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VOLUME I: TEXT

Design of a Monitoring and Evaluation Plan
for Egypt's Environment Sector and
USAID's Egyptian Environmental Policy Program

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VOLUME II (Additional appendices)

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	Strategic Objective
SpO	Special Objective
TDA	Tourism Development Authority
TIMS	Tabbin Institute for Metellurgical Studies
USAID	United States Agency for International Development
VET	Vehicle Emissions Testing, Tune-up, and Certification

1 INTRODUCTION

1.1 Purpose of the Monitoring and Evaluation Mission

USAID/Egypt's overall goal is to promote sustainable development that improves people's lives without exhausting the natural environment. For example, as a goal or target, it is not enough to simply increase tourism; what is needed is tourism that will prosper and yet not sap the ecosystem. A key part of this challenge is to implement programs and projects that improve Egypt's physical environment and support its future viability. As part of this effort, USAID, the Government of Egypt (GOE), and other stakeholders need timely and credible information on the effectiveness of their efforts to advance sustainable development. The proposed Environment Management Information System (EMIS)[1] has been designed to meet this need. It will serve a variety of purposes, as listed in Box I-1. At the most general, aggregated level, it will provide a picture of the Egyptian environment to reveal trends at the most macro level. It is not suggested by inclusion of this societal focus that USAID is to be held accountable for these trends; rather it will provide a picture of the total environmental sector and reveal broad patterns of improvement or decline. The success of a particular USAID intervention, for example, may be affected by these trends, and thus, they should be taken into account in any analysis.

Box I-1: Environment Management Information System

- Track performance of the Egyptian Environmental Policy Program and provide feedback for policy dialogue.
- Track performance of results (R4) packages and monitor performance at the strategic objective level.
- Provide sectorwide monitoring of key indicators.
- Maintain a database to respond to information requests.

The system will also track performance of the new Egyptian Environmental Policy Program. The EMIS team consulted with the Environmental Policy and Institutional Strengthening Project (EPIQ) assessment team during the development of the EMIS design. It should be noted that the EMIS will also include evaluations and policy analysis studies as well as performance monitoring. These types of studies may be prompted by a significant discontinuity in the trend of monitoring data (e.g., sharp decline in air quality), suggesting that more in-depth analysis is needed to understand the reasons for the decline.

Finally, the system will monitor performance at the strategic objective and results package levels. It will include a few vital indicators that will help the EMIS user easily grasp how well a particular environmental intervention (e.g., ecotourism education) is achieving its intended results.

[1] *EMIS* is the name of the system discussed in this report. The official name of the EHP task order is *Design of a Monitoring and Evaluation Plan for Egypt's Environment Sector and USAID's Egyptian Environmental Policy Program (EEPP).* To simplify matters, the group of individuals who worked under the EHP activity are referred to as "the EMIS team" in this report.

Box I-2: Assumptions of the EMIS Design Activity

- EPIQ environmental assessment results will be available in a time for use in the EMIS design.
- There will be sufficient available data to support the EMIS.
- The Egyptian Environmental Policy Program policy and institutional objectives are defined in time for use in the EMIS design.
- The EMIS customers can identify their priority information needs.

The results of these activities, as well as the performance indicator data, will be maintained in the system database. A PC database will be the repository to archive information for quick retrieval and utilization in policy dialogue and management decision making.

1.2 Assumptions of the EMIS Design

Several assumptions were made during design of the EMIS system. The team reviewed early findings from the EPIQ assessment. Since the final assessment results (e.g., policy measures) are in preparation, the team used illustrative *draft* policy measures in Chapter 3 to formulate the EMIS verification and results analysis strategy.

USAID/Egypt has also made a point that the EMIS will rely upon extant Egypt environment data. The EMIS has been designed to incorporate existing data wherever feasible and warranted. As discussed in this report, however, data pertinent to the Egypt environment sector are incomplete and of varying quality for several of the most appropriate monitoring indicators. (Appendix II-A lists various sources of environmental data collected in Egypt. Volume II of this report is separately bound, containing four appendices.)

The proposed approach assumes that potential EMIS users can accurately define their information needs. As discussed in the customer survey in Appendix II-C, potential EMIS customers were very articulate in identifying their information needs. Their input was extremely useful in conceptualizing the EMIS.

1.3 Customer Focus

The EMIS is based on the principle of *customer focus*. This means that any information collected and maintained by the system database, such as monitoring and evaluation data, must have a specific customer who has expressed a need for that information and an intent to use it. In other words, customer information demands will determine the content of the system's database and, in turn, the system information output, based on the premise that monitoring and evaluation data, and other information people need and ask for, will be data and information they use. The logic of this approach is depicted in Box I-3.

The key to the success of the system is to focus on the *vital few indicators* that will meet customer information needs with minimum effort, rather than to fill the system database with all possible indicators regardless of whether or not anyone has expressed a desire for the information or an intent to use it. In addition to being demand-driven, EMIS data and information should be *available* in time to

Box I-3: Customer-Driven Design Approach

EMIS Customer Information Need- ° EMIS Database ° EMIS Information Output ° EMIS Customer Information Use

be useful, easily *accessible*, and methodologically *credible*.

The system should be *cost-effective* and *collaborative*. Being cost-effective means that the system will use data and information that is the most useful to its customers for the least cost. Existing data, for example, should be used wherever possible. Operation of the EMIS will also call for collaboration with other stakeholders, such as other environment sector donors and the Government of Egypt, to avoid duplication of effort and to make available data and information useful for environment program and project management decision making.

Finally, the system permits a limited range of analysis (e.g., time series) that will permit more extensive use of the data and information to examine monitoring and evaluation issues in more depth. For example, an EMIS customer may want to analyze environmental impacts in different governorates. The system will be able to permit this type of disaggregated investigation.

1.4 Report Preview

Chapter 2 of this report will discuss the overall structure and logic of the proposed EMIS. Of particular note is the rationale for how indicators are constructed from the building blocks comprised of individual variables. The relevant system tools are also discussed along with a system management strategy. The next three chapters present the categories of EMIS indicators, their rationale, and how they can be used in policy and program decision making. The final chapter presents the computerized database approach that will support the system's operation.

These six text chapters are bound as Volume I, with a list of individuals contacted in the course of preparations of the EMIS (Appendix A) and references used (Appendix B).

Information in Volume II expands the discussion in the text chapters. Appendix II-A lists the sources of environmental data currently available from Egyptian agencies and ministries. Appendix II-B gives definitions of variables, with method of collection, frequency, and an assessment of data quality. The customer interview survey is described in Appendix II-C. A proposed staffing plan, giving anticipated duties and qualifications for each position, is contained in Appendix II-D.

2 EMIS OVERVIEW

2.1 Overview

As noted in Chapter 1, the EMIS is a set of processes and procedures for monitoring, evaluating, and verifying environmental information in four component areas:

- Policy monitoring
- Results review and resource request (R4) and SO/IR reporting
- Sectoral monitoring
- Responding to information requests

The first three of these components are "core" functions of the system and are described in detail in Chapters 3, 4, and 5. For purposes of understanding process flow, these four components can also be divided into two categories: routine and nonroutine reporting. The first two of the components, policy monitoring and R4, require reporting at predetermined intervals. This will involve periodic collection of environmental data and other information, generation of indicators and comparison of new values to previous values, review and analysis, and generation of standard reports. The process flow for the first two functional components is therefore based on systematizing procedures that must be repeated year after year—i.e., routine reporting.

Sectoral monitoring, on the other hand, is conducted on an ad hoc basis as part of an overall effort to monitor key environmental indicators sectorwide. Additional ad hoc information needs include special studies, external queries, and the development of success stories and press releases or other media announcements. These information requests can either be externally imposed (such as a request from the U.S. Congress) or internally imposed in response to reaching certain program milestones or other internal events. The process flow for these two components is based on providing tools to facilitate and enhance the generation of one-time outputs, i.e., "nonroutine reporting" or information products that are not repeated.

The EMIS will be able to generate policy reports of various kinds: regularly scheduled press releases on environment policy reforms; policy briefings for USAID stakeholders; policy briefings for GOE officials; focused policy briefs for potential investors in Egypt; and succinct policy success stories. The EMIS database will archive policy measures information, verification results, impact results, and dialogue results for quick access.

2.2 EMIS Process

The difference in process flow between the two categories is illustrated in Figures II-1 and II-2, found at the end of this chapter. These process flow models illustrate the major steps and decision points for the two categories. Rectangles represent activities; diamond-shaped symbols represent decision points. Each flow begins with an initiating event and ends with a terminating event, depicted as circles. These models are not meant to be specifications in themselves, but rather are illustrations of the two ways of interacting with the system to give a base of understanding for the more specific activities and functional requirements described in this document.

As with any monitoring system, the human component is the most important component. Skilled professional staff will be needed to establish, use, and refine the processes and procedures described here. These staff members will be supported by a computerized set of

"tools" which will facilitate the collection, management, and analysis of data, along with both the routine and the nonroutine reporting needs. The computerized component is not intended, nor should it try, to automate the entire monitoring, evaluation, and validation process. Rather, it will provide a set of tools that will facilitate that process, automating mundane tasks, and freeing the staff to carry out more important analysis and process-refinement activities.

2.3 System Components

At the base of the monitoring system will be a data repository which will consist of two main components: an environmental database and a bibliographic database. The environmental database will consist of a collection of environmental variables that will be used to generate indicators for project tracking and sectoral monitoring. The bibliographic database will contain reference materials such as laws and regulations, technical articles, video clips, graphics, and images. Tools will also be provided to allow searches of other external, on-line databases and libraries.

The environmental database design will be based on the concept that individual data values or "variables" can be combined in different ways to generate indicators which may be used for programmatic tracking, SO and R4 reporting, sectoral studies, or general analysis and planning. This is shown schematically in Figure II-3. The indicators will be combined through the use of "operators," which can range from simple arithmetic operations to complex statistical analyses and modeling. A fully defined variable will have with it all the information listed in Box II-1. This information facilitates collection of the variable and analysis of the associated indicator.

BOX II-1: VARIABLE COMPONENTS

Variable: Definition of the variable including the parameter measured, unit of measurement, and where necessary, the geographic location that it represents (e.g., fecal coliform, colonies per 100 ml, for Nile River downstream from Cairo).
Data Source: Organization from which the data is retrieved, with name of contact person (and/or title) if available.
Operator Collection Method: How the M&E Unit collects the variable including, where necessary, the name of the document or database in which the variable is located and the required procedures for obtaining the variable (MoU, formal request from USAID, etc.).
Primary Data Collection Method: Methodology used by the data source for collection of raw data and generation of the variable (technology, procedure, etc.).
Variable Frequency: How often the M&E Unit collects the variable and generates indicators.
Data Frequency: How often the data source collects the raw data from which it generates the variable.
Data Quality: Quantitative (if available) or narrative description of the quality of the variable.
Comments/Assumptions: Assumptions and limitations of the variable.

Simply tracking data indicators provides a limited view of progress or trends. True understanding comes with knowledge of the context and factors influencing change. Thus, a bibliographic database is proposed with reference information to augment indicator tracking and provide sources for further research and analysis. This database will be a bit like a library of reference information. It will not try to store every reference item imaginable, but rather will provide mechanisms for linking and searching other libraries and information resources. The contents of the bibliographic database will be tied through relational tables to the content of the environmental database so that records in one can be linked to records in the other.

In addition to tools for query and retrieval of data and information from the data repository, the system will include a selection of off-the-shelf software that can assist not only with the activities of the functional areas described above, but also with project planning and project management. These tools include spreadsheets and project planning software, schedulers, budget tracking systems, and a mechanism for tracking other donor activities.[2]

The first stage of EMIS implementation will be to establish the core set of functions that can respond to the needs of R4 and the EEPP and provide sectorwide monitoring of key environmental indicators. Software tools will be chosen that are identical to Mission standard tools, if they already exist, and to be compatible with Mission standards, if they do not. Thus, word-processing and spreadsheet systems will be based on WordPerfect and Lotus-4, respectively. At present, there is no Mission standard for databases, although the two most commonly used are Access and Fox-Pro. Similarly, there is no standard for desktop GIS; and, in fact, a variety of GIS systems are cropping up throughout the Mission. A committee has been formed to review this issue, and it appears that MapInfo could very well become the Mission standard. Development of new software should not be part of establishing the EMIS.

Nor should the focus be on populating the database with huge amounts of data that may or may not be used. Once the core functions of the EMIS are established, the focus should be on responding to real requests and developing aggregate reports and demonstration data products intended to stimulate interest and generate demand. In this practical approach, the specifics of the underlying database can be designed to respond to known demands and real uses, not imaginary or hypothetical ones. Subsequent upgrades to the system should involve development of applications that are responsive to real user needs.

[2] This mechanism is already available in the Environment Division in a Fox-Pro-based system developed by Hussein Sedky of USAID/Egypt.

