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APPLIED SCIENCE AND TECHNOLOGY RESEARCH IN EGYPT

STATUS REPORT: 1978-1981

(End of Phase I)

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CHAPTER 1 OVERVIEW AND SUMMARY

INTRODUCTION

Egypt's scientific and technical manpower and institutional resources are the most significant in the Arab world and for many years have been a major resource used not only locally but also by other countries in the Middle East. For 30 years Egypt has witnessed impressive growth in these scientific and technical resources; today over 6,000 university graduates are engaged in research and development (R&D) in universities, research institutions, technical ministries, and autonomous technical organizations and laboratories. Significant numbers of scientists, engineers, medical, and agricultural specialists, as well as teachers and scientific support personnel, also are employed outside Egypt in the Arabic-speaking world. Many of these spend two to four years abroad and then return to Egypt, but many are permanently lost to the scientific community, even when they return.

Traditionally, however, R&D activities in most Egyptian centers have an academic orientation, with great emphasis upon publication in international journals. The Egyptian scientific community has been rather slow to involve itself in economic and social development. It is also true that industry and the public sector have not taken full advantage of the scientific and technological reosurces of the country in advancing socioeconomic development.

Recognizing this dilemma, Egyptian leaders have committed themselves to redirecting and integrating Egypt's formidable scientific resources more fully into the development process. Within this context, the Egyptian Academy of Scientific Research and Technology (ASRT) has been given a major coordinating role for research and development activities in Egypt.

In the mid-1970s the ASRT and its affiliate, the National Research Centre, initiated collaborative activities and discussions with U.S. scientific institutions, namely the U.S. National Science Foundation (NSF), and the U.S. National Academy of Sciences/National Research Council (NAS/NRC). Early in 1978, as one result of these activities, the government of Egypt and the United States government through its Agency for International Development (AID), entered into a joint cooperative science and technology program. This activity, known as the "Applied Science and Technology Research Program," was funded for a five-year period to:

- Initiate broad institutional and attitudinal changes toward applied R&D in Egypt's scientific community
- Give higher status and rewards to scientists and engineers engaged in applied, practical, problem-solving research in Egypt
- Establish new linkages between research institutions and "end-user" groups in industry and in agriculture
- Provide more up-to-date equipment and instrumentation facilities for applied research
- Upgrade skills for repair and maintenance of sophisticated scientific equipment and instrumentation
- Strengthen R&D management in the ASRT and its affiliated institutes.

For administrative purposes, the Applied Science and Technology Research Program in Egypt was divided into two parts: Phase I, from early 1978 through September 1981; and Phase II, from October 1981 through September 1983. This report covers those elements of the program through December 1981 that were the contractual responsibility of the National Academy of Sciences/ National Research Council and the Academy of Scientific Research and Technology. It is a status report for the period of Phase I and subsequent activities beginning Phase II.

The balance of this chapter highlights the activities of the Applied Science and Technology Research Program to date and incudes an overall financial summary (a more complete statistical presentation may be found in Annex A). Chapter 2 provides detailed information on each "demonstration" and R&D project. The program's training activities are discussed in Chapter 3.

PROGRAM ELEMENTS (PHASE I)

The overall program during Phase I comprised the following elements:

- Policy Planning and Management. This element was designed to strengthen policy planning and management within the Academy of Scientific Research and Technology through three main efforts, all of which were the contractual responsibility of the NAS/NRC:

  1. Formation of a Joint Egyptian-American Consultative Committee (JCC) composed of high-level science and technology management experts. Each country nominated five people for the JCC, which was chaired by the Egyptian Academy president. The JCC was recognized as an advisory group to the ASRT president and met eight times (semiannually) during Phase I. (Annex B lists the Egyptian and U.S. members of the JCC and provides a summary of each meeting.)

  2. Support of training opportunities and activities for Egyptian scientists and engineers of the ASRT and its principal associated research institute, the National Research Centre (NRC/Cairo).

  3. Assignment of a full-time senior R&D manager in Cairo from the NAS/NRC to assist the ASRT and NRC/Cairo in all aspects of the program. This representative was stationed in Cairo for 30 months.

- Technical Assistance for R&D. The NAS/NRC provided training, advisory services, and consultants for the series of projects designed to link Egyptian R&D institutions to end-users in industry and agriculture.

- o Scientific Equipment. As part of its contractual responsibility, the National Science Foundation (NSF), provided scientific instrumentation and equipment to the NRC/Cairo and other participating Egyptian institutions. Strengthening maintenance and repair capabilities was particularly emphasized.

- o Scientific Information. Because of the importance of scientific and technical (S&T) information resources to R&D, a major program effort was to strengthen both the fundamental design and trained manpower resources of the Egyptian S&T information system. This effort also was managed by the NSF.

- o Planning for Phase II. All American and Egyptian participants in the program were asked by AID to assist in planning for Phase II.

ACTIVITIES OF THE NATIONAL ACADEMY OF SCIENCES/NATIONAL RESEARCH COUNCIL

In addition to its responsibility for the policy planning and management elements, the National Academy of Sciences was responsible for providing technical cooperation (training opportunities and advisory services) for three multidisciplinary and multi-institutional demonstration projects.

1. More and Better Food (a food production and nutrition improvement activity at the village level)

2. Biogas Technology for Rural Areas (a technical, economic, and social development project for energy generation using human, animal, and plant wastes)

3. New Crops for Arid and Semi-Arid Zones (an activity to improve agricultural productivity for nonconventional crops in marginal lands).

The NAS/NRC also initiated four multidisciplinary "research and development" (R&D) projects, which are smaller in scope than the demonstration projects and emphasize close cooperation between the research teams and beneficiaries in industry and agriculture. The R&D projects for Phase I were:

1. Evaluation of Egyptian Phosphate Ores for Wet Process Phosphoric Acid and Phosphate Fertilizer Production (end users were the phosphate fertilizer industry and Egyptian farmers)

2. Corrosion Causes and Control (end user was the oil refinery at Suez)

3. Improving the Processing of Wool Scouring and Wool Wax Recovery (end users were an Egyptian textile processor and the export market)

4. Development of Red Sea Fisheries (end users were the Egyptian consumers of fish and seafood products)

Two other R&D projects were begun in Phase II. These projects deal with:

- Preparation of Selected Pharmaceutical Chemicals (started in August 1981)
- Investigation and Evaluation of Egyptian Bentonites for Industrial Applications (started in August 1981).

Chapter 2 of this report gives further information on each demonstration and R&D project.

ACTIVITIES OF THE NATIONAL SCIENCE FOUNDATION (NSF)

The National Science Foundation (NSF) was responsible for providing instrumentation and equipment to participating Egyptian institutions and for enhancing their scientific and technical information systems.

Scientific Instruments and Equipment

Procurement. The NSF contracted with the Scientific Instruments Center, University of Wisconsin, to prepare detailed equipment and instrumentation specifications for procurement under the program. (Note: Approximately $4.5 million of the total $8.1 million in AID funds was designated for procurement.)

Training. The NSF contracted with both the Scientific Instruments Center, University of Wisconsin, and the Biomedical Engineering and Instrumentation Branch, National Institutes of Health, to provide training in scientific instrumentation maintenance and repair to Egyptian scientists and engineers. The goal was to establish maintenance and repair centers in the National Research Centre and in five Egyptian universities.

Science and Technology Information Systems

Design. The NSF contracted with the Georgia Institute of Technology to work with ASRT and the Egyptian National Information and Documentation Centre (NIDOC) to conduct an analysis of the Egyptian scientific and technical information network and recommend the design for a modern, integrated information system.

Training. The NSF contracted with the Catholic University of America to provide short-term (three months) technical training for Egyptian information specialists.

OVERALL FINANCIAL ASPECTS

In Phase I the Egyptian government made available 1,495,000 Egyptian pounds (LE) and AID allocated $8.1 million plus 895,000 LE for the Applied Science and Technology Research Program. During that period (1978-81), one U.S. dollar was equivalent to 0.7 Egyptian pounds.

