- (iv) Operation of the composting, curing and drying times, utilization of compost, odour and nuisance problems at the plant;
- (v) Monitoring of hazardous residues generated from industrial or public service facilities will be undertaken by EPD. Generators shall submit information concerning: chemical composition and characteristics of the residues (ignitability, corrosivity, toxicity, radioactivity, mutagenicity or infectiousness): quantities generated; storage location (climatic data, topographic and soil characteristics, hydrological data including anticipated impacts on water resources); storage procedure (dikes, transfer areas, surface impoundments and tanks); industrial operations must formulate and implement contingency plans for emergencies and major spills which specify a course of action in the event of accidental release of hazardous materials, equipment and material used to combat release, staff training and notification procedures;
- (vi) As most of the hazardous wastes generated within GAA are disposed of off-site it is necessary to develop a manifest system to track handling, transporting and disposing of hazardous waste. The manifest should accompany a bulk shipment or individual batches and record the following information: the generators' name and address; description of waste; handling precautions and hazardous properties; quantity of transferred material; designated disposal facility. Following the signing of the manifest by the operator of the disposal facility, it should be returned to EPD. All facilities, industrial, commercial or institutional, should obtain a licence from EPD and its representative shall make periodic inspections to ensure compliance with the handling procedures.

5. Monitoring noise and occupational exposures

The monitoring plan sets forth the procedures for acquisitions, reporting and interpretation of noise and occupational exposure data.

- (i) Noise monitoring at emission sources (locations of major industrial, construction and business activities) and receptor areas (residences, hospitals, educational institutions and parks). Noise should be monitored at appropriate times such as periods of relaxation versus times of high-noise levels during rush-hours and shift changes;
- (ii) Noise measurements should be recorded by the A-weighted method and Octave Band Sound Pressure Level (OBSPL). Noise should be measured during normal operation for industrial facilities (compressors, generators, crushers, etc.) and temporary high-noise activities (constructions, major road repairs, renovation or expansion projects). Ambient noise standards will be established for various zones of AMA. Actions proposed for violating sources are: (a) when the noise level exceeds ambient conditions by a maximum of 5dBA, the violator will be notified to carry out routine maintenance and (b) if the level of excess is more than 5 dBA, EPD will order the violators to correct the problem and remonitor the facility after implementation of the proper corrective actions;
- (iii) Occupational exposures include a host of sources: physical (noise, vibration, excessive temperatures, ionizing radiation); biological (insects, moulds, fungi, bacteria); biochemical (monitoring, repetitive motion, fatigue); and chemical inhalation or skin absorption (mists, vapours, gases, dusts, fumes). The monitoring plan encompasses: (a) evaluation of sources of hazards; (b) measurement of exposure level; (c) setting controls to reduce exposure to acceptable levels; and (d) periodic health check-ups to trace unusual conditions. All major industries should be required to submit annual reports concerning levels of exposure to hazardous conditions, effectiveness of control programme.

proposed modifications to improve occupational environment and results of medical surveys.

- (iv) EPD shall issue guidelines for occupational monitoring methods and should conduct spot-checks to assess compliance and cross-check annual reports submitted by industrial facilities. Medical data will be reviewed to determine whether adverse health effects are being caused by exposure to hazardous materials. An annual state of occupational health report shall be prepared by EPD and shall include information on status and new sources of hazards and recommendations to alleviate occupational exposure problems.

## PART TWO

### Greater Amman: Its Urban Development and Environment

#### An overview

The urban region of Amman is the primate region of the Kingdom, the attractive magnet of development projects and the locus of many of the resultant problems. The rapid population growth, due to a natural increase of population which is among the highest in the world, but more particularly due to the sudden influx of refugees from Palestine which started in 1967 and continued spasmodically coupled with migration from the countryside, has created squatter settlements which sprang up almost overnight with adverse effects on the human environment and quality of life.

#### Amman urban region planning

To achieve a measure of planned development, the Government of Jordan, in collaboration with the United States Agency for International Development, initiated in January 1977 a planning effort known as the Amman Urban Region Planning Project which was timed to begin with the national five-year plan, 1981-1985. The approach of the plan was based upon planned development which focussed on the specific and practical activities of the private and public sectors that affect the capital region's functions in national development. It was multidimensional and interdisciplinary: physical, demographic, economic, social, fiscal and administrative. Although it was a comprehensive and well-prepared document, it was never implemented in its entirety because events overtook

it. Indeed, the inability of the planning machinery to precede events is the root cause of urban environmental problems.