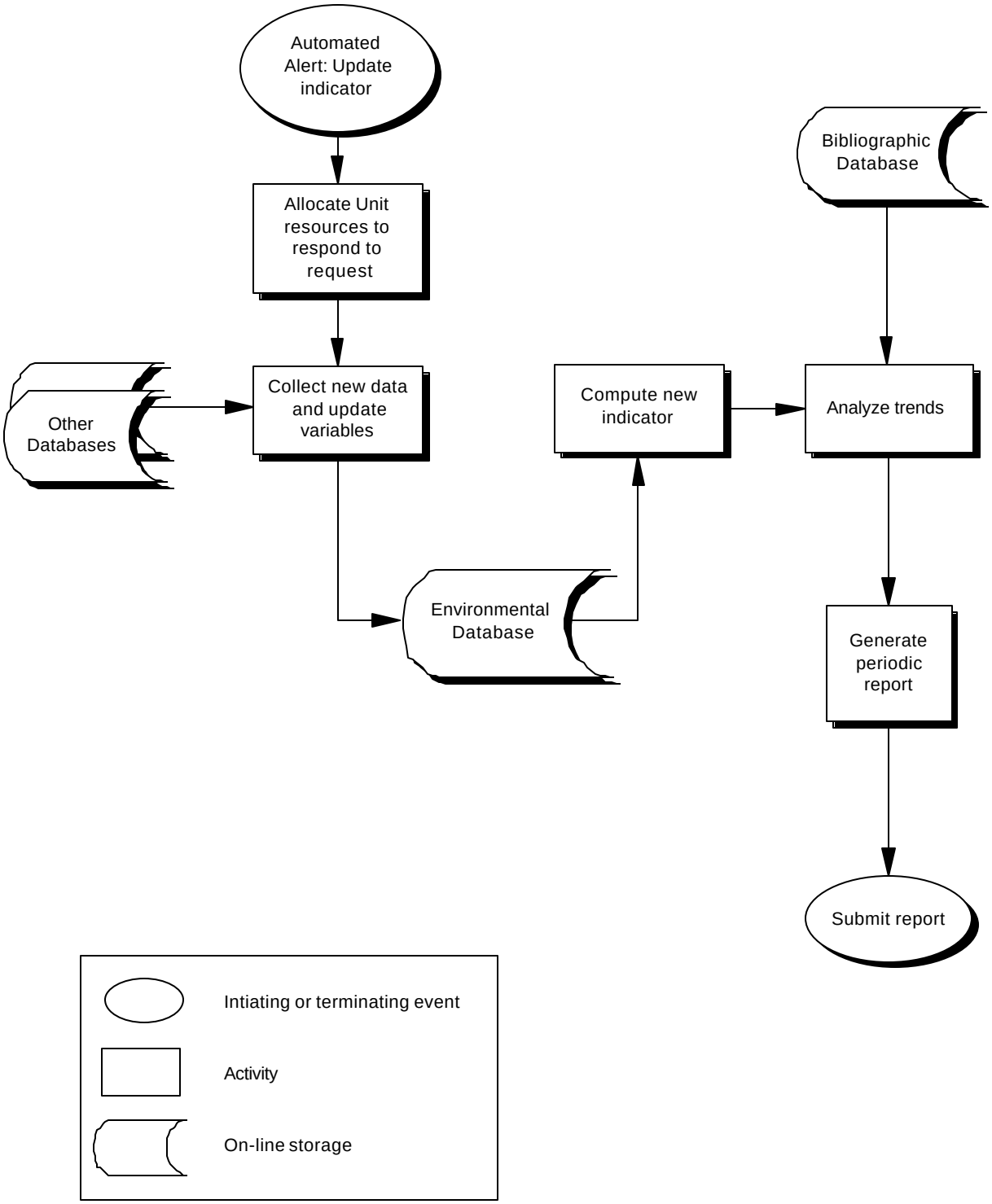

Figure II-1 - Process Flow for Routine Reporting

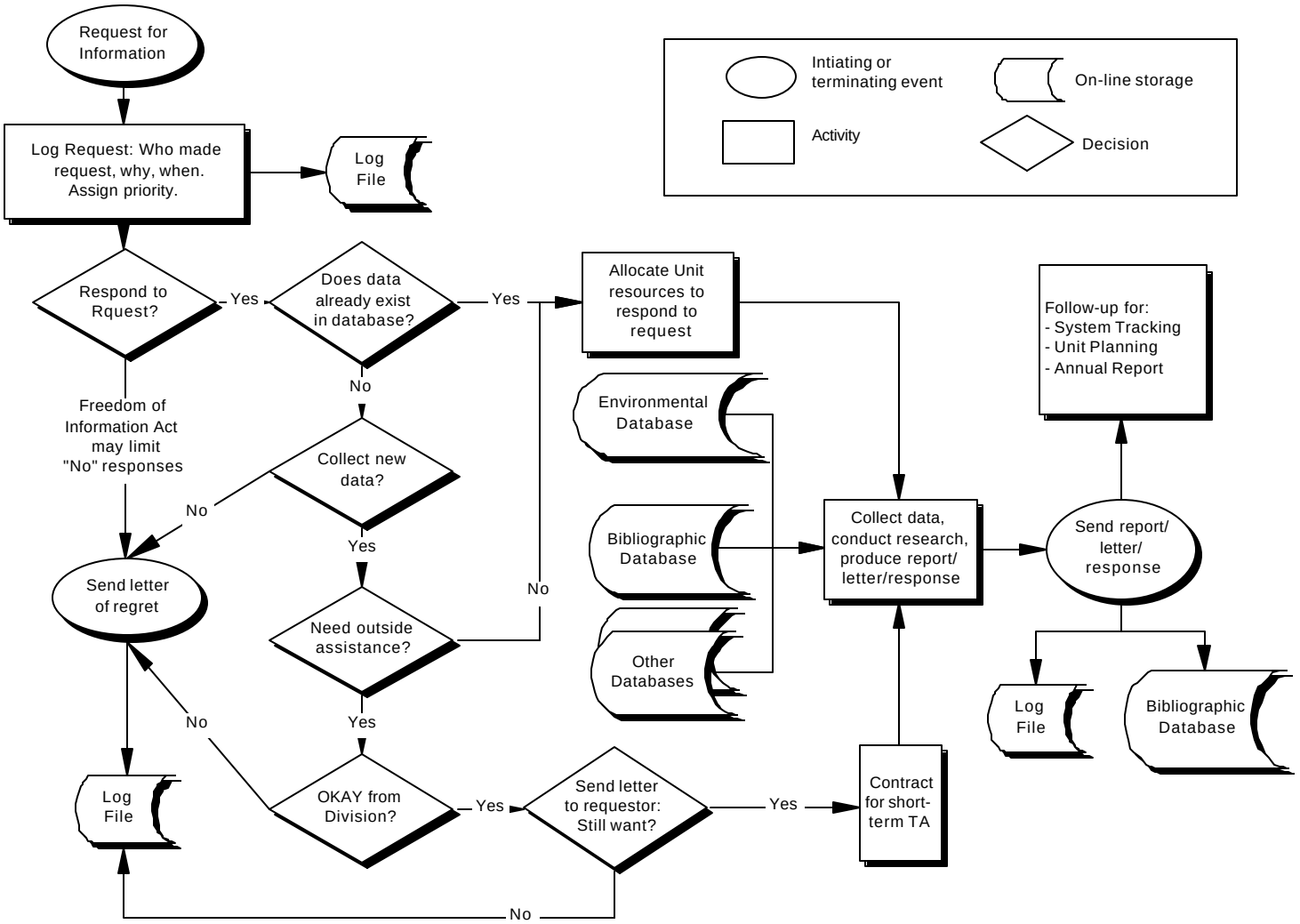

Figure II-2 - Process Flow for Non-Routine Reporting

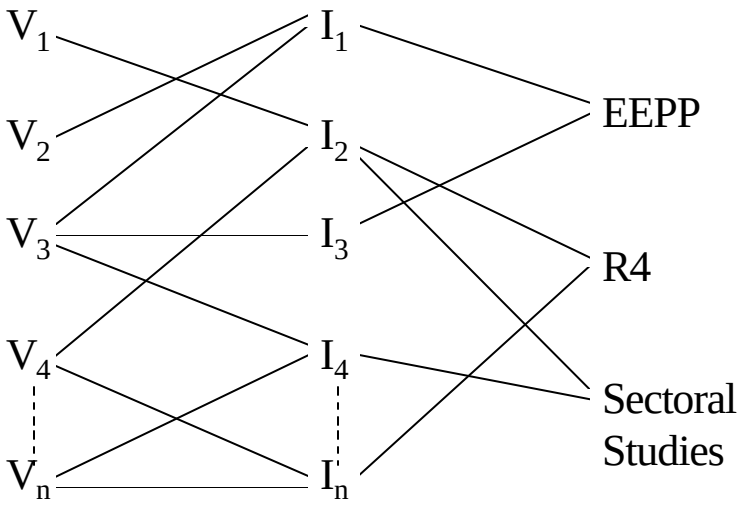

Figure II-3:
Schematic Relationship of Variables to Indicators and Program Uses

3 AND IMPACT ASSESSMENT

3.1 Overview

The Egyptian Environmental Policy Program (EEPP) attempts to improve the regulatory and institutional framework within which the society operates. It recognizes that a plethora of stresses to Egypt's complex environment hinder efforts toward sustainable development. These stressors include inappropriate economic policies, ineffectual institutions, unenforced laws and regulations, obsolete technologies, and insufficient capital resources to secure the environment.[3]

An environmental sector assessment conducted under the EPIQ project has focused on the "...regulatory, policy, and institutional barriers to improved management and protection of Egypt's environment."[4] The discussion in this chapter builds on the draft assessment material and the Summary of Policy Reforms,[5] which identified a variety of policy objectives and measures.

The EMIS must be able to verify implementation of policy measures, monitor the impact of their implementation on the environment, and provide feedback for policy dialogue and the development of future policy measures and other EEPP activities. To accomplish these tasks, the policy measures must be discrete, measurable actions, and each action must be tied to a broader, quantifiable policy objective.

3.2 Policy Measure Verification

3.2.1 Introduction

This section focuses on the verification process, which provides information about whether and to what degree a policy has been implemented. It is the basis for determining if the EEPP reached key benchmarks necessary for realizing its goals. The first step in the process is developing verifiable policy measures.

3.2.2 Characteristics of a Verifiable Policy Measure

To facilitate verification, each measure should have a subject, verb, and object. The subject should be the implementing agency (EEAA, OECP, EEA, etc.)[6]. The verb should be the type of action required (produce, publish, adopt, issue, promulgate, hire, train, etc.). The

[3] Egypt Environment Sector Assessment: Policy, Regulatory and Institutional Issues for the Egyptian Environmental Policy Program (EEPP), Mimeo, Cairo: USAID, n.d.

[4] Egyptian Environmental Policy Program (EEPP) Environmental Sector Assessment: Draft Work Plan, Mimeo, April 9, 1997.

[5] Annex A, Egyptian Environmental Policy Program (EEPP), Summary of Policy Reform, Mimeo, USAID/Egypt, August 1997.

[6] GOE should be the subject only when it is not clear what agency within the GOE will implement the action. Verification requires documentation that the subject took the agreed upon action, and it is difficult to verify behavior of the GOE.

Box III-1: Sample Policy Categories

- **Study** or analysis of an environmental condition or entity in order to draft law or regulation, develop plan, or document implementation**.**
- **Laws and regulations** which define the range and scope of activities and behaviors allowable under the law. These include taxes and incentives.
- **Documentation of guidelines** or procedures for responding to these laws and regulations. This would include enforcement guidelines for the implementing agency as well as compliance for the effected segments of the population.
- **Implementation process** by which the implementing agency identifies, records, and acts on infringements and by which effected sectors of the population take measures to ensure compliance.
- **Resources** of the implementing agency to implement the process and, perhaps, of the affected sectors to comply.

object should be a description of the product (study, law, regulation, guideline, report, etc.).

Each policy measure must address a single, discrete action. A measure which requires several actions (e.g., study, draft, establish, and fund) creates verification problems. Verification should determine whether the policy measure has or has not been implemented. A single measure which requires several actions raises issues about partial completion and places the verifier, rather than the parties to EEPP, in the position of determining at what level partial completion becomes substantial completion.

The object in a policy measure should not include qualitative adjectives. Verification procedures will need to be mutually agreed to by the parties to EEPP (USAID and GOE). This is most easily achieved by having the verification process certify "yes" an action was taken or "no" it was not, without an assessment of the quality of the object of the policy measure. The object can define necessary components of the product, but it should not include qualitative adjectives (reasonable, appropriate, practical, realistic, etc.). If qualitative adjectives are included in the policy measures, then the parties should agree in advance on how those qualitative characteristics of the product will be assessed.

When verification is qualitative, it is open to interpretation and potential conflict, for example, if a situation arose where USAID and GOE experts differed in their interpretation. To illustrate this point, SPR 1994/95 Protection of the Environment Measure A.1 required a qualitative assessment of promulgated air pollutant emission regulations to determine if they "are practical, realistic, and have a positive environmental impact without unduly burdening the economy." USAID should be concerned with the quality of products produced via implementation of the EEPP policy measures. Quality, however, can best be addressed as part of the technical assistance and other activities of the EEPP implementation unit. It should not be left until the time of verification.

3.2.3 Categories of Policy Measures

The final set of policy measures which will be included in EEPP have not been determined. Sample policy measures, however, have been developed. These samples fall into the five categories, as shown above in Box III-1.

3.2.4 Means of Verification

For each category there are general means of verification. These means, as well as examples for some of the sample policy measures, are presented in Table III-1. Once the final policy measures are developed, the verification approaches presented in Table III-1 can be used to develop actual means of verification for each measure. A categorization of the potential policy measures, as of August 27, 1997, is shown in Table III-2.

3.3 Policy Measure Impact Assessment

3.3.1 Introduction

Verification of policy measures is a necessary function of the EMIS, but the system must also be able to monitor the impact of the measures and give feedback about policy performance/impact assessment into the Mission's policy dialogue with Egyptian authorities. To do the latter, the policy measures must be tied to policy objectives, for which measurable indicators can be monitored. The monitoring results can then feed into subsequent design of policy measures and other EEPP activities.

3.3.2 Policy Objectives

To be able to monitor the impact of implementation of policy measures on the environment, each measure must be tied to a quantifiable objective. To the extent possible, the policy objectives should remain unchanged through the life of EEPP, so that movement towards achievement can the monitored over time. Each policy objective should be linked to a strategic objective (SO) or intermediate result (IR). The policy objective may be at a lower level than an SO or IR, but it should be at a high enough level to inform the policy dialogue.

For example, USAID/Egypt has an objective to reduce industrial pollution. Analysis to date has indicated that few industries are availing themselves of pollution prevention technologies. The EPIQ analysis identified high import tariffs as a constraint to the installation of pollution prevention technologies. Given this information, a tiered set of environmental policy objectives for this issue might be as follows:

1. Reduce industrial pollution.
2. Increase use of pollution prevention technologies.
3. Increase importation of pollution prevention technologies.
4. Reduce tariffs on pollution prevention technologies.

"Reduce industrial pollution" is an IR. The lowest level objective (4) is furthest removed from the IR. Its achievement can easily be measured, but it is binomial (a yes/no response) and has no direct impact on the environment. The second and third statements above would be better policy objectives because they are closer to the IR, are scalable, and have a more direct link to an environmental result. In terms of measuring a result more closely tied to the IR, number 2 is preferable to number 3. Number 3, however, is easier to measure than number 2, because presumably there is some type of record of imports. Measurement of number 2 would require development of a mechanism for measurement (survey, focus group, etc.). If the budget for data collection is a major constraint, then the appropriate policy objective would be number 3.

3.3.3 Policy Impact Indicators

Policy impact indicators are measurements through which achievement of policy objectives can be monitored. Each indicator should have a mechanism through which it can be measured, and ideally, the indicator should be scalable rather than binomial (yes/no).

Each indicator should be linked to a policy objective and its associated policy measures. Examples of the relationships between policy objectives, policy measures, and policy impact indicators are shown in Table III-3.

3.4 Matrix Upgrade Process

The policy measure development process will be dynamic, initiated as results feedback suggests the need for additional measures. As new policy measures are selected they should be defined and include the information called for in Tables III-1 and III-3. The EMIS will archive the resulting information and make it available for new cycles of policy measure implementation, verification, impact monitoring, and dialogue.

3.5 Policy Dialogue Feedback and Reporting

The policy measures in Table III-1 are aligned with their respective policy objectives in Table III-4 to highlight their presumed association. Table III-4 also indicates possible policy impact indicators that would register the potential efficacy of the policy measures in realizing their objectives. Key assumptions of the posited association are also identified; they assist in interpretation of observed results.

As noted above, the development of new policy measures fuels the dynamic policy dialogue process and initiates the generation of new results information to guide management of the policy process. This type of information will promote constructive policy dialogue by drawing attention to the results of specific policy measures, signaling what worked and why. Results feedback to the GOE will inform dialogue about future policy measures that may be necessary to advance the environment agenda. Examples of two feedback loops are as follows:

- *Scenario 1:* GOE reduces tariffs, imports go up, measure is productive.
  Policy dialogue continues on other issues and appropriate measures.
- *Scenario 2:* GOE reduces tariffs; imports do not go up.
  Dialogue continues on additional policy measures that may need to focus on demand rather than supply.

Dialogue can focus on future measures and what it would take to implement them. Results data informs the dialogue and suggests future action. The dialogue should also examine the key assumptions underlying the policy measure (e.g., supply) to see if they are still relevant. The discussions will be ongoing as additional impact results become available. Routine generation of credible impact data tied to policy measures and objectives ensures that the dialogue will be focused and constructive.

Table III-1
Illustrative Policy Measure Verification

General Categories		Example		
Policy Measure	**Means of Verification**	**Policy Measure**	**Means of Verification**	**Documentation (In Verification Memorandum)**
I. Study	• Preparation and submittal to USAID. • Preparation and submittal to designated recipient. • Publication and distribution to affected parties.	MOEA completes and submits to the Cabinet a study which identifies eligible tariff code items and estimates the impacts of tariff reductions on revenues and local production.	• Receive a copy of the study from MOEA. • Review the study to determine if it identifies eligible tariff code items and estimates the impacts of tariff reductions on revenues and local production. • Contact Ministry of Cabinet Affairs and determine if the study has been submitted.	• Title of study. • Date EMIS received study. • Date Ministry of Cabinet Affairs received study. • Certification that the study identifies eligible tariff code items and estimates the impacts of tariff reductions on revenues and local production.
II. Law or Regulation	• Draft prepared and distributed for review to affected parties. • Adoption or promulgation and publication in the Gazette or Monthly Report of Decrees from Ministry of Cabinet Affairs.	GOE reduces tariff rates on environmental management, control, analytical, and monitoring equipment to no more than 5 percent.	• New tariff rates at or below 5% are published in the Gazette.	• Title of applicable law or regulation. • Date of publication in Gazette.
III. Guideline	• Draft prepared and distributed for review to affected parties. • Publication and distribution to affected parties.	MOEA/EEAA develops plan for recruiting, hiring and training of Regional Branch Office (RBO) staff	• Receive a copy of the Plan from MOEA/EEAA • Review the plan to see if it includes complete guideline for the hiring, recruiting, and training RBO staff.	• Title and data of plan. • Date EMIS received plan. • Certification that the plan contains guidelines for recruiting, hiring, and training RBO staff

Table III-1
Illustrative Policy Measure Verification

General Categories		Example		
Policy Measure	**Means of Verification**	**Policy Measure**	**Means of Verification**	**Documentation (In Verification Memorandum)**
IV. Process	• Documentation of the implementation of authorized actions submitted to USAID • USAID reviews documentation to assess its completeness • Documentation is archived	GOE adopts/implements temporary tax credits to enable private sector entry into solid waste management activities	• Receive copy of the implementation report from EEAA • Review the report for completeness and timely relevance • Contact EEAA for additional evidence if needed.	• Title of the implementation report • Date of the report • Report author and contact information • USAID person who reviews the report
V. Resources	• Resources to be provided directly to implementing agency or regulated community is specified • Evidence that the resources were provided submitted to USAID • USAID reviews evidence to verify resource provision	MOEA/EEAA finances equipping of RBO facilities	• MOEA/EEAA Budget allocates funds for equipping RBO facilities • Documentation that funds have been expended on equipping RBO facilities.	• Nature of the resources provided • Identification of the resource recipient • Identification of the resource provider • Date(s) of the resource provision

Table III-2
Categorization of Potential Policy Measures[a]

Policy Measure Category	Potential Policy Measures
Study	MOEA completes and submits to the Cabinet a study which identifies eligible tariff code items and estimates the impacts of tariffs reductions on revenues and local production. OECP develops further the proposed Guidelines of a National Strategy, including the drafting of changes in legislation or regulations as may be required and the design and costing of a program to help the MOI set energy efficiency standards, and related incentives and training and education and the MOP presents them to the Cabinet. OECP and the MOI, in cooperation with industry, draft guidelines for certification and labeling. OECP prepares an analysis of continuing obstacles (including limited number of CNG outlets and their required safety standards, costs, and public awareness) to CNG adoption and submits it to the Cabinet. MOEA/EEAA prepares and submits to the Cabinet a study of the fiscal effects of 3-5 year tax credits to private enterprises offering environmental consulting services and/or manufacturers and vendors of pollution reduction equipment, defining alternatives of possible groups of enterprises and defining legal/regulatory changes required to implement them. EEAA prepares analysis of legal, regulatory and practice obstacles to cost recovery and drafts required changes and presents it to the Cabinet. EEAA reviews Public Procurement Law 9 and its implementing regulations for obstacles to local unit and governorate contracting of private sector solid waste management services, and analyze the need for 3-5 year tax credits. EEAA designs mechanisms that raise revenues from Red Sea tourist activities which are retained by private sector for Red Sea marine park and management programs. TDA drafts a plan to establish a TDA Environmental Unit; the plan includes Unit's staffing, functions, and roles and responsibilities.
Laws and Regulations	EEAA drafts regulations for an expanded EIA review process to permit period of comment by other GOE entities and the public for all major investment projects. MOEA/EEAA, consulting with stakeholders, drafts and submits for Cabinet consideration a Prime Ministerial Decree that amends Law 4 Implementing Regulations: in order to clarify institutional roles and responsibilities in enforcement, and modify emissions standards as appropriate. MOEA/EEAA, consulting with stakeholders, drafts and submits for Cabinet consideration a Prime Ministerial Decree (or if need be draft Amendments to Law 4) coordinating implementation and enforcement of Law Nos. 4, 48, and 93. EEAA drafts needed changes in Law 4 Implementation Regulations regarding solid waste management.