Table I Contractual Distribution of AID Funds

	Dollars	Pounds
1. Agency for International Development (direct expenses for equipment purchases)	4,500,000	--
2. U.S. National Science Foundation (information, equipment maintenance and repair)	2,023,700	268,600
3. U.S. National Academy of Sciences/ National Research Council (Joint Consultative Committee, R&D/demonstration projects, and R&D management)	1,200,000	307,400
4. Academy of Scientific Research and Technology (local materials and supplies; incentives)	--	320,000
5. Other (precontract costs, evaluations, etc.)	376,300	--
TOTAL:	$8.1 million	LE 895,000

Notes: (1) Dollar Equivalent $9.4 million
(2) AID reserved the equipment funds for direct procurement, using a purchasing contractor in New York as its agent and subcontracting the task of preparing detailed equipment specifications to the University of Wisconsin's Scientific Instruments Center.

The NSF contracted with the Georgia Institute of Technology for the design and planning aspects of the Science and Technical Information (STI) project, the Catholic University of America for STI training, and the University of Wisconsin and National Institutes of Health for training on instrumentation maintenance and repair (M&R) and for establishing five M&R centers in Egypt.

The NAS/NRC was responsible for the Joint Consultative Committee (JCC), demonstration and R&D projects, and for R&D management activities. NAS/NRC subcontracted with the Denver Research Institute (DRI) to organize and conduct R&D management courses and seminars both in Denver (43 Egyptian participants) and in Cairo (approximately 80 participants). Late in Phase I, U.S. AID supplemented the $1.2 million NAS/NRC dollar contract with an additional $166,000 from Phase II funds.

CHAPTER 2 DEMONSTRATION, RESEARCH, AND DEVELOPMENT PROJECTS

This chapter summarizes the three demonstration and six R&D projects, with a discussion of their origin, goals, and individual components as well as project status through December 1981. Major start-up or implementation problems during the Phase I period (1978-81) are also noted.

DEMONSTRATION PROJECT I: MORE AND BETTER FOOD

Background

The importance of agricultural productivity for Egypt is better understood when viewed in the context of the country's demanding demographic and geographic factors, and its limited natural resources. For example:

- Less than 4 percent of the total Egyptian land area lies in the natural pathway of the Nile River, where abundant water for irrigation is available.
- The population--now 43 million--is increasing at an annual growth rate of 2.4 percent and is expected to exceed 75 million by the year 2000.
- Even though the land-use factor is nearly 2 (that is, 6.3 million feddans cultivated so intensively that it approximates 11.2 million feddans in production), the same land area supplied food products to only 20 million people in the early 1950s. Although additional improvements are possible, obviously there are upper limits to agricultural productivity in the Nile Valley and Delta.
- Per capita food supplies from domestic animal and plant sources are falling far behind needs, thereby creating serious food shortage problems. Currently, food deficits in the aggregate are running 30 to 40 percent of annual consumption.
- Food subsidies have become the largest item in the Egyptian national budget.

These factors require that every effort be made in all sectors of the economy to use science, technology, and the best management practices to alleviate Egypt's food production, distribution, and industrialization problems.

More and Better Food attempts to bring to bear talents, resources, and experience from modern science and technology on a well-defined area of food-related problems for the Egyptian villages and the Egyptian food industry. The project is a major effort of the Academy of Scientific Research and Technology (ASRT) through its National Research Centre

(NRC/Cairo) to conduct a practical program of multi-disciplinary and multi-institutional R&D for the benefit of end-users and for the country as a whole. As part of the Applied Science and Technology Research Program, it has benefitted from technical cooperation and inputs of material resources provided by AID.

Within Egypt the participating groups in the project--in addition to ASRT and NRC--are the governorates of Menoufia (Kafr El Khadra village), Behera (Omar Makram village), the Ministry of Social Affairs, the Ministry of Land Reclamation, the Ministry of Agriculture, the Nutrition Institute, the Organization for Reconstruction and Development of Egyptian Villages, El-Nil Pharmaceutical Company, Al Badrachin Oil Company, and Misr Milk and Food Company.

Project Activities

In order to achieve its goals of serving end-users in both agriculture and industry, the project focuses on three major areas:

- Farm-related activities involving animal and agricultural studies and extension work in two demonstration villages to improve productivity and the quality of food, and to supplement farm income by introducing nontraditional, market-oriented products. Subprojects include animal nutrition (livestock), poultry raising, crop production (corn, peanuts, soya, tomatoes, onions, etc.), soil fertility, plant protection, beekeeping, raising of silkworms, and village dairy production (yogurt and cheese).

- Nutrition-related activities designed to improve the diet of nursing mothers, preschool and school children through supplemental feeding and comprehensive education. Subprojects include medical assessment of children and mothers in a selected age category, determination of nutrition deficiencies, assessment of the value of protein-rich weaning foods for use in Egypt, testing of selected food formulations in the two villages, and nutrition education programs.

- Food technology-related activities that help food industries improve processing and thereby help to make Egyptian food products more competitive in local and international markets. Subprojects include developing an improved refining process for cottonseed oil for local marketing, developing processes to use imported dried skim milk in manufacturing soft cheese, and investigating ways to improve palatability and shelf life of the protein-rich weaning food known as Supramine.

For the activities relating to farming and nutrition base line data were collected in the two demonstration sites . . the villages of Kafr El Khadra and Omar Makram. The data included social and economic analyses, nutritional and health assessments, and information on existing agricultural practices and crop productivity.

Project Status, End of December 1981

Investigative teams reported the following positive results in the two demonstration villages by the end of 1981:

- Doubling maize yields per feddan through the use of hybrid seed and introduction of improved field management practices during the 1981 growing season. In addition, the maize produced green fodder for the farm animals in September--a time when fodder supplies are scarce or nonexistent.
- Increasing tomato production by a factor of four through the expedient of wire support systems for the plants rather than conventional method without support.
- Increasing poultry production in the two demonstration villages by providing better breeds of chicks, monitoring their growth, and controlling poultry diseases. Returns on capital invested in this effort were as high as 65 percent.
- Improving honey yields and methods of beekeeping, by replacing the traditional mud cells with modern wooden cells for housing, and by improving sanitation of beekeeping operations. Yields were increased by a factor of 5 to 10.
- Demonstrating better livestock-raising practices and providing veterinary services to reduce financial losses due to early mortality.
- Implementing a nutrition intervention program to combat malnutrition and dietary iron deficiencies in infants as a means of reducing early infant mortality and accelerating linear growth of children. While the program is successfully in place, it is too early to determine its impact on the longer term health of children.

The program's food technology-related activities led to the development of a modified process for cottonseed oil refining suitable for the Al Badrachin factory. The modified process produces a better product, increases yields with lower use of refinery materials, and requires no major modification of, or additions to, capital equipment.

Similarly, the cheese subproject--in which soft cheese is made from dried skim milk--revealed new techniques suitable either for large-scale or small-scale factories that produce cheese for the Egyptian market. Cheese produced in this way was consistent in yield, composition, and quality, and was produced at lower costs than for traditional cheesemaking methods. Furthermore, the process produces a whey by-product that is recoverable and suitable for sale as an animal feed, thereby increasing net returns to the cheese industry while simultaneously decreasing the volume of waste materials that constitute a pollution problem.

Major Problems and their Resolution

One difficulty of large multi-institutional and multidisciplinary programs that has been rather successfully avoided is the isolation and lack of information sharing among the various subproject investigators. At the beginning of the More and Better Food project, a steering committee was established to have a strong management role. This committee meets regularly, is broadly representative of the participating organizations and villages, and has strong leadership. The committee chairman has sought and obtained participation and approvals from the governors of Menoufia and Behera for the conduct of demonstration projects in Kafr El Khadra and Omar Makram villages.

Good interaction between practical farmer-villagers and the more theoretical scientist-problem solvers is difficult to obtain. Fortunately, NRC/Cairo scientists have viewed their role in the village as one of participation in problems suggested by the villagers themselves, and the first tasks undertaken were those of the local people. Gradually, however,as the scientists gained the confidence of the villagers and increased their credibility, the scientists themselves could and did make suggetions that would not have been acceptable if they had been made earlier in the project. Data collection and information gathering were undertaken only after the village leaders had participated in project planning and understood the purpose of the task. In the health area, all measures were taken to ensure confidentiality and the full involvement of trusted local health care professionals in the village clinics.