### Urban development projects

Many thousands of people live in overcrowded housing conditions in the Amman urban region. Moved by the grave situation and out of concern for the problems of the lowest-income groups, the Government of Jordan commissioned a study in 1977 and as a result decided to implement a JD 17 million project, which involved a major new approach. With funds from the World Bank the Urban Development Department (UDD) was set up in 1980, within the Municipality of Amman, and has been given major responsibility for the project, which is designed to meet the needs of the poorest 40 per cent of Jordan's urban community and to benefit some 50,000 to 60,000 people over the next few years. The scope of the project includes small housing plots, buildings, shops and workshops, all serviced with water, sewers, power and roads or footpaths. Through an arrangement between the World Bank, the Housing Bank and the Government (UDD), the beneficiary is enabled to obtain a loan and buy the land, buildings, services and building materials. The loan is repayable to the Housing Bank over a period of up to 20 years. The Government supplies the essential utilities and services such as water and power supplies, schools and clinics. The components of the project are:

- Three minimum-cost housing schemes with a total of 5,000 new plots with various levels of initial housing provision (core-houses) to be developed at Queismeh, Marka and North Ruseifieh. (Work was progressing on these in May 1985);

- Five slum and squatter area improving schemes at East Wahdat, Jofeh, Wadi Um er-Rimam, Wadi Haddadah and Nazha, benefiting some 1,500 households (four fifths of this scheme was already completed by the end of 1984;

- Community facilities: a series of new schools, clinics, community centres, vocational training centres for both males and females, plus areas for public and children's play;

- Employment programmes: small shops and workshops to be provided for purchase through the Housing Bank and funds for equipment from the Industrial Development Bank. Together with the training centres, these are designed to increase the level of employment, particularly among youth and females, and thus to improve family income levels.

The above projects were conceived as the first in a series of such projects which were designed to be implemented between 1981 and 1984. They are complementary to a number of existing programmes and policies, particularly those of the Municipality of Amman, the Housing Bank, the Housing Corporation and the Industrial Development Bank. Other institutions that play a role in the project include the Amman Water and Sewerage Authority, the Water Corporation(\*), the Jordan Electricity Company and the Ministries of Health and Education. The co-operation and co-ordination that has been established among all these various bodies has contributed to the success of the first and current phase of the project and is an encouraging signal that other forms of co-operative endeavour in the field of low-income group housing, such as housing co-operatives and self-help schemes, may achieve similar success.

#### Environmental problems

This commendable effort at attempting to alleviate the unsatisfactory state of the housing situation does not hide the fact that a lot remains to be done. For one thing, the sizes and quality of the open spaces, even in areas covered by the improvement schemes, are far below acceptable standards. Similarly, the situation as regards transportation facilities and domestic waste collection and disposal in the poorer sections of the city is inadequate. Garbage tipping and burning, discharge of cesspool effluent and huge scrap metal grave-yards are sources of environmental as well as vision pollution. In some congested parts of the city the level of air pollution from automobile emissions is noticeably higher than in the less congested areas as is also the noise pollution.

As regards the individual houses, the size of plots in some of the upgrading schemes appeared to be too small for the size of an average family. It is also reasonable to assume that low-income families have to spend a considerable percentage of their income in heating their homes, particularly during the winter months, in order to combat the cold that easily permeates the concrete blocks of which the walls of these homes are constructed. The mission was surprised to be told by the Building Research Centre, the Royal Scientific Society, that no alternative building material was available. This, and the fact that some 60 per cent of Jordan's national income is spent on energy imports, prompts the mission to propose the use of solar energy for water heating in future

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(\*) Sewerage treatment plants are now under the Water Authority.

low-cost housing schemes and to initiate a pilot project(s) on energy-efficient architectural designs for the Greater Amman region.