Table III-2
Categorization of Potential Policy Measures[a]

Policy Measure Category	Potential Policy Measures
Documentation of Guidelines	EEAA develops draft application, selection, and monitoring processes for cofinancing environmental projects proposed by industries, local authorities, and nongovernmental organizations. EEAA develops priorities and procedures for implementing single project and integrated areawide EIAs, including those for environmentally sensitive tourism development areas. EEAA develops table of possible violations for each regulation and a violation response guide outlining penalties (e.g., fines, fees, and imprisonment). EEAA designs an inspector certification program and a plan to establish a core of trained public and private sector inspectors in industrial and solid waste management at national, regional, and local levels. EEAA designs a certification program for public and private sector analytical laboratories. With the participation of relevant stakeholders, EEAA prepares Red Sea Islands National Park Management Plan with realistic rules, incentives, and regulations. The Supreme Council of Antiquities (SCA) develops a formal policy and regulations governing adaptive reuse by private and public sector entities.
Implementation Process	TDA/GOE extend the 3-year development period in return for improved resort planning to protect the environment.
Resources	GOE nondonor budgetary allocations to Egyptian Environmental Sector Entities increase by 2% above the level of inflation in FY 98-99 budget.
Combined Categories	
Laws and Regulations and Documentation of Guidelines	MOEA/EEAA drafts decree and/or regulations specifying the functions of the EEAA Regional Branch Offices (RBOs) and Environmental Management Units (EMUs) and develops for them plans for recruiting, hiring, and training, for equipping of their facilities, and for defining and rationalizing their roles, in relation to local authorities and regionalized entities. GOE expands protectorate status to all islands and off-shore reefs, and EEAA identifies and delineates environmentally critical coastal zones proposed for protectorate status.

[a] The potential policy measures are the second tranche measures from Draft 4 of Annex A, Egyptian Environmental Policy Program, Summary of Policy Reforms.

Table III-3
Illustrative Policy Impact Indicators

Objective	Indicator	Variable	Algorithm	Data Source	Comments/Assumptions
Increase importation of environmental control, prevention, analytical, monitoring, and solid waste management equipment (environmental equipment).	Annual value of imported environmental equipment	VEE = Annual value of imports of environmental equipment (L.E.)	$VEE \times \frac{CPI_B}{CPI_C}$	Commodity Import Program	The US is the major supplier of environmental technologies.
		GDP_c = GDP deflator, current year		USAID/Egypt, Economics Division	
		GDP_v = GDP deflator, year of base value			
Decentralize core environmental management functions to regional level.	Total number of RBO staff	RBOS = Number of RBO staff	*RBOS*	MOEA/EEAA	This will be a new data collection activity for MOEA/EEAA; check data accuracy.
	Annual value of financing to equip RBO facilities	RBOF = Annual financing provided for RBO facilities (L.E.)	$RBOF \times \frac{CPI_B}{CPI_C}$	MOEA/EEAA	This will be a new data collection activity for MOEA/EEAA; check data accuracy.
		GDP_c = GDP deflator, current year		USAID/Egypt, Economics Division	
		GDP_v = GDP deflator, year of base value			
Increase private sector participation in solid waste management.	Number of private sector enterprises providing solid waste management services	PSSW = Number of private sector enterprises providing solid waste management services	*PSSW*	EEAA	

Table III-4
Policy Dialogue Matrix

Policy Objective	Associated Policy Measure(s)	Impact Indicator	Assumptions
Increase importation of environmental management, control, prevention, analytical, monitoring, and solid waste management equipment (environmental equipment).	MOEA completes and submits to the Cabinet a study which identifies eligible tariff code items and estimates the impacts of tariff reductions on revenues and local production.	Total value of imported environmental equipment.	A critical constraint on use of environmental management, control, analytical, and monitoring equipment is high tariffs; therefore, reducing tariffs will increase importation and use of such equipment and thereby reduce industrial pollution.
	GOE reduces tariff rates on environmental management, control, analytical, and monitoring equipment to no more than 5%.		
Decentralize core environmental management functions to regional level.	MOEA/EEAA develops plan for recruiting, hiring and training of Regional Branch Office (RBO) staff.	Total number of RBO staff.	RBO offices have the necessary infrastructure to absorb the new staff and appropriately use the new equipment.
	MOEA/EEAA finances equipping RBO facilities.	Annual value of financing to equip RBO facilities.	
Increase private sector participation in solid waste management.	GOE adopts/implements temporary tax credits to enable private sector entry into solid waste management activities.	Number of private sector enterprises providing solid waste management services.	Supply strategy: there are private sector enterprises prepared and desiring to provide solid waste management services.

4 R4 MONITORING COMPONENT

4.1 Overview

The R4 process is the vehicle through which USAID/Egypt reports progress in achieving its strategic plan. R4 tracks indicators for each Strategic Objective (SO), Special Objective (SpO), and Intermediate Result (IR). The division may also wish to track indicators for Lower Level Intermediate Results (LLIR), but these indicators will not be included in the R4.[7]

The Environmental Division in USAID/Egypt is currently responsible for SO 7 (reduced generation of air pollution) and SpO D (approaches to sustainable tourism). The division is currently developing proposed revisions to the Mission's strategic plan to better reflect USAID activities in the environment sector. The proposed revisions include drawing up a new results framework for SO 7 as well as elevating SpO D to become a new SO (SO 8) and developing a results framework for it.

In July and early August of 1997, the division, with support from the ANE Bureau, developed new language for SO 7 and SO 8 and their associated IRs and LLIRs (see Table IV-1). The division also identified illustrative performance indicators for the SOs, IRs, and LLIRs. The EMIS team reviewed and assessed the illustrative performance indicators. This chapter presents the results of the assessment, including recommendations for performance indicators, guidance on how to collect the data necessary to measure those indicators, and recommended procedures for updating the indicators.

[7] This information on LLIRs is from a conversation that Lane Krahl had with Jean DuRette, Program Office Director, Program Development and Support Directorate, USAID/Egypt, August 24, 1997.

4.2 Indicator Recommendations

Prior to the August visit of the EMIS team, the Environmental Division identified 19 illustrative performance indicators for SO 7 and 25 for SO 8. The team reviewed and assessed each of these illustrative indicators. The criteria used for assessment of each indicator were as follows: 1) its ability to measure achievement of the associated SO, IR, or LLIR and 2) the availability of data to generate the indicator. The assessments were made through consultations with USAID, GOE, and NGO personnel familiar with the subject areas and sources of data.

In most instances, data availability was considered a necessary element. If data on the variables for computing an indicator were not available, an alternative indicator for which data were available was sought. The absence of data often resulted in development of alternative indicators which do not measure the desired result as well as the illustrative indicator they replaced. For instance, one of the illustrative indicators for IR 8.1 (Red Sea ecosystems and biodiversity protected) was "number of person-hours spent patrolling shoreline or number or percent of area of shoreline proposed." Data for measuring this indicator are not available because the Protectorate Division in EEAA does not collect this information from its rangers. The alternative indicator recommended in Table IV-2—"number of rangers hired and trained to patrol the Red Sea coastal waters"—is a less precise measure of protection, but it is the best measure for which data are available.

As a result of the assessments, all but three of the indicators for SO 7 and 10 for SO 8 are recommended by the EMIS team for use as R4 indicators. Table IV-2 lists the indicators

recommended for elimination and the reasoning. As shown in the table, alternative indicators are proposed for 6 of the 11 indicators recommended for elimination.

All of the R4 indicators recommended by the EMIS team are presented in Tables IV-3 and IV-4. These include the remaining indicators from the illustrative list provided by the Environmental Division, the proposed replacements for many of the illustrative indicators recommended for elimination, as well as some additional indicators identified by the team. In addition to identifying R4 indicators, Tables IV-3 and IV-4 identify the variables used, the calculation to arrive at the indicator (algorithm), and where to collect the variables. The last column in each table, "comments/assumptions," provides information useful in analyzing the indicators. All of the variables used in the R4 indicators will need to be collected annually.

For each variable, the team also identified the operator collection method, primary data collection method, data frequency, and data quality. These characteristics are listed in Appendix II-B (in Volume II).

4.3 Upgrade Process

There are several reasons why the R4 indicators may have to be updated. The indicators recommended by the EMIS team were developed prior to completion of the Environmental Policy Assessment, Environmental Training Needs Assessment, Environmental Information/Education Assessment, and the Results Package for EEPP. These documents will identify specific objectives under the proposed SOs and IRs which may require the development of additional indicators. Some of the recommended indicators rely on data which are expected to become available in the near future but which are not currently available or well defined. For example, coastal water and air quality data from the Environmental Information and Management Program (EIMP) will not be available until 1998, and data on standard-meeting landfills, Environmental Protection Fund income and expenditures, and compliance with Law 4 will not be available until EEAA develops required procedures. In addition, the objectives and needs of USAID/Egypt could change.

The EMIS team recommends that when the R4 indicators are updated, a participatory process be used. The participants in the process should include both the users of the R4 report and the producers of the variables, including USAID/Egypt staff from the Environment Division and the Program Development and Support Directorate, CAIP and EEPP contract staff (as well as staff from EST, ECEP, and EP3, if these programs still exist when updating occurs), and representatives from NGOs and GOE agencies which may be the sources of variables for the indicators.

4.4 R4 Reporting

The R4 report must be prepared annually. Preparation usually begins at the first of the calendar year, with submittal to USAID/Washington in the Spring. The EMIS will produce the R4 report matrix for SOs 7 and 8 automatically as part of its routine reporting component, as described in Chapters 2 and 6. Near the end of each year, the system will prompt the EMIS staff to collect and enter the variables necessary for calculating the R4 report matrix. The matrix will be produced by the first of the year, so that it can be used by the staff of the Environmental Division, with assistance from the EMIS staff, to prepare the narrative component of the R4 component for SOs 7 and 8.

Table IV-1
Proposed Language for SOs 7 and 8 and Associated IRs[a]

SO 7 Reduced generation of air pollution and selected related contaminants.

- IR 7.1 Cleaner and more efficient energy use (production and consumption).
- IR 7.2 Reduced industrial pollution.
- IR 7.3 Improved solid waste management.
  - LLIR[b] 7.01 Enhanced capacity of GOE to sustainably manage/reduce industrial pollution.
  - LLIR 7.02 Enhanced private sector capacity for pollution prevention.
  - LLIR 7.03 Increased public awareness of environmental issues.

SO 8 Tourism resources managed for environmental sustainability.

- IR 8.1 Red Sea ecosystems and biodiversity protected.
- IR 8.2 Red Sea tourism infrastructure/facilities designed and managed for environmental compatibility.
- IR 8.3 Cultural resources managed for sustainable (adaptive) reuse.
  - LLIR 8.01 Enhanced capacity of GOE to manage tourism for environmental sustainability.
  - LLIR 8.02 Create or strengthen effectiveness of NGOs and public/private partnerships.
  - LLIR 8.03 Increased public awareness of environmental issues.

[a]As of August 10, 1997.
[b]Lower Level Intermediate Results. These are results which support the SO and all of its IRs.

Table IV-2 Indicators Recommended for Elimination from SOs 7 and 8	
Indicator	**Reason for Elimination**
SO 7	
IR 7.3 Percent of solid waste disposed of in standard-meeting landfills.	Replaced with: Number of standard-meeting landfills in operation. There is insufficient information about the volume of solid waste produced in Egypt to construct the original indicator.
IR 7.3 Percent of PM attributable to burning of solid waste in sample areas.	Eliminated: Use of this indicator would require an annual study of sources of PM.
LLIR 7.02 Sales (imports, domestic?) of pollution prevention technologies.	Replaced with: Total value of imported pollution prevention technologies. Data on domestically produced pollution prevention technologies is not available.
SO 8	
SO 8 Amount of revenue generated for Egypt Environmental Fund from tourism sector.	Replaced with: Ratio of budget for Protectorate Division in EEAA to revenue generated for Egypt Environmental Fund from tourism sector. The illustrative indicator, by focussing only on revenues, provides no information on whether the funds are used for protection of the resources sustaining tourism. The proposed replacement is imperfect, in that other EEAA units, GOE entities (e.g., TDA), and nongovernmental organizations are also involved in protecting the resource.
IR 8.1 Percent of Red Sea coastal waters zoned for designated uses.	Eliminated: EEAA is not committed to zoning the Red Sea coastal waters. Even if it were committed to this activity, this indicator would not describe protection, but rather planning for protection (or in the worst case, lip service for protection).
IR 8.1 Number of person-hours spent patrolling shoreline or number or percent of area of shoreline patrolled.	Replaced with: Number of rangers patrolling the Red Sea coastal waters. This is less precise than the illustrative indicator, but data on person-hours or shoreline patrolled are not collected by EEAA.
IR 8.2 Stabilization in the number of private marinas, docks, and coastal landfilling.	Eliminated: USAID/Egypt does not consider this to be a major issue.
IR 8.2 Percent of hotels with secondary wastewater treatment.	Eliminated: All developments are required to have secondary wastewater treatment, so this indicator would be 100% for every year.
IR 8.2 Number of urban areas implementing solid waste management plans.	Eliminated: USAID/Egypt has no activities planned for solid waste management.

Table IV-2 (Continued) Indicators Recommended for Elimination from SO 8	
Indicator	**Reason for Elimination**
IR 8.3 Number of cultural sites with environmental risk management plans adopted.	Replaced with: Number of cultural sites with adaptive reuse plans. There is no such thing as an environmental risk management planning process in the cultural resource sector. The proposed policy measure for cultural resources involves development by SCA of an adaptive reuse policy, which may include provisions for development of adaptive reuse plans.
IR 8.3 Number of cultural sites [at which public-private partnerships are] implementing environmental and other improvements in touristic quality.	Replaced with: Number of cultural sites with adaptive reuse generating revenue. The rewording tracks better with the IR and the potential cultural resource policy measures in EEPP, and measures implementation via the requirement for revenue generation.