As in the other demonstration and R&D projects, problems arose in Phase I relating to equipment procurement, availability of transport to the villages, and timely provision of local materials and supplies. Although all of these problems have not been fully resolved, the arrival of a special vehicle for the More and Better Food project, the installation of major new analytical laboratory equipment at the NRC/Cairo, and a plan to regulate procedures for securing local materials using project funds will be fully functioning early in 1982.

DEMONSTRATION PROJECT II: NEW CROPS FOR ARID AND SEMI-ARID ZONES

Background

Egypt in 1982 must sustain a population of over than 43 million on a total productive land area of 6.3 million feddans (1 feddan = 1.038 acre). Although intensive land cultivation and crop rotation methods expand the effective productive area to 11.2 million feddans, Egypt's continuing population growth creates an ever-increasing food deficit. With an annual growth rate of 2.4 percent, the total population

could exceed 75 million by the year 2000. Under these circumstances it is clear that there is great urgency both to extend land areas under cultivation and to improve productivity of already intensively cropped areas.

Although new lands tend to be far less productive and more subject to crop failures than those already under cultivation, methods must be found to lower risks by using scientific agriculture and sound management of the climatic regions under stress. In many arid and semi-arid regions of the world, agricultural innovations have been employed with very positive benefit-to-cost returns on investment. Thus, the New Crops for Arid and Semi-Arid Lands project was developed by the ASRT for inclusion in the Applied Science and Technology Research Program. The goals of this project, which is broader in scope than the other demonstration projects, are to:

- Find practical means to exploit new lands for the supply of food or cash crops
- Demonstrate new technologies for the production of nonconventional crops in arid and semi-arid lands
- Acquire new skills in both technical and managerial areas of agriculture
- Provide knowledge, skills, and experience for establishing settlements in new and necessarily arid environments.

The project components may be classified as short-term (less than 5 years), medium-term (5 years), and longer-term (10 years) objectives. The short-term and some medium-term objectives can be achieved during Phase II of the Applied Science and Technology Research Program, However, completion of the longer-term objectives can only be realized during an institutionalization phase after 1983 when foreign assistance in its present form is no longer available under this program.

Short-term Objectives

- Study the microclimatic and agronomic requirements of native plant species that are not commonly grown in Egypt in order to ascertain whether those species would have a high probability for successful economic exploitation in new lands.
- Train a cadre of Egyptian agricultural and related scientists in the special techniques required for successful management of environments under stress.
- Adapt foreign experience to Egyptian conditions, using new plant and animal species, techniques, and methods.
- Establish one or more small research stations to continue and extend applied work on the newly introduced agricultural species.

Medium-term Objectives

- o Make the introduction of new plant species in Egypt an accepted, standard procedure by helping farmers develop good production methods (irrigation, fertilization, field management, and harvesting), combat crop pests and diseases, and constantly optimize yields.
- o Assist industrial end-users in using new agricultural products to ensure good markets for the producer.

Long-term Objectives

- o Conduct both basic and applied research to improve genetic stocks, develop adaptations suited to Egyptian conditions, and extend their economic potential by further adaptation to regions of higher stress.
- o Join international efforts to use arid lands and saline water agricultural techniques, and develop nonconventional native plant species to extend Egypt's agricultural productivity and improve its food security.

To implement the project, the ASRT established a multi-institutional, multidisciplinary team drawn from Al-Azhar University, Ain Shams University, and the National Research Centre. The responsibilities of the groups are as follows:

- o Al Azhar University is responsible for the propagation and field studies of jojoba and guayule. Jojoba is a desert plant yielding high quantities of an oil that has excellent properties for industrial and other nonfood uses; guayule is a bush plant containing latex identical in chemical composition to natural rubber from East Indian and Malaysian tree plantations. (Dr. M. El Barkouki, Faculty of Agriculture, is the team leader, and principal investigator.)
- o Ain Shams University is responsible for introducing to the program nonconventional legumes such as winged bean, cowpea, buffalo gourd, guar, and other species. (Dr. Adel El Beltagi, Faculty of Agriculture, is the team leader and principal investigator.)
- o National Research Centre collaborates with the group at Ain Shams on nonconventional legumes and assists all project researchers on aspects of plant protection. (Prof. Dr. H. S. Abdel Rahman Salama, from the Division of Agricultural and Biological Research, is the team leader and principal investigator.)

Project Status, End of December 1981

The investigative team continued to work on project definition and design during Phase I of the program, even after the JCC approved the broad outlines of the demonstration project. Although actual

implementation commenced in mid-1980, each of the three principal groups began its activities under constraints of long lead times for arrival of equipment and lack of funds for local materials and supplies.

Al Azhar University began propagation of jojoba but did not receive a supply of guayule seeds until very early in 1982. A plant nursery was established for jojoba seedlings in the Department of Horticulture, Faculty of Agriculture. Salinity tolerance studies are under way, and work on jojoba experimental plots has been initiated in different soil types at a site near Alexandria (Maryout, where they work with the Ain Shams team) and at a Bahareya Oasis site.

Ain Shams University established a field site at Maryout where they are conducting experimental activities on salt tolerance of nonconventional legumes.

The National Research Centre has begun work to characterize plant diseases and insect pests that affect nonconventional legumes, especially buffalo gourd, pigeon pea, cowpeas, and guar. Similar work has started on the oil-producing jojoba plant varieties. In a separate effort, the NRC/Cairo team is undertaking the chemical identification of products from the euphorbia species (an interesting plant hydrocarbon species).

Major Problems and their Resolution

The arid lands project was implemented later than the other two demonstration projects, in part because of JCC requirements concerning the workplan.

The multi-institutional character of the project was different from that of More and Better Food and of Biogas Technology. The latter two demonstration projects were organized within the National Research Centre which was the "responsible" or implementing agency, whereas the New Crops project required a consortium-type management committee among the three participating institutions, who found it difficult to coordinate their efforts and plan activities together.

Because the work requires field sites remote from the three Cairo cooperating institutions, efficient transport and availability of local funds to develop those sites is essential. Local resources for field sites were not available during the 1980-81 period.

As in other projects of the overall Applied Science and Technology Research Program, equipment procurement procedures required long lead times, but deliveries began in late 1981 and early 1982. The streamlining of procurement procedures in Phase II is expected to alleviate -- but not entirely solve -- time requirements for equipment definition, specification, order, and delivery.

DEMONSTRATION PROJECT III: THE DEVELOPMENT AND APPLICATION OF BIOGAS TECHNOLOGY IN RURAL AREAS OF EGYPT

Background

Food supply, energy availability, and pollution abatement are among the most important problems faced by this and future generations in Egypt. Attention to these priorities figures prominently in the programs of the National Research Centre (NRC/Cairo) as it endeavors to serve the Egyptian people in both rural and urban sectors. The Development and Application of Biogas Technology in Rural Areas of Egypt fits well into that framework of applied scientific and technological problem-solving. The project explores ways to use vegetable, animal, and human wastes to produce energy (the "biogas" generator) and natural fertilizers under environmentally safe conditions.

Efforts to develop rural (one-family) and village-scale biogas generators in different countries of the world exhibit varying degrees of success. Chinese and Indian programs, both of which have been studied in detail by the Egyptian group, have extensive and very practical operating experience in areas such as digester design, operation, maintenance, and--most importantly--in techniques to win user participation and acceptance. But success in any one program is not easily translated into comparable success in another program. The technology must be field-tested and made compatible with existing local socio-economic conditions. Thus, the biogas technology project at the NRC has been specifically designed to explore and test the variables that determine success, which is defined in terms of rural acceptance, voluntary use, and economic viability rather than mere technical feasibility.

Succinctly stated, the project's goal is to show that applying biogas technology at the village level can be technically, socially, and economically feasible. In addition to generating the gas itself, major considerations include applying the technology to improving the village environment, producing useable fertilizer, enhancing waste treatment, and improving public health and sanitation.

The NRC/Cairo program's major activities are as follows:

1. Fact finding. Gathering of data and evaluation of experiences to provide a basic picture of the technology involved, the factors in Egyptian village customs and daily life that affect the acceptance of biogas systems, and the factors relevant to project implementation.