### Pilot projects

#### 1. Energy-efficient architectural design

The most prevalent building materials used in low-cost housing in the Greater Amman region are cement block and reinforced concrete, both of which have relatively poor thermal insulation properties. Indications are that low-income groups are forced to spend a substantial percentage of their income to maintain a reasonable level of comfort inside their homes, particularly during the winter months. In the absence of an affordable and more thermally-efficient alternative construction material, ways and means must be found to relieve the financial and psychological burden on the limited-income group of the population. To this end, it is proposed to initiate a pilot project which aims at the following:

(a) Investigating the thermal performance of an existing low-cost housing scheme in order to evaluate, through computer analysis, the consequences of architectural design on thermal behaviour;

(b) Proposing alternative architectural designs that would improve thermal performance;

(c) Formulating guidelines for such alternative designs to be adopted at the Greater Amman regional level and, if applicable, at the national level. The outcome of the exercise may be used not only for enhancing the thermal efficiency of existing buildings but also for producing better housing in the future.

#### 2. Solar energy

There are sufficient economic, social, climatic and environmental grounds to justify the use of solar energy in low-income group housing within the framework of the Urban Department projects, almost all of which are constructed with concrete blocks. ESCWA stands ready to co-sponsor with the Municipality of Amman and other interested bodies a pilot project which will be designed and built in the light of the findings and conclusions derived from the thermal analysis project mentioned above. The pilot project can be a dwelling house, a clinic, a community centre etc., or a combination of

all these. Locally manufactured equipment will be installed and its performance monitored to determine its efficiency in terms of economic and environmental (comfort) returns. Knowledge thus gained will be useful when planning future low-cost housing projects.

Once the ideas are accepted by the Municipality, the details of each pilot project will be worked out by ESCWA in close co-operation and with full participation of UDD, RSS, the University of Jordan and any other interested bodies. Emphasis will be laid on local expertise and traditions in the design and construction of the projects. Research results and experience gained from the pilot projects will be disseminated through publications and through the organizing of training seminars and workshops attended by planners, architects, builders and administrators from Jordan and other Arab countries of the ESCWA region.

Provided the above is agreeable and in order that the preparatory work may commence without delay, the Municipality of Amman should identify the type of pilot project it wishes to implement and the land and/or an existing low-cost housing scheme for its implementation. The Lord Mayor of Amman may also wish to designate a local expert to act as a focal point for the project(s). Other details as regards the role of each participating party will be worked out with the focal point.

Annex I

EVALUATION FORMS FOR WASTE TREATMENT SYSTEMS

Industrial Waste Survey

I. PLANT INFORMATION

Code	Region	Organization	Plant	Rating
Plant name				
Organization				
Activity				
Address				
Contact name				
Title				
Phone				

II. ACTIONS (Departmental Information)

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10

III. PROCESS DESCRIPTION



IV. WATER AND WASTEWATER

A. Water

1. Water resources: (a) Domestic (b) River (c) Well  
(d) Spring
2. In-plant treatment: (a) Process (b) Softening  
(c) Demineralization
3. Water flow: (a) V. high (10,000 m<sup>3</sup>/d)  
(b) High (5000-10,000)  
(c) Moderate (500-5000)  
(d) Low (500 m<sup>3</sup>/d)
4. Water uses %: (a) Process (b) Cooling (c) Clean-up  
(d) Boiler (e) Domestic
5. Water recycling: (a) High 50% (b) Partial 50% (c) None

B. Wastewater

6. Waste treatment: (a) Pre. (b) Pri. (c) Sec.  
(d) Special (d) None
7. Segregation: (a) Yes (b) No
8. Toxic handlings: (a) Yes (b) No
9. Oil traps: (a) Yes (b) No
10. Discharge: (a) Continuous (b) Batch
11. Disposal: (a) Rive (b) Sewerage (c) Lake  
(d) Underground (e) Sea

C. Solid waste

12. Type: (a) Organic (b) Refractor (c) Catalyst
13. Amount kkg/d
14. Reuse or recycle: (a) Yes (b) No
15. Handling: (a) Contractor (b) Incineration  
(c) Landfill (d) Others
16. Analysis: (a) Available (b) Not available

D. Operation

17. Type: (a) Modern (b) Classical (c) old
18. System: (a) Continuous (b) Batch
19. Major raw materials:
20. Catalyst:
21. Toxic:
22. By-product recycle: (a) Yes (b) No
23. Housekeeping: (a) Excellent (b) Good  
(c) Fair (d) Bad
24. W/W operators: (a) Good (b) Fair (c) Not enough

V. PLANT LOCATION

A. General

1. Detailed description of plant location and distance of the nearest population and commercial centres (attach map).
2. Level of underground water and wind direction.
3. Zoning restrictions.