Table IV-3
Recommended Indicators for SO 7

Objective	Indicator	Variable	Algorithm	Data Source	Comments/Assumptions
SO 7 Reduced generation of air pollution and selected related contaminants	Emissions of lead, PM10, carbon monoxide, ozone, sulfur dioxide, and nitrogen oxides from point sources	$CO_{e,t}$ = Carbon monoxide emissions from point source *e* at time *t*, mg/m^3	$\sum_{e=1}^{E}\sum_{t=1}^{T} CO_{e,t}$	EIMP, Environmental Quality Section, EEAA	Although an attempt is being to made to have the facilities be representative, the total number of facilities is limited. Information will not be available until 1998. Alternatively, the indicator could be reductions in these pollutants, but ECEP, the current source of this information, will terminate in 1998. The organizations ECEP trained and equipped, TIMS and DRTPC, would be able to generate similar data if they are supported to do so.
		$NOX_{e,t}$ = Nitrogen oxides emissions from point source *e* at time *t*, µg/m^3	$\sum_{e=1}^{E}\sum_{t=1}^{T} NOX_{e,t}$		
		$O3_{e,t}$ = Ozone emissions from point source *e* at time *t*, µg/m^3	$\sum_{e=1}^{E}\sum_{t=1}^{T} O3_{e,t}$		
		$Pb_{e,t}$ = Lead emissions from point source *e* at time *t*, µg/m^3	$\sum_{e=1}^{E}\sum_{t=1}^{T} Pb_{e,t}$		
		$PM10_{e,t}$ = Particulate emissions larger than 10 microns from point source *e* at time *t*, µg/m^3	$\sum_{e=1}^{E}\sum_{t=1}^{T} PM10_{e,t}$		
		$SO2_{e,t}$ = Sulfur dioxide emissions from point source *e* at time *t*, µg/m^3	$\sum_{e=1}^{E}\sum_{t=1}^{T} SO2_{e,t}$		

Table IV-3
Recommended Indicators for SO 7

Objective	Indicator	Variable	Algorithm	Data Source	Comments/Assumptions
IR 7.1 Cleaner and more efficient energy use (production and consumption)	Cumulative number of IR 7.1 EEPP policy measures implemented and verified.	$POL_{7.1}$ = policy measures implemented and verified	$POL_{7.1}$	EMIS verification documentation.	General targets for this indicator should come from EEPP design, with specific targets established at tranche intervals (18 months).
	Percent of bus fleet in Cairo using CNG	$CNGB_{CTA}$ = Number of buses in the Cairo Transit Authority (CTA) fleet using CNG	$\frac{CNGB_{CTA} \ \% \ CNGB_{GCBC}}{TB_{CTA} \ \% \ TB_{GCBG}} \times 100$	CAIP	
		$CNGB_{GCBC}$ = Number of buses in the Greater Cairo Bus Company (GCBC) fleet using CNG			
		TB_{CTA} = Total number of operational buses in the CTA fleet		CTA	
		TB_{GCBC} = Total number of operational buses in the GCBC fleet		GCBC	

Table IV-3
Recommended Indicators for SO 7

Objective	Indicator	Variable	Algorithm	Data Source	Comments/Assumptions
IR 7.1 Cleaner and more efficient energy use (production and consumption) (Continued)	Percent of unleaded gasoline in total gasoline production in Egypt	TUL = Total unleaded gasoline production in Egypt, in liters	$\frac{TUL}{TG} \times 100$	OECP	Egypt produces all of the gasoline for domestic consumption, so production equals sales.
		TG = total gasoline production in Egypt, in liters			
	Percent of vehicles in Cairo tested by the Vehicle Emissions Testing (VET) which pass the emissions test	PV = Number of vehicles in Cairo passing VET	$\frac{PV}{NV} \times 100$	CAIP	
		NV = Number of vehicles in Cairo tested under VET			
	Greenhouse gas efficiency of the economy	EF_i = Carbon dioxide emission factor for fuel *I* (*I* = natural gas, mazut, gasoline, diesel, coal, kerosene, and benzine)	$\frac{\sum_{i=1}^{I} Q_i \, EF_i}{GDP_c} \times \frac{GDPD_c}{GDPD_b}$	MOP	The EF_i constants assume complete combustion. Incomplete combustion is a particular problem in Egypt. This indicator thus underestimates emissions of CO_2 in Egypt, but it will track trend.
		Q_i = Quantity of fuel *I* used		MOP Annual Report	
		GDP_c = Current year GDP (L.E.)		USAID/Egypt, Economics Division	
		$GDPD_c$ = GDP deflator, current year			
		$GDPD_b$ = GDP deflator, year of base value			

Table IV-3
Recommended Indicators for SO 7

Objective	Indicator	Variable	Algorithm	Data Source	Comments/Assumptions
IR 7.1 Cleaner and more efficient energy use (production and consumption) (Continued)	Average sulfur content of fuel mix	Q_i = Quantity of fuel *I* used by year	$\frac{\sum_{i=1}^{I} Q_i \, SC_i}{\sum_{i=1}^{I} Q_i}$	MOP Annual Report	The SC_i factors are based on annual average sulfur content of fuels.
		SC_i = Sulfur content of fuel *I* in Egypt		MOP	
	Percent of natural gas or renewable energy in total fuel mix	Q_i = Quantity of fuel *I* used by year	$\frac{Q_{NG} \, TOE_{NG} \, \% \sum_{j=1}^{J} Q_j \, TOE_j}{\sum_{i=1}^{I} Q_i \, TOE_i \, \% \sum_{j=1}^{J} Q_j \, TOE_j} \times 100$	MOP Annual Report	Currently only hydroelectric power is an important component of Q_j, however, wind and solar power could become more important in the future.
		Q_j = Quantity of fuel/energy *j* used/produced by year (*j* = hydro, solar, and wind energy)		EEA	
		Q_{NG} = Quantity of natural gas used in current year		MOP Annual Report	
		TOE_i = Tons of oil equivalent of one unit of fuel *I*		OECP Annual Report	
		TOE_j = Tons of oil equivalent of one unit of fuel/power source *j*			
		TOE_{NG} = Tons of oil equivalent of one unit of natural gas			

Table IV-3
Recommended Indicators for SO 7

Objective	Indicator	Variable	Algorithm	Data Source	Comments/Assumptions
IR 7.2 Reduced industrial pollution.	Cumulative number of IR 7.2 EEPP policy measures implemented and verified.	$POL_{7.2}$ = policy measures implemented and verified	$POL_{7.2}$	EMIS verification documentation.	General targets for this indicator should come from EEPP design, with specific targets established at tranche intervals (18 months).
	Percent of industries in compliance with Law 4	IT = Total industries in Egypt $L4_I$ = Number of industries in compliance with Law 4.	$\frac{L4_I}{IT} \times 100$	EEAA	EEAA has yet to develop compliance tracking for Law 4.
	Percent of industries with Law 4 compliance plans submitted.	IT = Total industries in Egypt ICP = Number of industries with compliance plans submitted	$\frac{ICP}{IT} \times 100$	EEAA	EEAA has yet to develop compliance tracking for Law 4.
	Reduction of lead emissions from smelters in tons	TLES = total annual lead emissions from smelters (tons)	*TLES*	CAIP	CAIP will have sampling results, but it (or the EMIS using additional data from CAIP) will need to do further computational work to calculate annual reductions in tons.
IR 7.3 - Improved solid waste management	Cumulative number of IR 7.3 EEPP policy measures implemented and verified.	$POL_{7.3}$ = policy measures implemented and verified	$POL_{7.3}$	EMIS verification documentation.	General targets for this indicator should come from EEPP design, with specific targets established at tranche intervals (18 months).

Table IV-3 Recommended Indicators for SO 7					
Objective	**Indicator**	**Variable**	**Algorithm**	**Data Source**	**Comments/Assumptions**
	Number of standard-meeting landfills in operation	LF_{Egy} = Number of standard-meeting landfills in Egypt	LF_{Egy}	EEAA Governorates	There are currently no standard-meeting landfills in Egypt. EEAA will need to promulgate standards before this indicator can be measured.
LLIR 7.01 Enhanced capacity of GOE to sustainably manage/reduce industrial pollution	Training indicator(s)	Pending outcome of DT2 assessment.			
LLIR 7.02 Enhanced private sector capacity for pollution prevention.	Total value of imported pollution prevention technologies	VI = Total value of imports of pollution prevention technologies (L.E.)	$VI \times \frac{GDPD_b}{GDPD_c}$	Commodity Import Program	The US is the major supplier of environmental technologies.
		$GDPD_c$ = GDP deflator, current year		USAID/Egypt, Economics Division	
		$GDPD_b$ = GDP deflator, year of base value			
LLIR 7.02 Private sector capacity for pollution prevention enhanced. (Continued)	Training indicator(s)	Pending outcome of DT2 assessment.			

Table IV-3 Recommended Indicators for SO 7					
Objective	**Indicator**	**Variable**	**Algorithm**	**Data Source**	**Comments/Assumptions**
LLIR Increased Public Awareness of Environmental Issues.	Pending outcome of GreenCOM assessment.				

Table IV-4
Recommended Indicators for SO 8

Objective	Indicator	Variable	Algorithm	Data Source	Comments/Assumptions
SO 8 Tourism resources managed for environmental sustainability.	Percent of coral reef survey area occupied by hard and soft coral species.	AH_l = m^2 of hard coral species at location *l* (*l* = coral sampling location in the Red Sea)	$\frac{\sum_{l=1}^{L} AH_l \;\%\; \sum_{l=1}^{L} AS_l}{\sum_{l=1}^{L} AT_l} \times 100$	ROTC Protectorate Division of EEAA	Only valid for survey areas. Based on visual estimates by the divers conducting survey of five general categories (hard, soft and damaged coral; rubble; and sand). This activity was initiated and funded by USAID. It will require continued funding by USAID to produce the necessary variables.
		AS_l = m^2 of soft coral species at location *l*			
		AT_l = m^2 of total survey area at location *l*			
	Amount of revenue generated for Egyptian Environment Fund from tourism which is retained for the opera-tion and maintenance of the Red Sea Marine Park.	TEEF = Amount of revenue generated for Egyptian Environment Fund from tourism which is retained for the operation and maintenance of the Red Sea Marine Park (L.E.)	*TEEF*	EEAA	It is not clear if EEAA is currently tracking inputs to the EEF from Tourism.
SO 8 Tourism resources managed for environmental sustainability. (Continued)	Amount of revenue generated from the lease of historic buildings for adaptive reuse.	RAR = Annual revenue to SCA from adaptive reuse (L.E.)	$RAR \times \frac{GDPD_b}{GDPD_c}$	SCA	
		$GDPD_c$ = GDP deflator, current year		USAID/Egypt, Economics Division	
		$GDPD_b$ = GDP deflator, year of base value			

Table IV-4
Recommended Indicators for SO 8

Objective	Indicator	Variable	Algorithm	Data Source	Comments/Assumptions
IR 8.1 Red Sea ecosystems and biodiversity protected.	Cumulative number of IR 8.1 EEPP policy measures implemented and verified.	$POL_{8.1}$ = policy measures implemented and verified	$POL_{8.1}$	EMIS verification documentation.	General targets for this indicator should come from EEPP design, with specific targets established at tranche intervals (18 months).
	Percent of designated diving areas serviced by mooring points.	MP = Number of designated diving sites with mooring points installed	$\frac{MP}{DDS} \times 100$	HEPCA/EEAA (HEPCA is current data source but this could change if program management changes.)	
		DDS = Total number of designated diving sites in the Red Sea		EEAA	
IR 8.1 Red Sea ecosystems and biodiversity protected. (Continued)	Number of mooring maintenance activities.	MM = Number of mooring maintenance activities.	MM	HEPCA/EEAA (HEPCA is current data source but this could change if program management changes.)	Targets for this indicator will have to be developed, probably based on an average number of maintenance activities per installed mooring point, drawing upon HEPCA's experience.
	Number of rangers patrolling the Red Sea coastal waters.	PR = Number of rangers hired and trained to patrol the Red Sea coastal waters.	PR	Protectorate Division, EEAA	

Table IV-4
Recommended Indicators for SO 8

Objective	Indicator	Variable	Algorithm	Data Source	Comments/Assumptions
IR 8.2 Red Sea tourism infra-structure/facilities designed and managed for environmental compatibility.	Cumulative number of IR 8.2 EEPP policy measures implemented and verified.	$POL_{8.2}$ = policy measures implemented and verified	$POL_{8.2}$	EMIS verification documentation.	General targets for this indicator should come from EEPP design, with specific targets established at tranche intervals (18 months).
	Number of regional marinas developed.	RM = Number of regional marinas	RM	TDA	
	Percent of new tourism develop-ment sites on the Red Sea with approved Environmental Impact Assessments (EIAs).	EIA = Number of new tourism developments with approved EIAs TD = Total number of new tourism de-velopments approv-ed for construction.	$\frac{EIA}{TD} \times 100$	TDA	TDA officials told the EHP team that they do not approve construction without an approved EIA. With TDA being the source of data for both variables, this indicator may always be 100 percent.
IR 8.2 Red Sea tourism infra-structure/facilities designed and managed for environmental compatibility.	Percent of new tourism development sites on the Red Sea reinspected for compliance with EIAs.	INSP = Number of new tourism development sites reinspected for compliance with approved EIAs EIA = Number of new tourism developments with approved EIAs	$\frac{INSP}{EIA} \times 100$	TDA	TDA officials told the EHP team that they reinspect all sites for compliance with the EIA. With TDA being the source of data for both variables, this indicator may always be 100 percent.

Table IV-4
Recommended Indicators for SO 8

Objective	Indicator	Variable	Algorithm	Data Source	Comments/Assumptions
IR 8.3 Cultural resources managed for sustainable (adaptive) re-use.	Cumulative number of IR 8.3 EEPP policy measures implemented and verified.	$POL_{8.3}$ = policy measures implemented and verified	$POL_{8.3}$	EMIS verification documentation.	General targets for this indicator should come from EEPP design, with specific targets established at tranche intervals (18 months).
	Number of cultural sites with adaptive reuse plans.	NSP = Number of cultural sites with adaptive reuse plans	NSP	SCA	Progress in this area will depend upon development of procedures for adaptive reuse planning by SCA.
	Number of cultural sites with adaptive reuse generating revenue.	NPP = Number of cultural sites with adaptive reuse generating revenue.	NPP	SCA	Progress in this area will depend upon adoption of an adaptive reuse policy by SCA.
LLIR 8.01 Enhanced capacity of GOE to manage tourism for environmental sustainability.	Number of employees in TDA's Environmental Review and Sustainable Development offices.	ETDA = Number of employees in TDA's Environmental Review and Sustainable Development offices	$ETDA$	TDA	
	Training indicators	Pending outcome of DT2 assessment.			
LLIR 8.02 Creat or strengthen effectiveness of NGOs and Public/Private partnerships.	Membership in HEPCA.	NM = Number of members (corporate and individual) of HEPCA	NM	HEPCA	
	Training indicators	Pending outcome of DT2 assessment.			
LLIR 8.03 Increased public awareness of environmental issues.	To be developed, pending outcome of GreenCOM report.				

5 SECTORAL MONITORING COMPONENT

5.1 Overview

The sectoral monitoring component provides a means for systematically monitoring and tracking broad environmental and related conditions in Egypt. Because they are broadly defined, it will not be possible to attribute changes in these indicators to specific environmental initiatives of USAID or other donors. The indicators will, however, provide the data necessary to respond to requests for information on selected measures of the state of Egypt's environment and the impact of environmental conditions on the population of Egypt. The indicators will also support environmental policy development for both USAID and GOE.

Three types of sectoral indicators are developed: state-of-the-environment, health, and economic. State-of-the-environment sectoral indicators track the state of Egypt's physical environment. Sectoral health indicators track health conditions that are conceptually related to aspects of environmental quality. Economic indicators focus on the economic costs associated with environmental conditions.

5.2 Indicator Recommendations

There is a large amount of literature on the development of environmental indicators. Data availability in Egypt, however, is not adequate to develop many of the indicators used in other locations. The indicators proposed in this section are those that appear meaningful in the Egyptian context and for which data are readily available. Table V-1 summarizes the proposed environment sectoral indicators. The remainder of this section reviews the proposed indicators by type—state-of-the-environment, health, and economic.

5.2.1 State-of-the-Environment Sectoral Indicators

State-of-the-environment indicators focus on measures of air quality and water quality. Air quality indicators measure ambient concentrations of selected air pollutants. The specific pollutants selected are particulate matter (PM10), ozone (O_3), and lead (Pb). These indicators were chosen because of their impact on human health and their correlation with concentrations of other pollutants. A comprehensive study of comparative health risks in Cairo identified lead and particulate matter as posing "high" health risks (PRIDE 1994). The study identified ozone as a "middle/lower" risk pollutant. Visibility is another aspect of air quality. Particulate matter and ozone are the primary contributors to reduced visibility. Thus, these indicators reflect the visibility effects of air pollution as well as the health effects.

Other air pollutants of concern in Cairo include sulfur dioxide (SO_2), nitrogen oxides (NOx), carbon monoxide (CO), volatile organics (VOC), and carbon dioxide (CO_2). Particulate matter (PM10) is likely highly correlated with SO_2, NOx, CO, and CO_2 and thus serves as a proxy indicator for these pollutants.