2. Support Services. Interdisciplinary efforts in preparing village (field) testing, providing services needed for the work, and analyzing the results. These efforts include laboratory and bench-scale research, engineering design and development,

fundamental microbiological work, fertilizer testing and evaluation, and sociological and feasibility studies.

3. Village demonstration. Demonstration of the practicality, usefulness, and cost effectiveness to the village users is the most important element in this project. Two villages were selected to test the technical and economic feasibility and village acceptance of biogas energy systems in rural application.

Project Status, end of December 1981

Fact Finding

The project team conducted a review of the literature and relevant experience gained by other groups engaged in biogas technology at the village level. A fact-finding trip to China, Thailand, and India gave particular impetus to the Egyptian project because of the opportunity to observe various biogas digester designs, their operating characteristics, and ways in which on-the-scene problems were solved. Especially important were the discussions on social acceptability and village-level training for maintenance and normal operation of various systems.

Team members also participated in international technical meetings in India and the United States in order to interact with a wide cross section of people, many from developing countries, on local approaches to biogas system design and rural applications.

Support Services

1. Village selection. Preliminary surveys were conducted in four villages, using such criteria as interest of villagers in a biogas technology experiment; representation of both traditional and new-planned village models; availability of data from government and other sources on village services, population, family statistics, and energy use; and relative proximity to the NRC/Cairo. Two villages -- Al Manawat (very near Cairo and undergoing a transition from rural to rural-urban status) and Omar Makram (160 km from Cairo and a new village on the western fringe of the Delta) -- were selected as sites for testing biogas systems.

2. Laboratory and bench-scale research. This comprises all of the digestibility research aimed mainly at achieving greatest efficiency and highest pathogen destruction rates. The biogas team investigated mixtures of cow dung, sewage, and agricultural wastes (weeds, water hyacinth, and maize/cotton stalks). Following their investigation, they decided to focus on such operational characteristics as solids concentration in digester loading, temperature effects on gas volumes and on generation rates, time-length of digestion process under various conditions,

and destruction of bacteria under operating conditions. The presence of pesticides in agricultural wastes was found to have a marked effect on the volume of gas produced.

3. Engineering and development work. This comprises all work for developing simple, reliable and inexpensive village-type biogas plants and appropriate gas-use devices. Three prototype digester units were designed, built, and operated at the NRC/Cairo by the engineering group. The group considered the entire range of construction, digester start-up, maintenance, and long-term operational parameters in order to arrive at a design that could be transferred to a village and would perform reliably. The same group evaluated prototype gas-use devices and designed, for local fabrication in Egypt, a test burner with replaceable parts for final testing in villages.

4. Fertilizer development work. This aspect includes all work relating to the assessment of digested products, such as fertilizer and soil conditioners, and necessarily must cover laboratory, greenhouse, and field testing. Based upon the work to date, digested materials show good fertilizer value (particularly with respect to available nitrogen and phosphorus) as well as favorable microbial population.

5. Fundamental microbial work. This work has concentrated in two areas: (a) suppression of hydrogen-sulfide formation during digestion, because that material adversely affects gas formation, and (b) conditions for the destruction of harmful microbial agents in the digestion process.

Village Demonstrations

Implementation of the village demonstration project began at Al-Manawat in March 1981. Two family-size digesters — each about 10 cubic meters in volume -- were built. One, a modified Indian type, was attached to a local farmer's house; the other, a Chinese model, was installed in the village collective unit. Both units have operated satisfactorily since May 1981. Operational experience on the local farmer's digester showed that gas use was much less, particularly in summer, than was originally estimated. This has the advantage of lengthening the retention period of the charge and gives the investigation team a new opportunity to optimize cost/benefits in future digester designs.

During the coming months of Phase II, the NRC/Cairo group working with Omar Makram villagers will begin the program there, continue the socioeconomic and technical evaluations in both villages, review the possibility of adding other test sites, and inaugurate a central biogas services laboratory within the NRC/Cairo.

Major Problems and their Resolution

No major technical problems have arisen that adversely affected the work or seriously delayed the schedule as projected in 1979. The interdisciplinary team has worked well together, and various opportunities for observation/study trips abroad have proved very beneficial to the project, not only from the technical and data-gathering aspects but in reinforcing working relationships and team rapport.

Mention should also be made of the good working interaction between the Egyptian team and the U.S. advisory panel. The U.S. panel consists of two engineers with specific R&D experience in biogas systems and a rural sociologist with field experience in technology transfer methodologies.

Procurement of equipment for the central biogas services laboratory has been a time-consuming process, and the lack of that equipment has held back the work at several critical junctures. As of December 1981, approximately 63 percent of the equipment had been shipped to NRC/Cairo. New procedures are expected to reduce the steps in the procurement- approval chain in Phase II.

The biogas project necessarily requires locally purchased materials and supplies to construct prototype generators at the NRC/Cairo site and test generators in Al-Manawat village. Several times when these funds were delayed, alternative arrangements--including personal loans by the researchers themselves--had to be made. Similarly, the transition from Phase I to Phase II has been hampered by a lack of funding for materials, supplies, and salary incentives. Although the problems are on their way to resolution, the lost time has lengthened the total time needed to achieve project goals.

R&D PROJECT I: EVALUATION OF EGYPTIAN PHOSPHATE ORES FOR WET PROCESS PHOSPHORIC ACID AND PHOSPHATE FERTILIZER PRODUCTION

Background

Egypt, like many other countries, faces the monumental task of increasing its domestic agricultural production in order to close the gap in food imports. Currently, food imports are meeting 40 percent of the needs of Egypt's 43 million people (based on 1981 figures). In light of a projected population growth to 75 million by the year 2000, the need to bring new, often marginal lands into production and to intensify already productive agricultural areas is readily appreciated. Thus, a growing market for locally produced phosphate fertilizers is one of the needs to be satisfied. In addition, there are demands for phosphoric acid for Egyptian industry and for other phosphate compounds in iron and steel production, pharmaceuticals, and pesticides.

Although the vast majority of the phosphate-rich ores have been consumed, Egypt has ample reserves of lower content, economically recoverable phosphates in the Eastern Desert, Nile Valley, and the Western Desert.

The Ore Beneficiation and Chemical Processing Laboratory, Central Metallurgical Research and Development Institute, which is affiliated with the National Research Centre, initiated an R&D project in 1978 to evaluate Egyptian phosphate ores for wet processing of phosphoric acid and phosphate fertilizers. The work involves technical and economic studies which must be completed before the feasibility of economic use of any type of ore can be assessed.

The project's goals are as follows:

1. To evaluate--in the NRC/Cairo laboratories--the technological problems in beneficiation of a variety of phosphate ores from the Nile Valley and Eastern and Western Deserts.

2. To complete pilot-plant design studies of the beneficiation of these ores, based upon NRC/Cairo lab results.

3. To complete laboratory and bench-scale technical and economic studies of the chemical processing of beneficiated ores to produce end-products suitable for fertilizers and for industrial applications.

Project Status, End of December 1981

NRC/Cairo Laboratory Beneficiation Tests

Laboratory beneficiation tests were completed in NRC/Cairo laboratories on phosphate ores from Abou Tartour (Western Desert), Al-Sebeia (Nile Valley), and Al-Hamrawein (Eastern Desert). The investigative team expended considerable efforts to beneficiate Abou Tartour ores both by wet and dry beneficiation methods; however, they found wet beneficiation clearly the superior route and the most economical method. Table 2 presents a summary of the laboratory results.

TABLE 2 Beneficiation of Egyptian Phosphate Ores

Ore Type	Beginning P_2O_5 Concentration	Average Sample Size	Ending P_2O_5 Concentration	Remarks
(A) Results of Laboratory-Scale Testing:				
Abou Tartour	25.6%	-1 to 0.03mm	32.8%	Attritioning and flotation
El Sebeia	24.5%	-0.5 to 0.038 mm	32.0%	Attritioning and calcination
(B) Results of Pilot-Plant Testing:				
Abou Tartour	25.6%	12 + 0.37 mm	31.5%	Flow sheet same as that of laboratory

Conversion to Fertilizers

Investigators completed batch-scale laboratory conversion of beneficiated phosphate materials to end-products suitable as fertilizer materials, with good results. Investigators were able to demonstrate the technical feasibility of converting the beneficiated materials into concentrated superphosphate (CSP) and mono ammonium phosphate (MAP) for fertilizer use.