B. Waste treatment facilities

1. Description of existing location of waste treatment facilities (solid, liquid) and points of intake and effluent discharge attach sewer map).
2. If not existing, describe available location for new waste treatment unit.
3. If land is not available, assess potential for connection to centralized treatment plant (attach map of the proposed location).
4. Environmental impacts of existing location of the waste treatment system.

VI. AIR POLLUTION

1. Gases (SP, Dust, Nox, SO<sub>2</sub>, HC, CO, other)

2. Quantity mg/m<sup>3</sup>

3. Sources emission

4. Quantity of fuel kg/d

5. Sulphus content

6. Number and height of Chimneys

7. Average gas temp °C

8. Method of control

(a) Filters

(b) Adsorption

(c) Absorption

(d) Scrubbers

(e) Electroprecipitators

(f) Centrifuges

(g) Others

Analysis of industrial effluents

Plant

Code No.	Raw Eff.	Treated Eff.	Flow rate ( ) m <sup>3</sup> /d
Parameter	mg/L	mg/L	Load kg/d IES
1. Color (unit)			
2. pH			
3. Temp. °C			
4. Turbidity			
5. Cond. umho/cm			
6. TDS			
7. TSS			
8. Set. S ml/L			
9. O & C	Recommended Analytical Parameters		
10. DO	INDUSTRY		PARAMETERS
11. BOD	Dairy	1 to 18, 20, 21, 32, 33, 34, 35	
12. COD	Canning	1 to 18, 20, 33, 34, 35	
13. TOC	Sugar	1 to 18, 20, 35	
14. PO <sub>4</sub> <sup>-2</sup>	Textile	1 to 15, 17, 18, 20, 21, 24, 26, 27, 29, 30	
15. NH <sub>3</sub> <sup>-N</sup>	Cement	2, 5, 8, 9, 18	
16. TKN	Poultry & Meat	1 to 18, 23, 33, 43, 35	
17. NO <sub>3</sub>	Iron & steel	2 to 15, 17, 18, 20, 22 to 29	
18. SO <sub>4</sub>	Organics	1 to 18, 20, 21, 31, 36, 37	
19. F	Inorganics	1 to 15, 17 to 20, 30, 31, 32, 36	
20. Cl	Plastics	1 to 29, 31, 35, 37	
21. MBAS	Soap & oil	1 to 20, 23, 24, 26, 27, 32, 33, 34, 36	
22. Cu	Fertilizers	1 to 20	
23. Ni	Oil refining	1 to 18, 20 to 30, 36, 37	
24. Zn	Non-Ferrous metals	2 to 12, 17, 18, 19, 21, 22 to 34, 37	
25. Cd	Phosphate	1 to 20, 36	
26. Pb	Power	3, 6, 9, 1, 22, 24, 27, 29	
27. Fe	Tanning	1 to 18, 20 to 37	
28. Sn	Glass	1 to 15, 26, 30, 37	
29. Cr	Asbestos	1 to 8	
30. Hg	Rubber	1 to 19, 26, 29, 37	
31. CN	Pulp & paper	1 to 18, 20, 21, 30, 31	
32. S	Electronics	1 to 18, 20, 21, 30, 31	
33. TC/100 ml			
34. SS/100 ml			
35. HC/100 ml			
36. T. HARD			
37. Phenol			

Performance of wastewater treatment plant

Summary information

A. General

1. Code No.
2. Name
3. Type of treatment (scr. sed. aer. Cla. Cl. dig. dry)
4. Average daily flow
5. Collection system (domestic, industrial, combined)
6. Types of industrial discharges
7. Volume of industrial flow
8. Receiving water

B. Plant performance

Records	Flow m <sup>3</sup> /d	DO mg/l	BOD mg/l	SS mg/l	R-Cl <sub>2</sub> l/100	FC ml
Average maximum	Average maximum monthly ave. flow					
Monthly flow	Day of max. flow date					
Month year	Day of min. flow date					
Average minimum	Monthly average flow					
Monthly flow	Day of max. flow date					
Month year	Day of min. flow date					

Mark deviation from "effluent standards for discharge to water bodies".