The water quality indicators monitor selected water quality parameters in inland waters (the Nile and drains), groundwater, and coastal waters (Mediterranean, Gulf of Aqaba, Gulf of Suez, Red Sea).

5.2.2 Health Sectoral Indicators

Environmental conditions affect many aspects of human health. Air pollution, for example, contributes to acute respiratory infections (ARI). Contaminated water and lack of access to good quality drinking water and sanitation services contribute to the incidence of diarrheal diseases. Exposure to lead in the environment can retard the physical and mental development of children. Many factors other than environmental conditions also influence these health outcomes. Thus, while there is substantial evidence that environmental conditions affect health, it is difficult to separate their effect from other factors. The health sector indicators track health effects that are closely linked to environmental conditions. It is not possible, however, to attribute changes in these indicators solely to changes in environmental quality.

One way to control for factors other than environmental conditions that affect health is to focus on a population that is exposed to as few other factors as possible. For this reason, the health sectoral indicators focus largely on the health status of children under five years of age. Children in this age group leave their immediate neighborhoods less often than older children or adults. It is thus easier to isolate causes of disease in this population because they are exposed to fewer disease vectors. Furthermore, children under the age of five are more susceptible to disease than older children or adults.

The disease-based health sectoral indicators track (1) infant and child mortality due to diarrhea and ARI, (2) per-capita cases of ARI in children under five years of age, (3) percent of all ARI cases requiring antibiotic treatment, and (4) percent of children under five suffering from diarrhea in any given two-week period.

Inadequate water and sanitation services contribute substantially to the incidence of diarrheal disease in children (PRIDE 1994). In addition, untreated sewage from households without sewer services contributes to pollution of groundwater and surface water. An additional indicator thus tracks the percent of the population connected to water and sewer systems. This indicator reflects both health and water quality impacts.

5.2.3 Economic Sectoral Indicators

The economic sectoral indicators track selected economic impacts of environmental conditions and environmental protection measures. They fall into three broad categories: health care costs, energy efficiency savings, and the value of services that protect the environment.

The health sectoral indicators use ARI and diarrhea as two diseases closely associated with environmental conditions. Two economic sectoral indicators track some of the costs of treating these diseases. The cost of outpatient treatment is a partial measure of the money costs associated with treatment of ARI, based only on cases treated in public health care facilities. The indicator does not capture the monetary costs of home treatment or the nonmonetary costs associated with illness. The indicator based on the cost of treatment for diarrhea includes estimates of treatment both in public health care facilities and at home. Home-treatment costs are represented by annual sales of oral rehydration salts (ORS), commonly used for diarrhea in Egypt.

The power sector is the single largest fuel user in Egypt and is thus a major contributor to air pollution. More efficient generation reduces fuel costs and air pollution. The “unified power sector thermal efficiency” and “power sector fuel efficiency” indicators track two aspects of the fuel efficiency of electricity generation. The indicator, “tariffs as a percent of long-run marginal cost,” tracks the economic performance of the power sector in collecting tariffs sufficient to cover costs. This indicator uses an estimate of long-run marginal cost based on the export price of fuels. GOE uses extraction costs of fuels to estimate long-run marginal cost. Given the current price structure for petroleum fuels, the latter method yields a larger value of the indicator than the former.

Another type of economic indicator tracks the value of services that are meant to protect the

environment. Household water and sewer connections help improve water quality. These services also provide other benefits to households. For instance, a household water connection reduces the time, effort, and inconvenience of obtaining water outside the home. A household sewer connection reduces the inconvenience and money cost associated with vaults[8] and improves the local environment by eliminating vault overflows (Hoehn and Krieger 1996). Two economic sectoral indicators track the economic benefits to households associated with water and wastewater services.

5.3 Indicator Matrix

Table V-1 summarizes the sectoral indicators. The first column lists the category of indicator or objective: state-of-the-environment, health, and economic. The second column contains the title of the indicator. The third column reports the variables used to construct the indicator. These variables represent the basic units in which data is collected. The fourth column gives the algorithm used to construct the indicator from the variables. In many cases the indicator is a single variable and there is no algorithm. The fifth column reports the data sources for the variables. The sixth column contains assumptions used in constructing the indicator and comments about its use.

The indicator matrix is necessarily abbreviated. Appendix II-B contains the data sheets from which the indicator matrix was developed. These worksheets contain much more information about specific variables than does the matrix in Table V-1.

5.4 Matrix Upgrade Process

The sectoral matrix can be upgraded as additional data become available. Two additional indicators that would be relevant to tracking progress in the environment sector include the value of Red Sea coral reef protection activities and the value of improved solid waste collection and disposal services.

Protection of Red Sea coral reefs has economic value, including the value recreational divers place on access to the reef and its characteristics, the value of reef-based recreation to businesses that support tourism and the economy as a whole, and the value placed on the reef, even by those who may never see it but know that it exists. To the extent that protection activities prevent deterioration of the Red Sea coral reefs, they generate economic value.

Well-established methods exist to estimate these values. Survey methods can be used to estimate the economic impact on the local economy of reef-based recreation. The contingent valuation method can estimate the amount people would be willing to pay for specifically defined protection activities. Indicators based on either of these values would track the economic impact of reef protection activities.

Households in Egypt likely value municipal solid waste collection and disposal. Respondents to a recent study about general environmental concerns mentioned solid waste as the most important environmental problem (Hopkins *et al.* 1994/95). The household economic value of collection and disposal services summed over all households with these services would be one indicator of the economic impact of improved or expanded solid waste management. Data to produce this indicator do not currently exist; they could be produced, however, with a modest study.

The indicators of the value of water and wastewater services apply only to Cairo, because estimates of the household value for these services do not exist for other cities. Future research may be able to generate estimates. If additional value estimates do become available, these two indicators could be upgraded to account for connections in other locations.

5.5 Sectoral Reporting

The sectoral indicators were designed for reporting on overall conditions in the

[8] Most households in Cairo that are not connected to sewers dispose of wastewater in a covered vault. This vault is usually located in the street in front of the building. Most vaults require regular evacuation.

environmental sector. They do not explicitly track the impacts of specific environmental activities. Responses to the customer survey suggest several reporting formats; this section presents two illustrative examples.

The U.S. Embassy and USAID receive requests for information about general environmental conditions in Egypt. These requests come from the media as well as from within the agencies themselves. The sectoral indicators will facilitate response to these requests. The data will permit reporting of the current state of the environment in terms of air quality, water quality, health conditions, and economic impacts related to environmental conditions and activities. As the database is built up, the monitoring and evaluation system will also be able to generate information on trends in the sectoral indicators.

Other potential customers stated a need for sectorwide information for use in planning and reviewing their own activities. Current values of the sectoral indicators and trends in these indicators over time will facilitate identification of problem areas in the environmental sector as well as areas where significant improvements have occurred. This information will aid in evaluating the need for activity in a particular area and targeting activities to areas of special concern.

Table V-1
Recommended Environment Sectoral Indicators

Objective	Indicator	Variables	Algorithm	Data Source	Comments/Assumption
State of the Environment Ambient Air Quality	Ambient ozone concentrations at fixed monitoring stations throughout Egypt	$O3_{k,t}$ = Ambient ozone concentrations at site *k* at time *t* (*k* = all O_3 monitoring stations in EIMP)	$O3_{k,t}$	EIMP, Environmental Quality Section, EEAA for monitoring throughout Egypt; CAIP for Cairo only	CAIP will reevaluate monitoring after initial period to determine whether there would statistically significant loss if it uses 6-day cycle instead. EIMP and CAIP are scheduled to produce sampling results by 1998. EIMP data may be entered into EEIS, which EMIS could access electronically, if USAID participates in EEIS.
	Ambient lead concentrations at fixed monitoring stations throughout Egypt	$Pb_{k,t}$ = ambient lead concentrations at site *n* at time *t*, $\mu g/m^3$ (*n* = all Pb monitoring stations in EIMP and CAIP)	$Pb_{k,t}$		
	Ambient PM10 concentrations at fixed monitoring stations throughout Egypt	$PM10_{m,t}$= ambient PM10 concentrations at site *m* at time *t*, $\mu g/m^3$ (*m* = all PM10 monitoring stations in EIMP and CAIP)	$PM10_{m,t}$		

Table V-1
Recommended Environment Sectoral Indicators

Objective	Indicator	Variables	Algorithm	Data Source	Comments/Assumption
State of the Environment Ambient Water Quality	BOD concentrations in inland water throughout Egypt	$BODI_{k,t}$ = Biological Oxygen Demand at site *k* at time *t* (where *k* = all inland {Nile and Drains} sampling sites in EEIS)	$BODI_{k,t}$	Nile Research Institute (NRI) Drain Research Institute (DRI) May be collected by Egyptian Environmental Information System (EEIS).	EEIS will not become operational until 1998. EMIS will be able to access this information electronically if USAID participates in EEIS.
	Total coliform in inland water throughout Egypt	$TCI_{k,t}$ = Total coliform at site *k* at time *t* in colonies/100ml	$TCI_{k,t}$		
	Total nitrogen in inland water throughout Egypt	$TNI_{k,t}$ = Total nitrogen at site *k* at time *t*	$TNI_{k,t}$		
	Total dissolved solids in groundwater throughout Egypt	TDS_m = Total dissolved solids at site *m* (*m* = all groundwater sampling sites in EEIS)	TDS_m	Groundwater Research Institute (GRI). May be collected by Egyptian Environmental Information System (EEIS).	
	Total coliform in groundwater throughout Egypt	$TCG_{m,t}$ = Total coliform at site *m* at time *t* in colonies/100ml	$TCG_{m,t}$		
	Total nitrogen in groundwater throughout Egypt	$TNG_{m,t}$ = Total nitrogen at site *m* at time *t*	$TNG_{m,t}$		

Table V-1
Recommended Environment Sectoral Indicators

Objective	Indicator	Variables	Algorithm	Data Source	Comments/Assumption
State of the Environment	Total suspended solids in Mediterranean Sea, Gulf of Suez, and Gulf of Aqaba	$TSSC_{k,t}$ = Total suspended solids at site *k* at time *t* in colonies/ 100ml (*k* = all Mediterranean Sea, Gulf of Suez, and Gulf of Aqaba sampling sites in EIMP)	$TSSC_{k,t}$	EIMP, Environmental Quality Section, EEAA	Data will become available in 1998 and may eventually be available in the EEIS where EMIS will be able to access it electronically, if USAID participates in EEIS.
Ambient Water Quality (Continued)	Total suspended solids in the Red Sea	$TSSRS_{l,t}$ = Total suspended solids at site *l* at time *t* in colonies/ 100ml (*l* = all Red Sea sampling sites in EIMP)	$TSSRS_{l,t}$		
	Total coliform in Mediterranean Sea, Gulf of Suez, and Gulf of Aqaba	$TCC_{k,t}$ = Total coliform at site *k* at time *t* in colonies/100ml	$TCC_{k,t}$		
	Total coliform in the Red Sea	$TCRS_{l,t}$ = Total coliform at site *l* at time *t* in colonies/100ml	$TCRS_{l,t}$		

Table V-1
Recommended Environment Sectoral Indicators

Objective	Indicator	Variables	Algorithm	Data Source	Comments/Assumption
State of the Environment Ambient Water Quality (Continued)	Total nitrogen in Mediterranean Sea, Gulf of Suez, and Gulf of Aqaba	$TNC_{k,t}$ = Total nitrogen at site *k* at time *t*	$TNC_{k,t}$		
	Total nitrogen in the Red Sea	$TNRS_{l,t}$ = total nitrogen at location *l* at time *t*	$TNRS_{l,t}$	EIMP, Environmental Quality Section, EEAA	Data will become available in 1998 and may eventually be available in the EEIS where EMIS will be able to access it electronically, if USAID participates in EEIS.
Health	Infant and child mortality rate per 1,000 due to acute lower respiratory infections (ARI)	$MORT_{ARI}$	$MORT_{ARI}$	MOHP, National Acute Respir-atory Infections Control Program Health Infor-mation System Annual Report	

Table V-1
Recommended Environment Sectoral Indicators

Objective	Indicator	Variables	Algorithm	Data Source	Comments/Assumption
Health	Per capita number of cases of combined (all types of) ARI in children under 5 years of age	ARI_5 = Number of combined ARI cases reported in children under five years of age	$\frac{ARI_5}{POP_5} \times \frac{ER_{ARI}}{AR_{ARI}}$	MOHP, National Acute Respiratory Infections Control Program Health Information System Annual Report	Data is collected by governorate. It could be entered in the monitoring and evaluation system in this format if desired.
		AR_{ARI} = Actual reporting			
		ER_{ARI} = Expected reporting			
		POP_5 = Population estimate of children under five years of age		CAPMAS	

Table V-1
Recommended Environment Sectoral Indicators

Objective	Indicator	Variables	Algorithm	Data Source	Comments/Assumption
Health (Continued)	Percent off combined (all types of) ARI cases requiring antibiotic treatment	$ARIA_5$ = Annual number of combined ARI cases requiring antibiotic prescriptions ARI_5 = Number of combined ARI cases reported annually AR_{ARI} = Actual reporting ER_{ARI} = Expected reporting	$\frac{ARIA_5}{ARI_5} \times \frac{ER_{ARI}}{AR_{ARI}}$	MOHP. The National Acute Respiratory Infections Control Program Health Information System Annual Report 1996.	Data is collected by governorate. It could be entered in the monitoring and evaluation system in this format if desired.
	Percent of total population served by direct connections to the water supply and wastewater systems	POP_w = Percent of population in areas assisted by USAID served by direct connections to the water supply and wastewater systems	POP_w	USAID/Egypt: Office of Urban Administration and Development	This indicator is used for evaluation of SO 6. It reflects only the percentage served in areas receiving assistance from USAID. If reliable data is available on total Egyptian population, that would be preferable.
	Infant and child mortality rate per 1,000 due to diarrhea	$MORT_{dia}$	$MORT_{dia}$	CAPMAS	

Table V-1
Recommended Environment Sectoral Indicators

Objective	Indicator	Variables	Algorithm	Data Source	Comments/Assumption
Health (Continued)	Percent of children under 5 with diarrhea in any given two-week period	DIA_5 = Number of diarrheal episodes per year for children under 5 years of age, reported by public health facilities	$\frac{DIA_5}{POP_5} \times \frac{ER_{dia}}{AR_{dia}} \times 100$	MOHP, National Diarrheal Control Program	
		AR_{dia} = Actual reporting			
		ER_{dia} = Expected reporting			
		POP_5 = Population of children under 5 years of age		CAPMAS	

Table V-1
Recommended Environment Sectoral Indicators

Objective	Indicator	Variables	Algorithm	Data Source	Comments/Assumption
Economic	Cost of outpatient treatment for ARI	ARI_5 = Number of combined ARI cases reported annually	$ARI_5 \times C_{ARI} \times \frac{ER_{ARI}}{AR_{ARI}} \times \frac{GDPD_c}{GDPD_{ARI}}$	MOHP. The National Acute Respiratory Infections Control Program Health Information System, Annual Report	The average cost of outpatient treatment was estimated in 1996. The GDP deflator is used to convert costs over time into a base year. If health care costs rise faster than other costs, however, the indicator will underestimate actual outpatient costs.
		AR_{ARI} = Actual reporting			
		ER_{ARI} = Expected reporting			
		C_{ARI} = Average cost of outpatient treatment for ARI, L.E.		DDM, Cost Analysis of Health Care. L.E. 5.95 (1996 price level) per visit.	
		$GDPD_c$ = GDP deflator, current year		USAID/Egypt, Economics Division	
		$GDPD_{ARI}$ = GDP deflator for the year in which ARI outpatient costs are estimated (currently 1996)			

Table V-1
Recommended Environment Sectoral Indicators

Objective	Indicator	Variables	Algorithm	Data Source	Comments/Assumption
Economic (Continued)	Cost of outpatient treatment of diarrhea in children under 5 years of age	DIA_5 = Number of diarrheal episodes per year for children under 5 years of age, reported by public health facilities	$DIA_5 \times C_{dia} \times \frac{ER_{dia}}{AR_{dia}} \times \frac{GDPD_c}{GDPD_{dia}}$ % $(C_{ORS} \times ORS)$	MOHP, National Diarrheal Control Program	The average cost of outpatient treatment was estimated in 1996. The GDP deflator is used to convert costs over time into a base year. If health care costs rise faster than other costs, however, the indicator will underestimate actual outpatient costs.
		AR_{dia} = Actual reporting			
		ER_{dia} = Expected reporting			
		C_{dia} = Average cost of outpatient treatment for diarrhea (currently 1996)		DDM, Cost Analysis of Health Care. LE 9.46 (1996 price level) per case.	
		C_{ORS} = Current year cost of ORS packet		MOHP	
		ORS = Number of ORS packets sold in Egypt annually			