Development of the Wet-Processing Unit

A laboratory-scale, wet chemical processing unit has been evaluated and found to be highly suitable for the NRC/Cairo's Ore Beneficiation and Chemical Processing Laboratory. This unit can convert phosphate ores to phosphate end-products suitable for small-scale testing of those products, following a design of the International Fertilizer Development Center (IFDC) in Muscle Shoals, Alabama. Two Egyptian scientists were sent to the IFDC to learn how to operate the unit and to design a modified unit for the NRC/Cairo laboratory. Because the modified unit is custom designed, procurement has taken longer than initially anticipated. Individual elements for the overall acidulation unit are on order and are now being fabricated or assembled for delivery by July 1982.

It will take six months to assemble and test the operation, and to train an NRC/Cairo operating team. Thereafter the unit will provide data that can be extrapolated to pilot-plant scale wet chemical processing.

Industry Involvement

A most important aspect of the project has been the cooperation between NRC/Cairo and Egyptian industry, represented by Kafr El Zayat Fertilizer Company and Misr Phosphate Company (El Hammrawein Project), both in the public sector. Two contracts were successively signed between NRC/Cairo and Misr Phosphate Company as a result of visits by and discussions with the project group, the U.S. panel, and the industry staff.

Training

Another valuable element of the phosphate project has been the training opportunities provided at the International Fertilizer Development Center and the laboratories of the Tennessee Valley Authority (TVA). Several Egyptians on the phosphate project team received training for:

- o phosphate ore characterization
- o laboratory and pilot-plant scale ore beneficiation
- o laboratory and pilot-plant wet chemical conversion of beneficiated materials to phosphate end products suitable for fertilizer use
- o granulation of fertilizer materials.

Plans are under way during Phase II to examine the technical-economic feasibility for marketing of phosphate materials.

U.S. Consultant Team

A consultant team from the United States made two visits to Egypt to provide technical advisory services on beneficiation, chemical conversion/processing ore characterization, pilot-plant design and operation, training, and technical economic studies. The team members were James R. Lehr, Senior Scientist, National Fertilizer Development Center, Tennessee Valley Authority, Muscle Shoals, Alabama, U.S.A.; and Owen N. Livingston, Director, Fertilizer Technology Division, International Fertilizer Development Center, Muscle Shoals, Alabama, U.S.A.

The team visited Egypt for one week in 1979 and for 10 days in 1981. Dr. James E. Lawver, technical manager for International Minerals and Chemical Corporation (IMC), Bartow, Florida, joined the team for the 1979 visit; and Prof. Douglas Fuerstenau from the University of California at Berkeley visited the project team for one week in 1979. Both Americans, who are specialists in ore beneficiation, shared their extensive industrial experience to help orient their Egyptian colleagues to world phosphate fertilizer production and marketing.

Major Problems and their Resolution

The ore from Abou Tartour presented the following technical problems:

1. Lower P_2O_5 content and higher content of gangue minerals, mainly iron, aluminum, and magnesium.
2. Extremely fine dissemination of pyrite with the phosphatic bone canals.
3. Different forms of magnetic dolomite which are partly included in the phosphatic matrix.
4. High content of organic carbon.

The Abou Tartour ore does not satisfy the requirements for wet-process phosphoric acid and phosphate fertilizer production. Its high carbonate content causes foaming problems during acidulation. The fine pyrite stabilizes the foam and causes filtration problems; the high magnesium content of the ore affects the viscosity of the acid and determines its concentration.

The greatest inconvenience to the project has been the long time period required to specify, procure, and ship the wet-process acid unit. In part, this is due to the fact that it is a specially designed facility made up of equipment procured from several sources.

There will be no central receiver in the United States where the elements of the wet-process unit can be assembled and tested prior to shipment to Egypt. Although not absolutely necessary, proof testing of the special design prior to assembly in Egypt would have been desirable.

R&D PROJECT II: CORROSION CAUSES AND CONTROL

Background

Corrosion is an ever-present phenomenon, and is normally destructive of man-made materials. The U.S. National Bureau of Standards in 1976 estimated that 40 percent of U.S. steel production goes directly for replacement of steel destroyed by corrosion. Some estimates of annual corrosion costs in industrialized countries have been as high as 2 - 4 percent of the gross national product for those countries. Similar and even higher estimates have been noted in developing countries. In Egypt the Central Metallurgical Research and Development Institute of the National Research Centre--together with the Ministry of Industry--expects to publish a report late in 198[illegible] detailing corrosion costs in Egypt and making recommendations for reducing those costs. Thus, from empirical data as well as from studies of actual economic costs of corrosion, one must conclude that R&D to alleviate the effects of corrosion and to understand the basic phenomenon are amply justified.

Recognizing the need to reduce corrosion costs in Egyptian industry, the NRC/Cairo's Laboratory of Electrochemistry and Corrosion in 1979 proposed a special program within the framework of the Applied Science and Technology Research Program. The program has two major goals:

- To develop corrosion inhibitors using primarily domestic raw materials, with a focus on problems in the Egyptian petroleum industry, and
- To establish a modern, well-equipped corrosion laboratory in the NRC/Cairo that is capable of dealing with practical problems and providing technical services to industries.

In order to achieve these two major goals, the following program elements were developed:

Applied Corrosion Activities (Development of Corrosion Inhibitors)

- A working relationship was established with the Suez Oil Refining Company (Egyptian public sector) to identify critical corrosion sites in the Suez refinery, monitor the situation, analyze the data in light of known corrosion mechanisms, and prepare and test corrosion inhibitors.

- Training of refinery personnel on corrosion monitoring and control was undertaken in order to begin establishing links between NRC/Cairo and the Suez refinery.

Strengthening NRC/Cairo's Resource Base to Solve Applied Corrosion Problems

- Observation/study and training opportunities were provided in the United States to enable participants to interact with R&D departments in two large petroleum refineries, participate in technical meetings of the U.S. National Association of Corrosion Engineers, visit university and other corrosion research groups, and obtain training on specific, highly sophisticated corrosion monitoring equipment.

- Major items of new equipment were identified and provided to the NRC/Cairo laboratory. This included the X-ray photoelectron spectroscopy and scanning auger microscope (ESCA/SAM) unit for measuring surface corrosion effects.

- Fundamental studies on galvanic and pitting corrosion were conducted to increase understanding of corrosion reaction mechanisms and to design preventive measures in factories and laboratories.

Project Status, End of December 1981

Applied Corrosion Activities

The National Research Centre's close working relationship with the Suez Oil Refining Company provided them access to plant inspection and maintenance records, thus enabling NRC/Cairo staff to locate the refinery sites where corrosion attack occurs. Corrosion-prone sites were inspected, characterized, and related to the main cause of failure. Recommendations for every case were given to the company both in the form of an immediate, quick remedy and a long-term monitoring scheme involving desalting (of crude), periodic analysis, careful pH recording, and inhibitor injection.

Ten aqueous extracts of plant origin were prepared and tested in the laboratory as inhibitors for the corrosion of steel, zinc, aluminum, and copper in solutions of different concentrations; composition inhibition efficiencies as high as 85 percent were recorded. These corrosion inhibition materials tested in an electric power station during metal cleaning and descaling processes.

In addition to the above inhibitors, some amine derivatives of linseed oil and oleic acid were prepared and evaluated in the laboratory and proved their inhibiting efficiencies in corrosion of steel both in the liquid and gas phases. Larger quantities of the more efficient formulations are now being prepared for evaluation in the refinery.

Strengthening the NRC Resource Base for Corrosion Studies

A major purchase of equipment for determining surface phenomena in solids was acquired by the NRC/Cairo Laboratory of Electrochemistry and Corrosion through the program. The unit, an X-ray photoelectron spectroscopy and scanning auger microscope (ESCA/SAM) instrument, is valued in excess of U.S.$400,000 and is the only one of its kind in the Middle East outside Saudi Arabia. It will enable the laboratory to make precise surface chemical and physical measurements of corrosion, to facilitate introduction of foreign ions from impurities, and monitor the effect of inhibitors on surface phenomena. Moreover, this piece of equipment is available to assist other research laboratories and industries in Egypt concerned with solids of specified surfaces.