10. Alternate electric power source.
11. Availability of consultants for O & M problems.

12. Bypass incidence

- (a) Agencies
- (b) Frequency
- (c) Average duration
- (d) Principal reasons

C. Monitoring and training

13. Laboratory monitoring

- (a) Monitoring scheme

Location	Set.S	TSS	BOD	TDS	VSS	TVS	DO	O&G	COD	R-CL <sub>2</sub>	CC
Raw	1										
	2	CD	CD	CD	CW	CD	CW		CD		
Primary	1										
	2	CD	CD	CD		CD	CW				
Secondary	1										
	2	CD	CD	CD		CD	CW		CD	CD	
Mixed Liquor	1										
	2		CD			CD		CH			
Effluent	1										
	2		CD	CD	CW			CH	CD		CH

- (a) Actual (2) Appropriate
- (C) Composite (G) Grab (W) Weekly (D) Daily (H) Hourly
- (b) Adequacy of laboratory instruments
- (c) Adequacy of manpower

14. Operators training.

15. General observations (i) Satisfactory (ii) Marginal  
(iii) Unacceptable

- (a) Facilities (laboratory, building, grounds).
- (b) Pre.
- (c) Pri.
- (d) Sec.
- (e) Chlorine

16. Future measures for upgrading

17. Follow-up actions by Environmental Protection Department (EPD)
  - (a) Industrial waste problems
  - (b) Operational problems
  - (c) Excessive by-passing
  - (d) Inadequate in-plant monitoring
  - (e) Staff deficiencies
  - (f) Training needs
  - (g) Over-capacity
  - (h) Environmental problems
  - (i) Unacceptable effluent quality
18. General rating
  - (a) Satisfactory
  - (b) Marginal
  - (c) Poor
19. Information furnished by sewerage authority
  - (a) Title
  - (b) Organization
  - (c) Date
20. Information compiled by EPD staff
  - (a) Name
  - (b) Date

Annex II

JOINT ECWA/FRANCE MISSION TO AMMAN 8-19 MAY 1985

Schedule of meetings

Thursday 9/5/1985

- 09.00 Ministry of planning
- 10.30 Municipality of Amman
- 12.00 Public Transport Corporation

Friday 10/5/1985 Visit King Talal Dam.

Saturday 11/5/1985

- 10.00 Minister of Municipalities, Rural Affairs and Environmental (MMRE).
- 12.30 Department of the Environment, MMRE.

Sunday 12/5/1985

- 08.30 Ain Ghazal Sewage Treatment Plant, Water Authority  
Visit to selected industrial sites
- 12.30 Water Authority Main Laboratories
- 16.00 Environment Health Department, Ministry of Health

Monday 13/5/1985

- 08.30 Amman Municipality, Briefing of all Departmental Heads
- 16.00 Royal Scientific Society. Industrial Chemistry Department

Tuesday 14/5/1985

- 09.00 Housing Corporation
- 10.30 Ministry of Industry and Trade, Standards and Measures Department.



Tuesday 14/5/1985 (continued)

12.30 Natural Resources Authority, Ministry of Energy and Electricity

Wednesday 15/5/1985

09.00 Regional Planning Department, MMRE

10.30 Water Authority

12.30 University of Jordan

18.00 Joint Meeting with the French Team to review conclusions and recommendation for action.

Thursday 16/5/1985

09.00 Urban Development Department, Amman Municipality.

10.30 Debriefing Heads of Departments at Amman Municipality.

12.00 Visits to upgrading and new sites, Urban Development Department, including landfill areas.

16.00 Royal Society for the Conservation of Nature.

Friday 17/5/1985

Free (Mr. Laparad leaves for Paris).

Saturday 18/5/1985

09.00 Ministry of Municipalities, Rural Affairs and Environment, Debriefing the Minister.

- Mr. Hamza leaves for Cairo.