Table V-1
Recommended Environment Sectoral Indicators

Objective	Indicator	Variables	Algorithm	Data Source	Comments/Assumption
Economic (Continued)	Cost of outpatient treatment of diarrhea in children under 5 years of age (Continued)	$GDPD_c$ = GDP deflator, current year $GDPD_{dia}$ = GDP deflator for the year in which diarrhea outpatient costs are estimated (currently 1996)		USAID/Egypt, Economics Division.	
	Unified power system thermal efficiency	TE = Unified power system thermal efficiency	*TE*	Arab Republic of Egypt, Ministry of Electricity and Energy, Egyptian Electricity Authority, Annual Report of Electric Statistics.	This indicator contained in SO 1
	Power sector fuel efficiency	FC = Total power sector fuel consumption rate (Fuel consumption (TOE) divided by KWH produced.)	*FC*	Arab Republic of Egypt, Ministry of Electricity and Energy, Egyptian Electricity Authority, Annual Report of Electric Statistics.	This indicator contained in SO 1

Table V-1
Recommended Environment Sectoral Indicators

Objective	Indicator	Variables	Algorithm	Data Source	Comments/Assumption
Economic (Continued)	Value of household sewer services in Cairo	WTP_{ew} = Willingness to pay for household sewer connection in Cairo, L.E.	$WTP_{sew} \times SEW \times \frac{GDPD_c}{GDP_{sew}}$	Cairo Water and Wastewater Economic Benefits Assessment Report. The annual value is thus L.E 260 (1995 prices).	The Cairo Water and Wastewater Economic Benefits Assessment Report estimates are valid only for Cairo. This indicator could be extended to other cities through a benefits transfer approach. Application of this approach, however, would require additional research.
		SEW = Number of households connected to sewers in Cairo		USAID/Egypt, Office of Urban Administration and Development	
		$GDPD_c$ = GDP deflator, current year		USAID/Egypt, Economics Division.	
		$GDPD_{sew}$ = GDP deflator for year when willingness to pay for household sewer connection was estimated (currently 1995)			

Table V-1
Recommended Environment Sectoral Indicators

Objective	Indicator	Variables	Algorithm	Data Source	Comments/Assumption
Economic (Continued)	Value of access to in-home piped water in Cairo	WTP_{wat} = Willingness to pay for access to in-home piped water in Cairo, L.E.	$WTP_{wat} \times WAT \times \frac{GDPD_c}{GDPD_{wat}}$	WTP - Cairo Water and Wastewater Economic Benefits Assessment Report. The annual value is thus L.Ee 296 (1995 prices).	The Cairo Water and Wastewater Economic Benefits Assessment Report estimates apply only to Cairo. The indicator could be extended to other areas of Egypt using a benefits transfer approach. Application of this approach, however, would require additional research.
		WAT = Number of households connected to water in Cairo		USAID/Egypt, Office of Urban Administration and Development	
		$GDPD_c$ = GDP deflator, current year		USAID/Egypt, Economics Division.	
		$GDPD_{wat}$ = GDP deflator for year when willingness to pay for household sewer in-home water connection was estimated (currently 1995)			

6 SYSTEM DESIGN AND MANAGEMENT

6.1 Introduction

This chapter describes a computerized system for automating the monitoring, evaluation, and verification of environmental information in support of the four EMIS core functions: (1) policy monitoring, (2) R4 monitoring, (3) sectoral monitoring, and (4) reporting. The proposed system includes a sequence of activities to perform these four functions and recommended hardware and software to carry them out. This chapter also suggests specific procedures that illustrate an "event-driven" rather than a "data-driven" use of the system and how the computer tools will be used to serve such events Three scenarios of equipment specification are provided ("high-end," intermediate, and "low-end") along with suggestions for system security, system management, and personnel. Finally, a phased implementation plan is given which takes the system from its initial set-up stages through application development to long-term maintenance and partial institutionalization.

6.2 System Components

The computerized system will consist of a data repository and numerous computerized planning, management, and communication tools. The data repository is discussed first, followed by a discussion of the computer tools organized into two reporting categories: routine and nonroutine.

6.2.1 Data Repository

The data repository is the underlying data and information resource which will support all four of the functional areas. It serves as the foundation of the entire system by organizing data and information in a way that eases access and analysis. The data repository will have two main components: an environmental database and a bibliographic database.

Environmental Database

The environmental database will have, at its root, a collection of environmental variables that will be used to generate indicators for project tracking and sectoral monitoring. The design is based on the concept that individual variables can be combined in different ways to generate indicators which may be used for programmatic tracking, R4 reports, sectoral studies, or general analysis and planning. This was shown schematically in Chapter 2 (Figure II-3).

Each variable will be stored with a collection of attributes to ensure consistency from one year to the next and to facilitate comparison and analysis between years. Except for the actual value of the variable, these attributes can be considered to be "metadata" (data about data). The suggested metadata fields are listed below. These fields are consistent with many of the standards for metadata cataloging, including the U.S. Federal Geographic Data Committee's metadata standard, the EOSDIS Directory Interchange Format, and the Canadian Federated Multi-Database System. This consistency will facilitate metadata exchanges with other environmental data catalogues and databases. Variable attributes will include at least the following:

Variable

- Name
- Acronym
- Unit of measure
- Geographic location
- Date
- Value

Primary Source of Data
- Organization name
- Acronym
- Contact person (name or title)
- Division or department
- Street address
- City and postal code
- Phone and FAX
- Procedures for obtaining data

Alternate Source of Data
- (same fields as above)

General Comments (information about data quality, data collection methodology, relative advantage of alternate data source assumptions, data format, etc.)

Date variable was last updated

The metadata itself, i.e., the content of each variable attribute field, should be acquired for each variable (data point) in sufficient detail to ensure that different people at different times, given the task of collecting data for a given indicator, will collect identical types of data. (Note that each record need not be reported multiple times for similar variables; redundancy can be minimized and speed increased through the use of relational tables.)

The content of the metadata also requires standardization. For example, consider the field called "geographic location." Since the information in this field will necessarily come from a variety of sources, the actual content of the field "geographic location" will vary from one source to another. A donor-funded environmental monitoring project may specify the location of a sample point as Sample#103, a Governor's Office may specify the location in terms of an administrative boundary code, the Remote Sensing Center may specify the location as 31°28"4.56'N, 30°19'23.76'E, and an NGO might specify the location as "29 km east of Alexandria." Even when the information appears to be compatible it may not be so. A comparison of actual data from three ministries—Health and Population, Local Government, and Education—provides a real-world example. All three ministries store geographic locations as six-digit numerical codes. However, a quick check of the printouts from the databases of each reveals that the Ministry of Local Government uses all the digits to represent geographic locations down to the local government level, with, for example, the location Fayoum represented by the code 07 and Menya by the code 14. However, the Ministry of Health and Population represents Fayoum by the code 12 and Menya by the code 15; and the Ministry of Education represents Menya by a code of 24 but does not store data at any other administrative level—rather, the other digits are used to store the school serial numbers. Even simple variables, such as "annual nationwide sales of oral rehydration salts," may vary by measurement unit (LE versus US$) and definition of "annual" (fiscal versus calendar year). It is important to understand that such terminology differences will remain ***no matter how accurate the underlying data value***.

Unfortunately, the reality is that even the underlying values are often inaccurate. While the exact coding schemes are different for each ministry in the example given above, they can be correlated through a reference table. The codes themselves do accurately represent their locations. It is in translating from Arabic to English that most of the inaccuracies arise, especially for location names that may have more than one appropriate translation or spelling. Thus, attempting to correlate data from one source to another based on location names, rather than codes, would introduce numerous errors.

One way to deal with differences in terminology is by mutual agreement on standard keywords. In fact, the ministries have recognized the need for standardized location codes. While CAPMAS is the official source for such standardization, until recently it has not had the capacity to provide the necessary support to all ministries. This is changing. In addition, the post office has in the last two years developed an accurate coding scheme at the individual household level which is being adapted by others. Together, the post office and CAPMAS may evolve a default standard for location coding. These and other initiatives should be monitored so that the evoloving EMIS standards are

compatible with those of the government agencies on which it depends for data.

However, terminology standardization beyond location codes is extremely rare and typically found only in very authoritarian and highly structured environments. The EMIS team proposes, instead, that the system include routines for converting terminologies from the various data sources into a single set of keywords that are used consistently throughout the data repository. This technique is called a "controlled vocabulary," and the conversion routines are sometimes called a "data thesaurus." It is important to control the use of keywords within the EMIS; otherwise, meaningful keyword searches of the database are impossible. Thus, a street address must consistently use the same format (e.g., Sharkas St. versus Sharkas Street versus Sharkas Str.). The alternative is to not use keyword searches at all, but to use free-text searches with so-called "fuzzy" search parameters. (This should, in fact, be the primary search option for the bibliographic portion of the database, but the team recommends that keyword searches be used for the environmental data portion.)

In whatever way the data is catalogued and organized, it must be easy to access the individual variable values and their attributes. Basic mathematical functions can then be combined into algorithms to act on the variables to generate indicators. More sophisticated tools such as statistical analysis packages and modeling software should be used only as demand warrants.

Bibliographic Database

Simply tracking data values provides a limited view of progress being made. True understanding comes with a knowledge of the context and contributing factors influencing change. Thus, a bibliographic database is proposed which will contain reference information that can be used to augment data tracking by providing a source of material for research and analysis. Such materials might include copies of relevant laws and regulations, technical articles, and news clippings. This database will resemble a library of reference information. The contents of the bibliographic database will be related through relational tables to the contents of the environmental database so that records in one can be linked to records in the other. In this way, the causes of changes in an indicator can be better understood through the study of contributing factors and the analysis of assumptions. This is illustrated schematically in Figure VI-1, where reference materials are reviewed in conjunction with updating key indicators prior to reporting progress.

Whenever possible, reference objects themselves should allow for free-text search; of course, many objects, such as scanned images, do not allow for free-text searching. In these cases, a brief abstract describing the stored object should be created so that free-text searching is possible.

The bibliographic database should not attempt to store every reference item imaginable—an important part of the database will be mechanisms for linking and searching other libraries and on-line information resources. For the latter, search engines will be downloaded only when the demand is high enough to justify their use.

6.2.2 Reporting

In addition to the data repository, the computerized portion of EMIS will provide tools for systematizing procedures that must be repeated year after year—i.e. "routine reporting"—as well as tools to facilitate and enhance the generation of information products that are not repeated—i.e., "nonroutine reporting."

Routine Reporting

Routine reporting is the core activity of the system. The goal of EMIS is to ease monitoring of indicators and generation of standard reports for mission strategy reviews and Results Review, and Resources Requests (R4). This will be accomplished by automating procedures for periodic, required reporting and facilitating the conduct of associated operations. Figure II-2 provides a process flow for routine reporting. Routine reporting involves the following specific activities:

- tracking report due dates and prompting for data input
- periodic collection of environmental data and other information
- updating data and information in the data repository
- combining variables into indicators
- comparison of new indicator values to previous ones
- other review and analysis
- checks on appropriateness of analysis methodologies as well as on data quality
- generation of standard reports containing updated information that is consistent with USAID requirements for mission strategy and R4 reviews

Specifically, the system must alert the user before a scheduled report due date and prompt the user for the required information. For example, Figure VI-2 shows how this might be accomplished through the use of automatically generated forms such as an "Indicator Update and Review Sheet." In this example, the computer alerts the user that it is time to update and review a specific indicator. As shown in the database report of Figure VI-2, the previous values of the variables that are used to compute the indicator are presented. Blanks are provided for those variables whose values need to be updated. Values which do not require update (either because they are baseline values that do not change or else they have already been updated in conjunction with the review and update of another indicator) are output automatically and appear as "default" values. Comments can be entered either to describe an individual variable that goes into the calculation, or to comment on the indicator itself. This information can then be entered into the database in a "memo" field so that staff can maintain a history or record of important changes that occur in the computation of the indicators which may impact their comparison over time.

Figure VI-3 shows a "Variable Entry Sheet" which might be used for original input and later for update of the value and attributes associated with each variable. Of course, it will be up to the staff that ultimately use this system to define the actual procedures of its use. The "Indicator Update and Review Sheet" and the "Variable Entry Sheet" suggested here are only intended to illustrate how the data repository *could* be used to automatically generate reports in response to events. Such forms are intended to automate and ease data input. Whatever procedures are ultimately established for the use of the data repository, an interface into it will be required with the following characteristics:

- ease of data entry and data update by minimally skilled data entry clerks
- internal checks for data consistency and accuracy (such as tables to cross-check city names with city codes)
- robustness against multiple entries of the same data (for instance, cross-checking by variable name, acronym, or source) so that the same data are not entered into the database multiple times
- generation of forms which facilitate checks on appropriateness of analysis methodologies as well as on data quality
- ability to do multiple queries by keyword or combinations of keywords, including variable name, acronym, geographic location, and time
- ability to interact easily with the Mission's standard wordprocessing tool (WordPerfect) which can check for grammar and spelling errors
- ability to set automated alerts (or "ticklers") to remind users in advance of due dates, and ability to reset the alerts to account for the diverse complexity of different reports, availability of staff, or changes in reporting requirements

The data repository, standard office automation software, and a scheduler are all software tools which can support routine reporting. Additional data analysis software, such as statistical analysis and modeling packages, can be added as warranted. Discussions with Division staff revealed a general recognition that such

software tools would be useful, but not to such a degree to warrant immediate purchase.

Nonroutine Reporting

In addition to the routine reporting required by the policy and R-4 monitoring components, the system must be able to respond to nonroutine requests for information for sectoral monitoring and from the Mission, the U.S. Congress, the press, and the general public. There will also be calls for an occasional case study and publicity to promote accomplishments through press releases, success stories, and media announcements. Thus, ad hoc requests of the system can originate either internally or externally. From a process point of view, these will all be considered "information requests." Figure II-2 provides a process flow diagram for such activity. A request that comes into the system (either from an external or internal source) will be evaluated as to its priority and whether or not the information needed to meet the request is already available in the data repository. If the information is not available, a decision will be made whether or not to expend additional effort to meet the request, and if affirmative, resources will be allocated. The additional data and information will then be collected and analyzed, and a report made. If the request is in the form of a promotional piece, then the "report" will be a success story, press release, or other media announcement. Due to the importance of the latter to the Division, the EMIS team has provided some detail in the discussion of computerized tools to assist in this area.

Responding to information requests can thus be organized into three general categories:

- # Analysis and research
  - collection and correlation of data and information from a variety of sources
  - analysis of these data and information
  - development and delivery of reports
- # Understanding audience interests and needs
  - ongoing formal and information communications with the Mission, USAID/Washington, the U.S. Congress, and the general public
  - meetings with other donors and government agencies, attendance at conferences, study tours
  - "clipping service" (where information may be "clipped" from Web sites as well as paper media)
- # Developing and disseminating promotional materials
  - selection of project success stories suitable for profile development
  - research and development of "project profiles"
  - selection of appropriate media and content for various audiences
  - concept design for individual promotional pieces
  - writing and editing of text and graphics
  - graphic design
  - selection and acquisition of imagery, video or film, audio
  - printing, CD-ROM "burning," HTML coding, and other media production
  - coordination of content across media

There are many computer tools that can assist in these areas. Recommended computer tools are outlined below.

Analysis and Research

The primary source of data and information for analysis and research should, of course, be the data repository. However, depending on the source, type, and priority of the information request, there should also be tools for searching additional sources of information. Thus, to carry out this activity, staff will need access to some databases from other organizations. Computer tools to support this activity area include the following:

- # ability to query both the environmental database and the bibliographic database by common keywords, especially by geographic location (since most external information requests are location-specific), and to match data items from the first with reference items from the second

- Internet access, including Web and FTP access, to upload and download files from other databases and on-line information resources
- ability to easily tag, reformat, and store uploaded information in the data repository
- ability to input both digital and hard copy data not accessible from the Internet
- analysis software which may include statistical or modeling software to analyze data, combine it with data from other sources, extrapolate results, and predict trends by various parameters such as sector or geographic region
- budget tracking software to link progress to budget tranches
- tools for graphical representation of results

Software and hardware required for these activities include a fast modem and Internet browsing software, hardware for reading storage media most commonly used by other organizations with which staff will share data (including, but not limited to, 3.5" disks, 5-1/4" disks, and Syquest or Zip cartridges), optical scanner with OCR software for hard copy input, a desktop GIS (probably MapInfo) for both location-specific analysis and geographic representation, and optionally a common statistical analysis software package and a color printer and/or plotter for graphic output. Budget tracking software should be based on the standard Mission spreadsheet software, Lotus-4.