Training in the use of the ESCA/SAM unit was arranged for two NRC/Cairo scientists. Additional training opportunities will be included in Phase II, because the analysis and interpretation of data from the instrument require a wide variety of experiences under highly technical conditions.

Fundamental studies were completed of galvanic corrosion inhibition in aluminum coupled to stainless steel or copper. Irrespective of industry, almost every manufacturing plant uses different metals in close contact with one another. Dissimilar metals, when in contact with one another in a conducting medium, exhibit galvanic corrosion. The aluminum-stainless steel and aluminum-copper couples selected for these tests were chosen because of their simplicity and because these combinations are common in industry.

Similarly, fundamental studies of pitting corrosion were completed for conditions of cold working of carbon steel. Combating pitting corrosion of 18/8 stainless steels through the use of various additives showed that some aliphatic mono-, di-, and triamines were the more efficient inhibitors.

Major Problems and their Resolution

Technical problems of maintaining the ESCA/SAM instrument in reliable working condition are formidable. Although special precautions have been made in outfitting the laboratory to ensure the proper environment, such factors as temperature, humidity, and dust can affect overall operations and sensitivity to measurement. In addition, normal maintenance procedures must be done by technicians with special training. A supply of spare parts is maintained, and a contract with the manufacturer for periodic maintenance has been signed.

Interpretation of data from the ESCA/SAM unit is also a specialized skill. Although two NRC/Cairo staffmembers have had introductory training on the instrument, further assistance in the form of a visiting consultant for approximately two weeks is planned late in 1982.

Corrosion monitoring in the refinery is delayed because of long procurement lead times for certain key items of equipment and because of maintenance scheduling at the refinery itself. A particular cause of corrosion, the desalter unit, needs to be taken off-line and modified, but this action is one that management at the refinery must arrange so that overall down-time in operations is minimized.

R&D PROJECT III: IMPROVING THE PROCESSING OF WOOL SCOURING AND WOOL WAX RECOVERY

Background

Egypt imports about 8,000 metric tons of raw wool annually for domestic consumption and export, all of which is processed at the Misr Beida Dyers Company (a public-sector enterprise). Two products result

from wool scouring: (a) wool tops, the thick, untwisted wool fibers that are used to make worsted yarns and textiles, and (b) crude wool wax, a mixture of natural waxlike materials which, when further processed, have applications in pharmaceuticals and cosmetics.

The wool scouring and wool wax recovery R&D project is designed to link the National Research Centre's Textiles Research Laboratory with the management of the Misr Beida Dyers Company in a joint problem-solving activity with the following goals:

- Improve the economic efficiency of wool scouring
- Improve the quality of the wool tops
- Recover high-quality wool wax by-products for local and export markets
- Reduce consumption of heat, water, and chemicals in the scouring and de-waxing process
- Reduce amount of waste that is discharged to the environment.

The project elements that have been included in the Applied Science and Technology Research Program since the beginning of Phase I (early 1979) are as follows:

1. Analysis of the operational wool scouring, wool tops, and wool wax recovery steps at the Misr Beida Dyers plant near Alexandria.

2. Survey of the literature and, wherever possible, on-site appraisal of wool-scouring techniques used in the industry throughout the world.

3. Research and development at the National Research Centre and at the plant as a basis for recommending changes in the present process, or for replacement by newer, more economically efficient processes for wool scouring and wool wax recovery.

4. Studies in Egypt and abroad to assess present and potential markets for by-products of the wool scouring process.

5. Research and development on appropriate processes for Misr Beida Dyers to become a producer of lanolin and a range of other derivatives from by-products of the wool-scouring process.

6. Reduction of effluents from the process of wool scouring and wool wax recovery as a step in pollution control.

Project Status, End of December 1981

Analysis of the wool-scouring process at the Misr Beida Dyers plant was completed by September 1979. This early completion date was made possible because the company's director authorized and funded the

installation of a monitoring laboratory in the wool-scouring area of the factory. Thus, data could be continuously gathered on actual wool-scouring runs. In effect, the manufacturing plant itself became a "pilot plant" for data collection and validation. The joint NRC/Cairo-Misr Beida Dyers team then conducted analyses of the wool-scouring process, its operational characteristics, and the problems to be solved.

The literature survey of wool-scouring techniques was also completed by September 1979. Early in the same year Dr. A. M. A. El Borai, Chairman and Managing Director of Misr Beida Dyers Company, visited (at no cost to the project) both the R&D laboratories of the Commonwealth Scientific and Industrial Research Organization in Australia, to investigate the "Lo-Flow" process for wool scouring; and the New Zealand Wool Bureau, to observe the "WRONZ" wool-scouring process. In January 1980 Drs. A.A. Kantoush and A. El Bendak visited the United States to discuss wool wax separation/conversion into lanolin and other products, and the United Kingdom, to study pilot-plant development of the "Lo-Flow" process at the International Wool Secretariat research facilities. They also visited France (at NRC/Cairo expense) to observe wool-scouring techniques in a French producer's manufacturing facility.

In its 1980 progress paper, the project team presented a technical report on R&D as a basis for improving the present wool-scouring methods at the Misr Beida Dyers plant. A decision was reached to recommend improvement of the present scouring process by replacing soap with synthetic detergents and by installing continuous-flow centrifuges and necessary auxiliary equipment of special design for wool wax removal. This in effect constitutes a replacement of the old acid-cracking method for wool wax separation by the centrifugal separation process.

Marketing studies for by-products of wool scouring have been started and will continue into Phase II. Because the modified scouring technique is expected to improve recovery of wool tops by about 3 percent and to increase the average fibre length (thereby assuring a product of high quality), the economic investment in a new scouring system can be fully justified. Recovery and marketing of high-quality wool wax by-products would provide an opportunity to increase revenue in the wool-scouring process. Reduction of wool-scouring effluents as a step in pollution abatement awaits installation of the centrifuges and operation of a new scouring system.

Major Problems and their Resolution

There have been no insurmountable technical problems in the R&D conducted at either the National Research Centre or the Misr Beida Dyers Company. The team of scientists and management personnel has worked smoothly to institute all steps necessary to analyze the problems and reach satisfactory solutions.

During the course of the study/observation visits to the International Wool Secretariat in Great Britain, it became apparent that one solution to improving wool scouring at Misr Beida Dyers lies in continuous centrifuge techniques rather than marginal improvements in the batch process acid cracking techniques now in use. Thus, a basic change in the R&D program became possible; that is, full-scale testing of the centrifuge technique on one operating line (of three) at the factory itself. In effect, one production line at the factory could be set up as a "pilot plant," and the intermediate scale-up step originally planned at NRC/Cairo could be eliminated.

The most profound consequence of the change in plans meant a change in scale of the "pilot-plant" equipment. After some delays in justifying the change in R&D plans, the following agreements were reached:

1. With project funds, three continuous-operation centrifuges are being purchased from the Alfa Laval Company (home office: Stockholm) for a total of $192,810.

2. Misr Beida Dyers is purchasing from Alfa Laval Company the necessary pumps, valves, heat exchangers, piping, control panel, and auxiliaries to complete one "processing line" for wool scouring and wax recovery in its factory. The estimated cost is about $100,000. Misr Beida Dyers will also pay all costs for installation of the centrifuges and auxiliary equipment for the new processing line.

3. The processing line will be available as a pilot plant for the NRC/Cairo-Misr Beida Dyers team for the period remaining in Phase II (end of September 1983). During the period from installation (June 1982) until the end of Phase II the team will finish its R&D to demonstrate improved operating efficiencies in wool scouring, determine optimum operational parameters for improved product and for pollution abatement, and allow training to be conducted for appropriate NRC/Cairo personnel on the scouring line.