Sunday 19/5/1985

Mr. Gertoux leaves for Paris.

10.00 Royal Scientific Society, Building Materials Research Centre (Mr. Abdalla only).

- Mr. Abdalla leaves for Baghdad.

Annex III

NAMES OF INSTITUTIONS VISITED AND PERSONALITIES WITH WHOM  
DISCUSSIONS WERE HELD DURING THE MISSION 8-19 MAY 1985

1. Ministry of Planning

- Mr. Hussein Shafa Amri, Director, Research and Studies
- Miss Ferdose Shahbaz, Researcher, Department of Science and Technology

2. Municipality of Amman

- His Excellency Abdur-Ra'uf Rawabdeh, Lord Mayor
- Mr. Sultan Khaleifat, Under-Secretary
- Mawlood Abdelgadir, City Council Member
- Mr. Abdelrahman Al Anaini, Assistant for Public Health Affairs
- Mr. Yacoub Ammari, Assistant for Urban Development
- Mr. Majeed Nimri, Assistant for Services and Inspector General
- Mr. Zuheir Haddadeen, Director, Community Health
- Engineer Kasim Hashem, Director, Solid Waste Management
- Mr. Adnan Abdulmajeed, Director, Rodents and Insects.
- Engineer Kamal Jalouga, Director, Greater Amman Comprehensive Development Planning Project

3. Ministry of Municipal, Rural and Environmental Affairs (MMRAE)

- His Excellency Marwan Hammoud, Minister

4. Department of the Environment, MMRAE

- Mr. Sufian Aref Al-Tel, Director, Department of Environment

4. Department of the Environment, MMRAE Cont'd)
  - Mr. Salih El-Share', Deputy Director, Department of Environment
  - Engineer Mohamed Shahbaz, Chief, Water Protection Division
5. Ain Ghazal Sewage Treatment Plant (Water Authority)
  - Engineer Abdel Wahab Matar, Manager
6. Water and Environmental Isotope Laboratories
  - Mr. Abdulhameed Ahmed Al-Khatib, Director
7. Environmental Health Department, Ministry of Health
  - Engineer Mohamed Hussein Dajani, Director
  - Mr. Ahmed Al Sallaj, Chief, Occupational Health
  - Mr. Issa Abarneh, Chief, Occupational Medicine
  - Mr. Mazen, Industrial Hygiene.
8. Ministry of Transport
  - Engineer Mansour Shammout
9. Public Transport Corporation
  - Engineer Samir Y. Sunna, Technical Assistant General Manager
10. Royal Scientific Society
  - Mr. Murad J. Bino, Industrial Chemistry Department
  - Mr. Dawood Gebegi, Director, Building Materials Section
11. Housing Corporation
  - Mr. Tariq M. Bushnaq, Deputy Director
  - Mr. Hatim Ghuneim, Director, Design and Planning Department

12. Ministry of Industry and Trade  
Engineer Salah Eddin Taba, Director, Department of  
Standards and Measures
13. Natural Resources Authority, Ministry of Energy and  
Mineral Resources  
Engineer Yousuf Al-Nimri, Director-General
14. Regional Planning Department, MMRE  
Engineer Nizar Wasif Al-Misri, Director
15. Water Authority
  - Mr. Mohamed Al-Kilani, President
  - Mr. Sagr Salim, Sewerage Treatment Department
  - Mr. Badr Hirzalla, Deputy Director, Water Resources  
Department
  - Mr. Omar Mukhtar, Public Relations Officer
16. University of Jordan
  - Mr. Abdulsalam Al-Majali, President
  - Mr. Rashad Natour, Botanical Science
  - Mr. Tawfiq Samaneh, Environmental Engineering
  - Mr. Adil Mahasneh, Applied Microbiology
  - Mr. Elias Salameh, Water Resources Institute
17. Urban Development Department (Municipality of Amman)
  - Mr. Yacoub Amari, Assistant Director
  - Mrs. Hidaya Al-Khayri Dajani, Director,  
Population Affairs
  - Engineer Khalid Jayousi, Director Technical Division
18. The Royal Society for the Conservation of Nature
  - Mr. Maher Zafar, General Director.