Understanding Audience Interests and Needs[9]

This activity constitutes a systematic attempt to collect and share information about the interests and needs of the Mission, USAID/ Washington, the U.S. Congress, and the general public. This activity will ensure that the reports developed for these audiences are responsive to their interests, timely, and relevant. It will use the bibliographic portion of the data repository to catalog the notes, proceedings, and reports of meetings with other donors and government agencies, attendance at conferences, and study tours. This catalog can be cross-referenced to the Mission library's cataloging system, thus eliminating redundant storage of hard copy materials. On-line "clipping services" and Internet "infobots" can also help to gather relevant data. The Internet will be a primary tool to support this activity. Standard Internet browsing software, electronic mail, and access to the bibliographic portion of the data repository must have the ability to do the following:

- access the World Wide Web with rapid downloading of embedded images;
- access FTP sites on the Internet and download files from these sites;
- support electronic mail;
- easily interact with the bibliographic portion of the data repository to catalog downloaded information; and
- conduct multiple queries by keyword and/or free-text search of the bibliographic database to retrieve information stored there for later review and analysis.

Developing and Disseminating Promotional Materials

Once the audience for a promotional piece is understood, project profiles can be developed to describe successes. The term "project profile" is used as a generalized term for promotional pieces such as press releases, success stories, and media announcements. Computerized tools can help make the development and dissemination of project profiles easier and more systematic and can provide templates to ensure a standard format. Success stories in particular should follow a common structure such as (i) brief description of context, (ii) problem identification, (iii) solution, (iv) benefits, and (v) future plans. Before dissemination, the project profile should be checked for grammar and spelling. The standard Mission wordprocessing tool, WordPerfect, and the bibliographic portion of the data repository must be able to

[9] See Appendix II-C for *Customer Survey*

- search by keyword and/or free text for background research and selection of existing narrative material;
- develop, write, and edit text and graphics; and
- print and publish project profiles.

No matter what the medium for disseminating promotional information, much of the content will be common. The content (text, imagery, audio, and video) organized in the bibliographic portion of the data repository must be able to support the following functions:

- management of a variety of objects: text files in a format compatible with WordPerfect, digital images in a standard format (JPEG, GIF, TIF), digital video in a standard format (AVI), and digital audio in a standard format (WAV)
- ability to relate the records for each promotional object (be it text, video, sound, or a combination) to multiple records for describing where the object has been used and when, to help users avoid conflicting uses of the same object
- ability to do rapid search and retrieval of both the promotional objects and the reference items used to support them, using keywords and combinations of keywords describing geographic region, environmental sector, date, and (if a promotional item) the name of the other promotional items already in the database

If only text-based promotional products are to be generated, there will be no need for specialized hardware or software. WordPerfect 8.0 can handle most desktop publishing needs. If color graphics or maps are to be used, there will be need for a color printer and/or plotter. If audio and video products are to be generated, a multimedia computer will be needed, with microphone, recording software, optical scanner, video converter, and CD writer. If a Web site is to be maintained, a fast server will be needed.

6.3 System Security

System operation and security are highly dependent on having properly trained technical staff and knowledgeable users. Software utilities and functions can help and are available in all major network operating systems. However, even the best system will not be effective without observing security and system operation procedures.

Level 4 Virus Protection

Viruses in a network can be extremely damaging. The ramifications of a virus introduced into a network are much greater than on individual workstations. Organizations can combat the problem with a combination of products and policies. As a first line of defense, all diskettes which are brought in from the outside should first be scanned on a stand-alone computer—a computer that is not connected to the network. Diskettes with viruses should be disinfected or destroyed. A network license should be purchased and installed on the network server from which it will be automatically deployed to all the other computers on the network. All computers should be scanned periodically with a variety of antivirus software—no single software package will catch all viruses. These virus software products go hand-in-hand with policies that insist that users know what viruses are, alert the system administrator if they detect a virus, and immediately run antivirus software before the virus has a chance to spread. Regular updates to the signature files should be implemented.

Firewall

A "firewall" is a set of hardware and/or software that provides overall system security by helping to prevent unauthorized intrusion via the Internet. In order to protect the sensitive data housed within the EMIS, especially that related to monitoring and tracking activities for internal Mission use, a firewall should be established between the server and the Internet. At a minimum, some sort of screening or filtering of network traffic should be carried out between the internal network (i.e., the LAN) and external networks (the Internet and, if applicable, the WAN). For instance, a "screening router" can be installed which will block traffic

from specific addresses. In addition, intruder detection lockout can be implemented, so that an intruder cannot randomly guess at passwords. A higher level of security can be gained through the use of a "proxy server" which can be installed to act as a store-and-forward server between internal applications and the Internet. With this option, the actual structure of the internal network will be invisible to any unauthorized users. If especially sensitive information is to be stored on the EMIS, then a "bastion host" should also be considered to prevent external access. This high level of security is a network segment between internal and external networks that provides a virtual wall between them. In addition, this computer provides important auditing features which allows tracking and condensed reporting of user logins as well as file access and modification. This allows detection of anomalous activity that may be associated with an unauthorized intruder. These higher levels of security do involve significant additional expense; the cost of adding additional levels of security must be weighed against the risk of losing or corrupting data. Whichever options are selected, ***the firewall MUST be established before any connection to the Internet is initiated.***

Password Protection

Password protection and periodic password changes should be mandatory for both network and database access. Password management software should be installed that will automatically remind users when to change their passwords. Such software adds another level of security (over intruder detection and lockout) by checking for uniqueness and decipherability of passwords.

Database Security

For the data repository, a primary database server should be established as a data warehouse, with a second database server established as a replication of the primary server. Database records will be modified only on the primary server and periodically (e.g., hourly) replicated to the secondary server. The physical location of each database will be "transparent" from the user's point of view. Except for periodic data updates, most database queries will only require "read" access. All read-only queries and reports will be generated from the secondary server.

Physical Security

The Division must determine how much physical security is required. Physical security includes physical lock-up of servers and data backups, and locking screen savers to prevent unauthorized access at unattended workstations.

System Backup, Archive, and Disaster Recovery

Daily incremental back-ups of both the network and the data repository will be required to recover from localized disasters (such as temporary loss of power or loss of data from an isolated virus). Weekly archives of the entire network and databases will be required to recover from more global disasters. These archives should be stored off site, otherwise they may not be available when a contingency plan is called into action.

A contingency plan is required for disaster recovery. For the purposes of this report, a disaster is defined as anything which threatens the integrity of the data or casts doubt on data. There are many possible causes of disaster ranging from a hardware crash to software-related bugs to a virus on the network to malicious destruction to fire or natural disaster. Some disasters can be solved fairly quickly by restoring data from the daily back-ups or the weekly archives. Other kinds of disasters will require additional measures. A plan for disaster recovery should be established which includes a plan for acquiring new equipment quickly and an order of priority to establish basic functionality in case of a major disaster. The plan should be tested for the most common events: hardware crash, software disasters, and viruses in the network.

6.4 System Operation and Management

This section describes the resources— equipment and personnel—needed to operate and manage the computerized system. The personnel

described include the expertise required for the day-to-day running and maintenance of the computer equipment. In addition, maintenance agreements should be purchased for support of all specialized equipment and for any equipment for which the staff do not have either time or the technical expertise to maintain. The budget estimates provided below include such maintenance agreements.

6.4.1 System Location Recommendations

Based on discussions with Division staff, the EMIS team recommends that the management of the EMIS fall under the Environment Division. If at all possible, the equipment should reside in the same building, thus saving considerable expense on connecting and securing the electronic link (WAN) between the EMIS and the Mission. However, due to lack of space at the Mission, it is the team's understanding that it may be necessary for the EMIS to reside physically outside the building. In that case, the team recommends that it reside with a contracting firm, preferably an Egyptian firm. If that is the case, then an electronic connection will need to be established between that site and the Mission. This can be accomplished either using the Internet or, if data security is an issue, through a dedicated line (or WAN, mostly likely using VSAT).

6.4.2 Equipment

This section presents three equipment scenarios, a "high-end," intermediate, and "low-end" scenario. All three of these equipment scenarios will be fully functional in the first three core functions—policy monitoring, R4 monitoring, and sectoral monitoring. The "low-end" and intermediate scenarios would have limited capability in the third functional area, reporting, especially in requests related to development of promotional materials. All three scenarios include Internet access. The more sophisticated the system, the better the link to the Internet, but all three scenarios will provide users with access to other databanks in Cairo. The major difference between the "low-end" and intermediate scenarios is the addition of computers on the system, not the addition of functionality. The difference between the intermediate and "high-end" scenarios is the addition of a dedicated WAN link to an off-site location and a multimedia computer which would provide additional functionality. The equipment needs for each of the three scenarios are provided in Tables VI-1 through VI-3.

The "high-end" system would include a dedicated WAN link from the Mission and several pieces of specialized hardware (such as a multimedia computer, CD-ROM writer, and color printer). Four client workstations would be connected to one server which would act as the database server, applications server, and communications server. A firewall can optionally be placed between the server and the Internet. (The firewall need not be a physical machine, but could simply be a set of software. CISCO Systems, for example, provides good firewall software for its routers. Firewall options were discussed in more detail in Section 6.3, System Security.)

The intermediate scenario, which the team recommends, would have the equipment colocated with the Mission. This would save considerable expense in the WAN link. Additional cost savings would occur if the multimedia option were declined, and if there were enough ports available on the Mission's existing hub to preclude the need for an additional switch or another hub. In both the "high-end" and intermediate scenarios, users would be connected to the data repository via a local area network (LAN). The recommended LAN is based on a network design with each server connected to a 12-port 100 Mbps hub using level 5 twisted pair cabling. Additional peripheral devices, such as printers and scanners, are connected directly into the network hub so that they become shared resources on the system. Figure VI-4 provides a schematic diagram of this set-up, which applies to both the "high-end" and the intermediate scenario.

A third scenario, the "low-end" scenario, is simply to have one computer with the minimum database and office automation software and few

peripheral devices. This single computer would be colocated with the EEPP management unit and would not require a dedicated WAN link. It would, however, have a telephone line connection into the Internet. Thus, all three scenarios would have Internet access and, therefore, access to other databanks in Cairo. Once monitoring and evaluation procedures are put in place, this one computer could be used as a basis for phasing in a full-system implementation by adding a server and additional clients on an as-needed basis.

It is important to note that only the intermediate and "high-end" equipment scenarios could support an in-house Web site, since only these scenarios include a communications server. If the "low-end" scenario is selected and a Web site is still desired, it may be possible to maintain a Web site on an outside server, either on the Mission's server or by leasing space from a local Internet service provider. The latter situation would involve at least some, and perhaps considerable, loss of control over the use and maintenance of the site and on the Mission's ability to monitor traffic to the site.

6.4.3 Personnel

The EMIS team recommends that long-term maintenance, use, and upgrades to the system be carried out by a contracting firm. Ideally, staff should include a supervisor or manager, one or more analysts, one or more researchers, a journalist, and a part-time data entry clerk. These roles could be combined. Suggested responsibilities and combinations of roles are presented in Appendix II-D. A team of short-term expert consultants should be hired to guide the set-up and early implementation of the EMIS. These experts would reside with the contracting firm. For the "low-end" option, only one person would be hired to develop and manage a single machine.

6.4.4 Estimated Equipment Budget

Initial estimates for the three equipment scenarios follow. These are estimates only— prices will vary depending on whether the equipment is purchased in-country or imported. Also, 220V equipment tends to be higher in price than 110V equipment. Finally, prices are changing rapidly in both hardware and software and are expected to continue to do so into the forseeable future. With these caveats in mind, estimates for the three scenarios are as follows:

The yearly expenses (last column) include hardware and software maintenance at 10% of equipment purchase price, Internet access (and VSAT access in the case of the "high-end" scenario), and consumables. The "high-end" scenario includes all optional features (multimedia computer, color printer, and CD-ROM recorder). The intermediate scenario does include the cost of a 12-port 100 Mbps stackable hub, an expense that need not be incurred if there are enough ports available on the existing hub. The "low-end" scenario does

not include any LAN hardware beyond the cabling and LAN card necessary to connect it to the existing LAN (i.e., assuming there is a port available on the existing hub or switch). None of the scenarios includes "specialized software" such as statistical analysis or modeling packages or graphics packages. These can be added later, as the need arises.

6.5 Implementation Plan

The EMIS should be able to evolve with the evolving needs of the Division. This section describes a phased implementation plan with options at various stages which can be selected to pace implementation to match the Division's goals and objectives.

It is assumed that management of the EMIS will logically fall under the Environment Division, but that the system will physically reside in the offices of a contracting firm. This is the scenario that the team understood was the most likely. Phase 1, System Set-Up and Implementation, describes the initial establishment of this system. For each of the three equipment scenarios, the phasing of the functionality as described below will be essentially the same. (For example, all three scenarios will support promotion activities to some degree. The higher-end scenarios would simply support more sophisticated use of multiple media and graphics. Similarly, all three scenarios have Internet access, but the higher-end scenarios have faster connections and are better able to access sophisticated Web sites with signficant graphics and database

Scenario	Equipment set-up	Yearly expenses
"low-end" scenario	$ 8,000	$ 2,700
intermediate scenario	$51,000	$11,000
"high-end" scenario	$79,000	$15,700 (includes VSAT)

query mechanisms.) In the case of the "low-end" scenario, additional equipment could be purchased at later stages as needed.

In the case of the intermediate and "high-end" equipment scenarios, the team recommends that project start-up be guided by a small team of expert consultants who will eventually turn over maintenance and use of the system to the contracting firm. These consultants would be putting in place information processing procedures, as well as computer equipment.

In Phase 2, Application Development, issues of long-term maintenance and application upgrades to the system are described. In the very long term, Phase 3, data redundancy can be minimized by "institutionalizing" the maintenance of the data for the sectoral component of the system with the appropriate Egyptian government agency, most likely EEAA. The implementation plan is summarized in a Gantt chart in Figure VI-5.

Phase 1 - System Set-Up and Implementation

The first phase of the project will be the establishment of a system that can respond to the needs of the R4 process and EEPP, provide sectorwide monitoring of key indicators, and respond to information requests. While the amount of data involved in these activities is not large, the complexity of the data and the multiplicity of uses to which it will be applied call for innovative ideas for data management and access. In addition, the data management component must be able to respond to a diverse and evolving set of user needs.

For the intermediate and "high-end" equipment scenarios, a team of expert consultants should be hired to guide the early implementation of the EMIS. These experts would reside with the contracting firm. The proposed consultant team includes a programmer/database specialist, a systems integrator, and an analyst. The programmer/ database specialist will provide guidance and support in development of the data repository and, if necessary, provide training in database design and implementation. The systems integrator will assist in integrating the hardware and standard software tools with the data repository into an integrated whole. The analyst will establish processing and procedures for using the system to address the three core functional areas and to respond to information requests. These processes and procedures will include the use of computerized tools for program planning, management, and communication. Overall coordination and guidance should come from the Division. The consultants must work closely with the contracting firm in all stages of system design, procurement, installation, and testing—at no time should the expert consultants be the primary persons carrying out the actual implementation. Ultimately, the system must be maintained by the contracting firm. The best way to ensure long-term sustainability of the EMIS is by ensuring that all the knowledge needed is resident with the contracting firm. This includes knowledge about how to modify and enhance the system so that it evolves as the Division's needs evolve. The expert consultants must provide guidance, while the contracting firm carries out the work.

The first step in set-up is, of course, to select, procure, install, and test the hardware and software. Included in this set-up will be all the necessary networking components, both LAN and Internet. If the system is to reside off site and data security is an issue, a dedicated line (WAN) between the site and the Mission may be considered. Once the equipment is installed, security procedures must be put in place and a disaster contingency plan established. System security includes network security, database security, and physical security. These security and contingency plans should be clearly documented. (Such procedures should be in place even for the "low-end," single-computer option.)

The focus of Phase 1 should not be to populate the database with huge amounts of environmental data that may or may not be used. Rather, the focus of Phase 1 should be on responding to real requests and developing aggregate reports and demonstration data products to stimulate interest and generate demand. In this way the specifics of the underlying database can be designed to respond to known demands and real uses, not conjectured ones. During Phase 1, user interfaces should be in

English; any Arabic data that is entered into the system should be first translated into English.

Phase 2 - Application Development

Phase 2 of the implementation will include operation and maintenance of the EEPP and R4 components of the system, establishment of the bibliographic portion of the data repository, establishment of procedures for generating and disseminating case studies, press releases, and media announcements, and translation of important user interfaces into Arabic.