R&D PROJECT IV: DEVELOPMENT OF RED SEA FISHERIES

Background

The Egyptian diet is generally deficient in animal protein, and efforts to increase animal food supplies are hampered by shortages of cultivable land. On the other hand, increased harvesting and consumption of fish -- both freshwater and saltwater — offer a viable alternative to raising livestock and other land animals. Per capita annual fish consumption in Egypt is in the range of 4 to 5 kg, compared with a world average of 9.5 kg. Initiating freshwater fish production in Lake Nasr behind the High Dam and increasing the catch from the Red Sea offer attractive possibilities for augmenting the supply of fish for Egyptian markets.

However, before the commercial value of Red Sea fisheries can be considered as a priority investment target in Egypt's economic development plan, several areas must first be evaluated. For example, both the Gulf of Suez and areas as far south as the Egyptian/Sudan border need systematic assessment of the fisheries stock; further prereqisites are a more thorough understanding of the ecosystem as well as the economics of exploiting these fisheries.

To address these needs, the Egyptian Institute of Oceanography and Fisheries proposed an R&D study project in Phase I with the following broad goals:

- To assist in developing fisheries in the Gulf of Suez and neighboring areas of the Red Sea
- To determine the inputs required to expand commercial fishing in those areas
- To improve the understanding of the biological productivity of the region
- To develop an administrative plan for studies and eventual commercial exploitation of the fisheries resources.

At the specific request of the Joint Consultative Committee for the Applied Science and Technology Research Program, a plan was approved to focus the study on fisheries resources near Foul Bay in the far southern region of the Red Sea, where significant quantities of fish were known to exist. Four subprojects assessing pelagic (open-sea) schooled fish, deep-water shrimp, reef fish, and spiny lobster were identified as top priority. In each subproject, the goal was to determine the relative abundance of the species for commercial development and seasonal availability. Once the size of the fisheries resources was known, it would then be possible to assess commercial viability in terms of investment in the human and physical infrastructure (i.e., boats, freezing and/or other production facilities), transport needs, and other areas.

Project Status, End of December 1981

Background information on the artisan and commercial fishing along the total length of the Egyptian Red Sea coast was obtained by visits to the cities and villages. Qualitative impressions and some quantitative catch data were collected, particularly relating to pelagic fish landed at Suez and Al Ghardaga.

Two fisheries biologists from the Egyptian Institute of Oceanography and Fisheries took a 15-day trip in 1981 aboard a fish seiner in Foul Bay to observe species of reef fish caught, their average size, and estimated weight.

Preliminary marketing studies at Al Ghardaga indicated that 70 percent of the fish landed went by refrigerated trucks to Cairo and the principal markets in the Nile Valley. The remainder of the catch was sold locally.

No quantitative assessment of the supplies of spiny lobsters or shrimp has been made.

One trainee, Mr. Sherif Ramadan, spent 8 weeks during 1981 in the United States in a special training/study program on lobster fisheries, which was organized by Dr. Harvey Bullis (fisheries consultant). The program included two weeks studying spiny lobsters, aboard a boat operating from Charlotte Amalie, St. Thomas, U.S. Virgin Islands. Mr. Ramadan is the team leader for the subproject on spiny lobsters.

Major Problems and their Resolution

Perhaps the major problem encountered in the project has been the lack of a station that is permanently manned by scientists and technicians at the Red Sea site. Personnel from the Institute of Oceanography and Fisheries are located mainly at Alexandria and Cairo. There is a small station at Al Ghardaga. To date, there is no plan to maintain a station or renewable base at or near Foul Bay on the Red Sea for a definite, continuous period for purposes of the study.

Although team leaders have been appointed for the four subprojects (pelagic fish, reef fish, spiny lobsters, and shrimp), no specific project plan has yet been communicated in writing to the ASRT and the Joint Consultative Committee. Because drafting project plan has been delayed, a more complete definition of the fisheries equipment required at the site has not been made. Thus, adequate specifications for equipment orders are not in hand and equipment orders have not been completed.

R&D PROJECT V: PREPARATION OF SELECTED PHARMACEUTICAL CHEMICALS
(Note: Project started in Phase II, August 1982)

Background

Although the Egyptian drug industry is one of the most active and profitable in the public sector, it is still essentially a formulation and packaging industry heavily dependent upon imports. The local industry has a good reputation for production of natural drugs, but it has made only marginal progress in the area of synthetic drug products. By increasing local production of pharmaceuticals and fine chemicals, Egypt could reduce its dependence upon imports, lessen the amount of foreign exchange expended on essential imports, and create a multiplier effect leading to still further expansion of local drug manufacturing.

The specific goal of the R&D project on the Preparation of Selected Pharmaceutical Chemicals is to characterize the types of technology that could be recommended to local industry for the commercial production and marketing in Egypt of a limited number (4 to 6) of pharmaceutical chemicals. The project will draw on the experience and capabilities of the National Research Centre's Division of Pharmaceutical Industries and that of the pharmaceuticals companies themselves, with the broader goal of achieving greater self-sufficiency in drug manufacturing.

Elements of the project are to be as follows:

1. Pre-laboratory Stage
   Formation of a steering committee that is broadly representative of the Egyptian drug industry; selection of the products to be given highest priority based upon a careful market analysis of needs and upon availability of information in the open literature on the commercial production of the selected chemicals.

2. Laboratory-scale Stage
   Investigation in the laboratory of each step in the chemical preparation of each proposed product, followed by a judgment on whether to continue based upon technical and economic data.

3. Pilot-plant Stage
   Scaling-up of the laboratory-scale process information to the pilot-plant stage using already existing facilities of the NRC/Cairo insofar as possible. (Time and funds will not permit the building of special pilot plants, but some new items of equipment or instrumentation may have to be purchased.)

4. Complementary Activities
   Development and adaptation of batch-type production techniques meeting pharmacopial standards of purity and safety; monitoring of the production operation of any given product and testing of end-products for reliability.

5. Definition of the Proposed Technology
   Studies in close cooperation with, and incorporating experts from, Egyptian pharmaceutical industries to characterize fully the proposed production methods.

6. Concluding Activities
   Reporting fully on the experience gained from each of the stages in order to ensure understanding of the project and the means of achieving the desired results. A detailed technoeconomic evaluation for each of the proposed products will also be prepared.

Project Status, End of December 1981

One U.S. specialist, the president of a major pharmaceuticals manufacturing company, visited Egypt briefly in August 1981 to discuss the proposed project. He was supportive of the idea but at the same time recommended a parallel effort involving greater participation of Egyptian pharmaceuticals/chemical industry in the commercialization of chemical entities.

Further activities await the assignment of a budget for local materials and supplies. This is expected to occur during the January March quarter of 1982.

R&D PROJECT VI: INVESTIGATION AND EVALUATION OF EGYPTIAN BENTONITES FOR INDUSTRIAL APPLICATIONS
(Note: Project started in Phase II, August 1981)

Background

Egypt is blessed with a wide range of mineral resources which, after further technoeconomic investigation and in some cases specialized research and development (R&D), may be exploited for domestic and foreign markets. Among the resources having a very promising potential for local markets are clay minerals.

The R&D project, "Investigation and Evaluation of Egyptian Bentonites for Industrial Applications," deals with bentonite clays, a class of clay-mineral compounds that absorbs many times their own weight of water to become nearly impervious to further passage of liquids. This property is useful in land reclamation, where bentonites can act as a basic barrier below sandy soils to prevent the escape of irrigation water and soluble fertilizers. Bentonites can also be changed by chemical modifications, either acidic or basic, to provide materials for binders in foundries, bleaching materials in the decolorization of vegetable and mineral oils, drilling muds for oil wells, catalyst carriers in chemical industries, extenders for insecticides and other chemical products used in relatively high volume. They are also useful as soil stabilizers in the construction industry and as a finishing material in pulp and paper making.

Bentonite clays occur in at least three locations in Egypt in quantities of potential economic significance. This R&D project will consist of two parallel activities (I and II) using clays from the three locations followed by industrial testing (Activity III)of the materials produced in the laboratories of the Central Metallurgical Research and Development Institute (CMRDI) of the National Research Centre (NRC/Cairo).

Activity I: Pilot activation of samples from the El Fayoum site. (These materials have already generated interest as to their quality and usefulness after laboratory-scale testing.)

Activity II: Characterization and laboratory-scale studies of bentonite materials from two additional sites -- near the Cairo-Alexandria desert road and at Wadi El Natroun.