Proposed demand-driven applications should be prioritized and developed during Phase 2. Such applications may include the purchase of new software such as statistical analysis or modeling packages. Applications should be developed systematically and in coordination with Division goals and objectives. If the number of proposed applications is large, an Applications Development Steering Committee made up of representatives from the Division and the contracting firm can be established to set priorities. Each new application should be developed with plenty of user review during its development phase. Such review is critical, since computer applications and data products that users do not understand do not typically gain wide acceptance. Some methods for gathering user feedback include studying current and preferred ways of carrying out the tasks that the application is intended to support, developing preliminary application designs together with users, and testing intermediate products on representative users. Based on user input, the application should be revised or refined during its development.

Phase 3 - Institutionalization

Redundant data maintenance can be minimized by "institutionalizing" the sectoral portion of the data repository at EEAA. Two new projects being funded through EEAA, the CIDA-funded Egyptian Environmental Information System (EEIS) and the DANIDA-funded Environmental Information and Monitoring Programme (EIMP) have the potential for being long-term sources of environmental information for USAID/Egypt. If successful, these projects will make EEAA a candidate for the "institutionalization" of the sectoral portion of the environmental database.

EEIS will electronically link EEAA with 13 other government agencies to share data and information on inland waters, land, and soil. (For coastal zone and air data, the system will depend on others, such as the DANIDA Environmental Information and Monitoring Programme [EIMP] and the Cairo Air Improvement Project [CAIP].) Funding for the five-year EEIS project was approved in 1996, and the project started in January 1997. Its first 18 months will concentrate on connecting all of EEAA's internal databases. The second 18 months will focus on connecting five other government agencies to EEAA through bilateral agreements with EEAA. The last two years will be spent connecting seven more government agencies. These other government agencies will then become "nodes" on the system.

It is important to note that the bilateral agreements are structured in such a way that the EEIS could become a closed system. That is, the agreements specify (1) what data is to be shared between EEAA and a partner agency, and (2) what subset of that data may be shared among all the nodes on the system. At present, there are no specifications in the agreements for sharing data with other organizations outside the system or with the general public. When questioned about this, the EEIS Project Manager responded that ultimately only a small subset of the data available on the system would be accessible to users outside the system, and in fact it may be that only metadata will be available. There is also the possibility that additional nodes can be added later. The current requirements for membership include sharing of data which fits into one of several categories of priority environmental initiatives and agreement to participate in demonstration projects. The EEIS Project Manager was open to entertaining the idea of adding additional nodes after the first 13, but only then and only if they offered added value to the system. On the other hand, there may not be enough demand from users internal to EEIS for the system to sustain itself in the long term. In that case, EEIS may find itself looking outside for

users in order to increase demand on the system. In any case, the system will not be on-line for a few years. Until the specifics of broader data access are worked out, EEIS shouldn't be counted on as a source of data.

The five-year DANIDA-funded EMIP is also in its early stages. The database portion of this system will have three components: coastal zone monitoring (with data from 72 sampling stations), ambient air quality monitoring (with data from 40 stations), and point source emissions (with data from 50 to 100 mostly industrial sites). Data collection, analysis, QA/QC, and formatting will be carried out at one of seven specialized institutes around Egypt. The data will then be transferred to EEAA for archiving and storage in one of three separate databases. The three databases will be stand-alone modules housed in their respective divisions and copied to their originating institutions. There will be no attempt to link them under EMIP, as this will be the responsibility of EEIS.

DANIDA has a very strong policy of open data access and will probably put pressure on EEAA to publish and share the data developed under EMIP. Access to this data awaits issuance of an official policy from EEAA. Once that happens (and until EMIS is up and running), the only way to access the data will be for someone to physically take a diskette to EEAA and download the data.

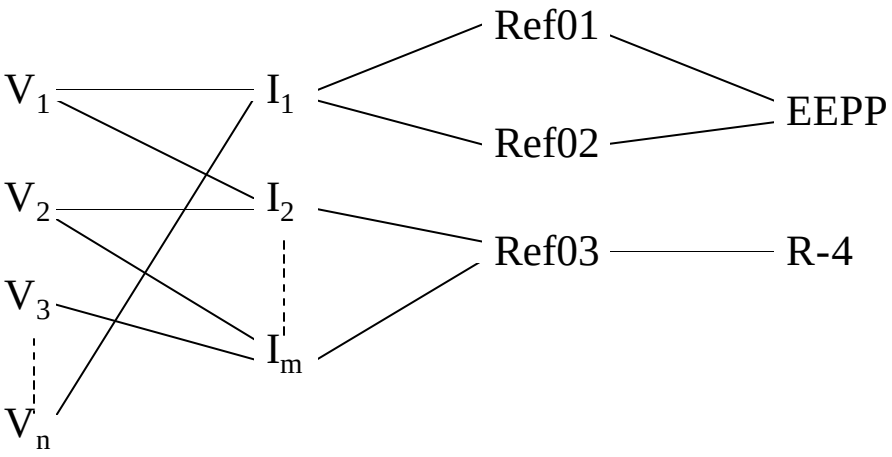

Figure VI-1:
Schematic Relationship of Variables to Indicators and Reference Materials

Figure VI-2 - Sample Database Report for Updating and Reviewing Indicator

EMIS - Indicator Update and Review Sheet

Indicator: Per capita expenditures on oral rehydration salts (ORS) for self-treatment of child diarrhea

Algorithm: $\frac{N_{R5}}{Pop_5} \times \frac{R_e}{R_a}$

Variable Name	*Acronym*	*Unit of Measure*		*Geographic Location*	*Date*		*Value*		*Comments*
Number of ARI cases in children under five (<5) years	N_{R5}	millions	millions	Egypt - nationwide	1995	1996	1.56	*1.74*	
Population under five (<5) years	Pop_5	millions	millions	Egypt - nationwide	1995	1996	9.00	*9.11*	
Current year GDP	GDP_C	index	index	Egypt - nationwide	1995	1996	1.2	*312.1*	*Estimated value*
Base year GDP	GDP_B	index	index	Egypt - nationwide	1978	1978	100	100	*Estimated value*

Comments/Notes:

GDP replaced CPI in calculation of indicator after 1994.

Initials: DWS Date: 06/06/96

Figure VI-3 - Sample Database Report for Updating Variables

EMIS - Variable Entry Sheet		
Variable	Variable Name	*# of ARI cases in children < 5 years of age*
	Acronyn	N_{R5}
	Unit of measure	*number in millions*
	Geographic location	*country-wide*
	Variable date	*Annual*
	Value of variable	*1.794*
Primary Data Source	Organization name	*Ministry of Health and Population*
	Acronym	*MoHP*
	Contact person	
	Division/Dept./Unit	
	Street address	
	City, Postal code	
	Phone	
	FAX	
	Procedures for obtaining data	*Obtain from USAID/Egypt Health Office*
	Report title	
Alternate Data Source	Organization name	*USAID/Egypt*
	Acronym	
	Contact person	*Dr. Nahed Matta*
	Division/Dept./Unit	*Health Office*
	Street address	*Cairo Center*
	City, Postal code	
	Phone	
	FAX	
	Procedures for obtaining data	
	Report title	
General Comments		
Include information about data quality, data collection		
Variable last updated on (date)		

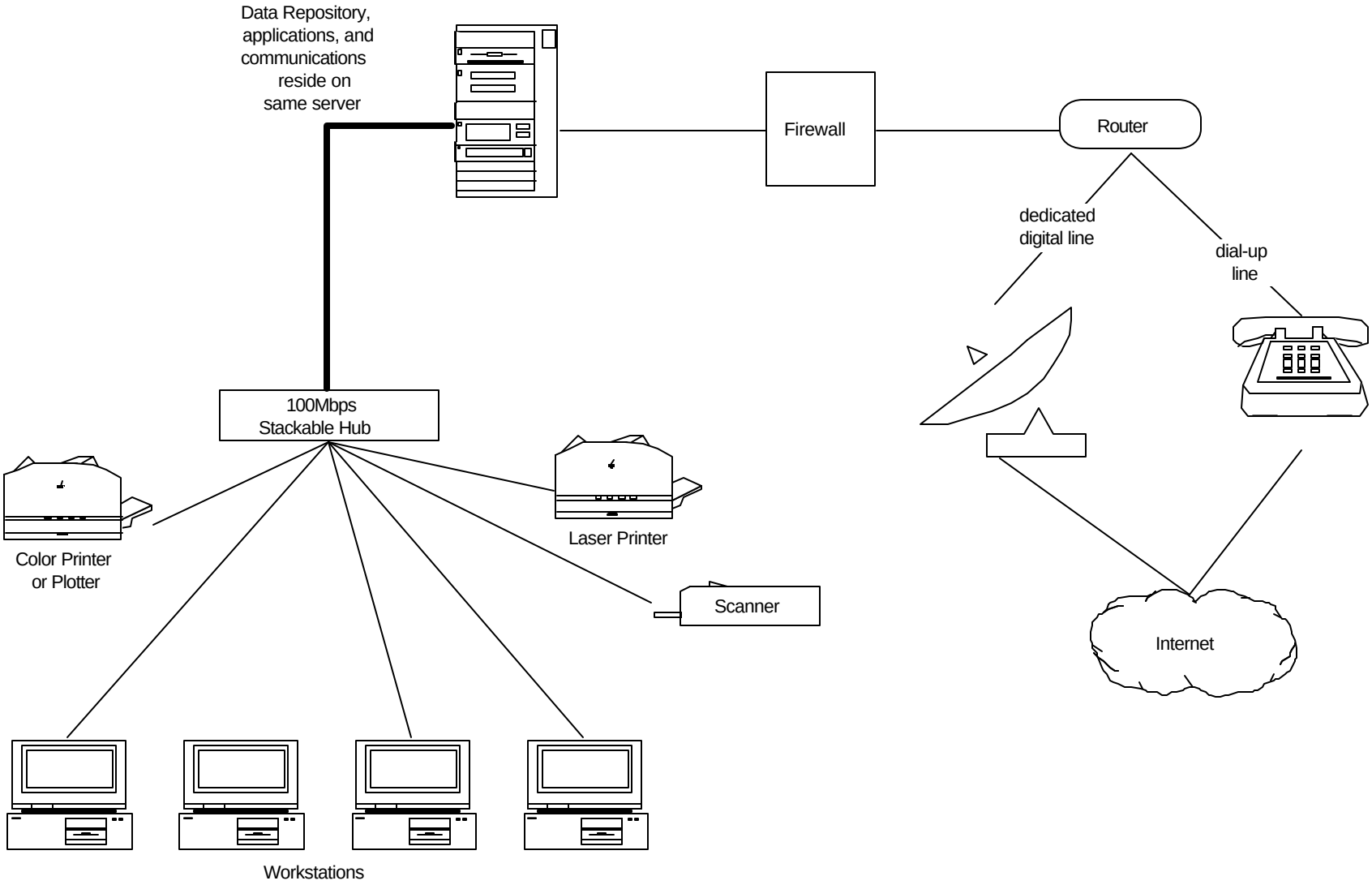

Figure VI-3 - LAN Design

Fig VI-5

Fig VI-5 continued

Table VI-1:

Suggested Hardware and Software for "Low-End" Option

Quantity	Description
Hardware	
1	Computer workstation with Internet access by modem only for staff member. The standard configuration should meet or exceed the following specifications: Pentium 233 MHz CUP, 16 M RAM, 1G hard drive, 3.5 inch diskette drive, SVGA 15" color monitor, 2 M RAM graphics card, mouse and keyboard, Network Interface Card (NIC), GUI operation system.
1	10 minute uninterruptable power supplies (UPS), one for each client workstation plus an additional one for the optional multi-media workstation
1 each	Laser printer. Backup media (e.g., Zip drive)
Networks	
1	LAN wiring (to connect to Mission's LAN)
1	Internet connection set-up fee
1 each	Direct dial-in dedicated phone line and modem
Software	
1	LAN operating system for client
1	Standard office software (including WordPerfect, Lotus-4, MapInfo, email, Internet browser)
1	SQL-compliant relational database management system, one license
TBD	Specialized software for project management (such as Microsoft Project), graphics, presentation, design, statistics, modeling, and so forth
Other	
one-year supply	Backup and archive media; paper and ink; other consumables
Operating Expenses	
1	Internet access Hardware and software maintenance, per year @ 10% of purchase price

TABLE VI-2: Suggested Hardware and Software for "Intermediate" Option

Quantity	Description
Hardware	
4	Computer workstations with Internet access for each staff member. A standard configuration for each workstation, or "client", should meet or exceed the following specifications: Pentium 233 MHz CPU, 16 MB RAM, 1G hard drive, 3.5 inch diskette drive, SVGA 15" color monitor, 2 M RAM graphics card, mouse and keyboard, Network Interface Card (NIC), GUI operating system
4	10 minute uninterruptable power supplies (UPS), one for each client workstation.
1	Network server must meet or exceed the following specifications: Pentium Pro 200 MHz CPU, 128 M RAM, 2.9G SCSI hard drives (duplexed), 3.5 inch diskette drive, CD-ROM SCSI drive (not as a shared network resource, but for loading and maintaining the Network Operating System software), mouse and keyboard , SVGA 15" color monitor
1	20 minute uninterruptable power supply (UPS) for network server.
1 each	Laser printer and a full page optical scanner. Backup media (e.g. Zip drive)
1	Color printer.
Networks	
1	LAN hardware including 12 port 100Mbps hub
8	LAN wiring per client (including peripheral devices)
1	Internet connection set-up fee
1 each	Direct dial-in dedicated phone line and modem (or other appropriate receiving device)
1	Router
Software	
1	Operating system for servers (e.g. NetWare 4.X)
4	Operating system for clients.
4	Standard office software (including WordPerfect, Lotus-4, MapInfo, email, Internet browser) for clients
4	SQL-compliant relational database management system, one license per user
TBD	Specialized software for project management (such as Microsoft Project), graphics, presentation, design, statistics, modeling, and so forth
Other	
one-year supply	Backup and archive media; paper and ink; other consumables
Operating Expenses	
1	Internet access
1	Hardware and software maintenance, per year @ 10% of purchase price

TABLE VI-3: Suggested Hardware and Software for "High-End" Option

Quantity	Description
Hardware	
4	Computer workstations with Internet access for each staff member. A standard configuration for each workstation, or "client", should meet or exceed the following specifications: Pentium 233 MHz CPU, 16 MB RAM, 1G hard drive, 3.5 inch diskette drive, SVGA 15" color monitor, 2 M RAM graphics card, mouse and keyboard, Network Interface Card (NIC), GUI operating system
1 (optional)	Optional multi-media workstation available to all staff members. This workstation should meet or exceed the following general specifications: Pentium 233 MHz CPU, 32 MB RAM, 1.2 G hard drive, 3.5 inch diskette drive, SVGA 17" color monitor, 4 M RAM graphics card, mouse and keyboard, 6X CD-ROM drive, sound card with stereo speakers and microphone, Network Interface Card (NIC), GUI operating system
4 + 1	10 minute uninterruptable power supplies (UPS), one for each client workstation plus an additional one for the optional multi-media workstation
1	Network server must meet or exceed the following specifications: Pentium Pro 200 MHz CPU, 128 M RAM, 2 9G SCSI hard drives (duplexed), 3.5 inch diskette drive, CD-ROM SCSI drive (not as a shared network resource, but for loading and maintaining the Network Operating System software), mouse and keyboard , SVGA 15" color monitor
1	20 minute uninterruptable power supply (UPS) for network server.
1 each	Laser printer and a full page optical scanner. Backup media (e.g. Zip drive)
1 each (optional)	Color printer and/or color plotter. CD-ROM recorder.
Networks	
1	LAN hardware including 12 port 100Mbps hub
8 - 12	LAN wiring per client (including peripheral devices)
1 set	WAN (dedicated line) connection to Mission (probably VSAT, with two (2) CSU/DSU and two (2) WAN cards (or other appropriate hardware)
1	Internet connection set-up fee
2 each	Direct dial-in dedicated phone lines and modems (or other appropriate receiving device)
1	Router
Software	
1	Operating system for servers (e.g. NetWare 4.X)
4 + 1	Operating system for clients.
4 + 1	Standard office software (including WordPerfect, Lotus-4, MapInfo, email, Internet browser) for clients
4 + 1	SQL-compliant relational database management system, one license per user
TBD	Specialized software for project management (such as Microsoft Project), graphics, presentation, design, statistics, modeling, and so forth
Other	
one-year supply	Backup and archive media; paper and ink; other consumables

Quantity	Description
Operating Expenses	
1 each	Internet access and WAN link (probably VSAT)
1	Hardware and software maintenance, per year @ 10% of purchase price

Appendix A

Persons and Offices Contacted

Contacts

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Appendix B

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