Activity III: Industrial testing of activated bentonite samples for different applications. Four public sector companies -- foundries, oil and soap, petroleum, and ceramics -- plus the Ministry of Land Reclamation and Ministry of Agriculture, will participate in testing and evaluation.

Project Status, End of December 1981

A comprehensive survey of the literature on activation and application of bentonites has been prepared, based on the detailed working plans of the different research groups.

A representative technological sample (15 tons) from El-Fayoum site was collected. Optimization of laboratory-scale acid and alkali activation processes was performed; the activated samples are being tested technically by petroleum, oil, and soap companies.

The research groups began laboratory and field testing of the effect of bentonites on the physical and chemical properties of sandy soils. They did reconnaissance of two new areas for bentonite recovery. The groups also prepared lists of the desired experiments for a U.S. panel and submitted specifications for the required equipment and for training programs in the United States. Similarly, a budget breakdown and lists of local materials and supplies were prepared and submitted.

Major Problems and their Resolution

Due to unforeseen delays in contractual and administrative arrangements, the project has not been able to proceed on the original time schedule.

It is anticipated that an initial visit by a U.S. consultant will be arranged during the first quarter of 1982 and that the local materials and supplies budget will be assigned to the project. Training is planned prior to pilot-plant activation tests.

CHAPTER 3 TRAINING ACTIVITIES

INTRODUCTION

In 1974 the Academy of Scientific Research and Technology (ASRT), U.S. National Science Foundation, and U.S. National Academy of Sciences (NAS/NRC) jointly sponsored a "Workshop on Science and Technology Policy, Research Management, and Planning" in the Arab Republic or Egypt. One important conclusion arising from the workshop was the need for strengthened R&D management systems in Egypt. That conclusion was incorporated into planning for the Applied Science and Technology Research Program, which was launched with financial sponsorship of the U.S. AID and the government of Egypt in 1978. The program design included an R&D management training program as well as other short-term technical training opportunities (generally for periods of one to three months). Emphasis was given to making training opportunities flexible to meet the specialized needs of the demonstration and R&D projects. Similarly, within those program elements administered by the National Science Foundation, training was provided both in the science and technology information activity and in the maintenance and repair of scientific equipment.

RESEARCH AND DEVELOPMENT MANAGEMENT TRAINING

In recent years the special need to improve management systems for R&D activities, both in the private and public sectors, has become increasingly important. There is general recognition of the economic as well as technical factors in R&D, and of the need for timely scheduling, progress reports, and evaluations as management tools. Requirements for accountability of manpower and financial inputs demand management skills and the full-time attention of administrators who understand science and technology. Because neither the ASRT nor its associated research institutes had developed integrated R&D management systems, considerable attention was devoted by planners of the Applied Science and Technology Research Program to training opportunities for R&D managers.

By 1978 both the ASRT and the National Research Centre (NRC/Cairo) were instituting organizational changes to strengthen their overall management procedures. The NRC/Cairo, for example, established an internal contracting system whereby new projects in the various divisions and laboratories were subjected to review and analysis prior to approval. Whenever external funding was sought, project proposals were first given internal peer reviews, including questions about the objectives of R&D, examination of proposed implementation plans, review of R&D methodology, and analysis of budgets and research schedules. These processes led the director of the NRC/Cairo to create a planning and programming office, a marketing office, and a technical-economic

review staff. All positions were part time, staffed by competent researchers having experience and leadership potential but not necessarily the specialized training in R&D management methodologies. Thus it was natural that opportunities for R&D management courses, seminars, and workshops be incorporated as an important element in the program with the NAS/NRC.

To initiate the R&D management training program, the ASRT and NAS/NRC decided to subcontract with the Denver Research Institute (DRI) to offer a series of seminars for Egyptian participants at the top management and program management levels. In 1979 four seminars were offered at DRI in Denver, Colorado. Another was organized in Cairo, Egypt, early in 1980. These seminars or short courses were designed with the following objectives in mind:

1. To provide operating management of the ASRT, the NRC/Cairo, and other associated research institutes with an overview of contemporary research and development management practices
2. To form, especially within the ASRT and NRC/Cairo, a management development nucleus for a self-sustaining program of education and application of sound R&D management principles
3. To assist top management officials of the ASRT and NRC/Cairo in evaluating and strengthening their in-house efforts to reorganize management
4. To introduce specific knowledge and to develop new skills in such areas as technology assessment, technical-economic analyses, and marketing of research services.

The four training seminars offered at the Denver Research Institute during the summer and fall of 1979 were:

1. Management Practice in the Research Environment, June 18-July 7, 1979 (11 Egyptian participants). The initial 3-week workshop was designed to give an overview of "management fundamentals," with emphasis on R&D proposal preparation, cost-accounting principles, selection and management of research personnel, organizational systems for directing and leading applied R&D institutions, sponsored research and sponsor relations, evaluating and controlling R&D progress, and marketing.

2. Technoeconomics for R&D, July 9-27, 1979 (10 Egyptian participants). The technoeconomics seminar addressed important questions relating R&D costs to expected benefits in the Egyptian context. Technoeconomic studies are useful in identifying potential new areas for R&D as well as bridging the gap between market-oriented managers and the scientist-engineers called upon to solve problems. The workshop included an introduction to macro- and microeconomic concepts of planning and analysis; quantitative methods in economics; sources, uses,

and limitations of social and economic data; formalized methodologies for cost/benefit analysis; nature and content of technical feasibility studies; technological forecasting; and uses and limits of technoeconomic approaches in project evaluation.

3. Research and Development Marketing, August 20-September 7, 1979 (9 Egyptian participants). One of the weakest links in a typical government-supported applied research institution is the linkage to beneficiaries, be they industrial, agricultural, or individual consumers Explaining the capabilities of an R&D organization and then demonstrating its market orientation to nontechnically trained managers and decision makers in the public or private sector is a most difficult task. The relationship between a particular R&D effort and economic pay-off in the short run is often hard to document. Nevertheless, economists have shown that returns from R&D are among the best investments any sponsor can make, if that sponsor is concerned about long-term profitability. This workshop focussed on examining the special characteristics of the R&D marketplace, proprietary rights of clients, the nature of intellectual property, the controversy about appropriate technologies, the characteristics of multinational corporations and their R&D activities, market forecasting and other research methods, costing of R&D services, incentives for researchers, tax implications of R&D, and investment alternatives for the R&D sponsor.

4. Research and Development Technology Assessment, September 10-28, 1979 (11 Egyptian participants). Technology assessment examines the relationship between human, institutional, financial, and technological factors and national development objectives. It represents an effort to weigh alternative strategies and to anticipate their probable impact on national development. Current methodologies of technology assessment are multidisciplinary; moreover, they are in a state of flux and are subject to political and economic forces as well. Thus, although end results may use the best techniques of operations research and system analyses, they are subject to political as well as economic criteria. The DRI course was divided into a two-week examination of methodologies and principles, and a one week review of the experience (in Washington, D.C.) of the U.S. Congressional Office of Technology Assessment and of the Division of Policy Research and Analysis of the National Science Foundation. Discussions focused on an overview of the role of technology assessment in national development planning, evaluation of methods for the social and/or environmental impact studies of technology choices, use of predictive and retrospective methods of technology assessment, and technology requirements for national resource planning.

A list of Egyptian participants in the R&D management workshops held in Denver is given in Annex D.

During February 6-11, 1980, a survey-workshop on management aspects of science and technology was conducted at Cairo University, involving 71 Egyptian participants representing the following groups:

- 37 from universities representing the levels of dean and vice-deans of faculties
- 14 from ministries representing the levels of research directors and assistant directors
- 20 participants from the ASRT and its affiliated research institutes representing the levels of institute directors and department heads.

The survey-workshop was offered by a group that included DRI senior staff who had been responsible for the four seminars held in the United States, two invited senior R&D managers and planners from Egypt (Dr. Ibrahim Helmy Abdel-Rahman, Advisor to the Prime Minister and former Minister of Planning, and Dr. Mohamed B. Fayez, ASRT Vice President and Head of the NRC/Cairo Division of Pharmaceutical Industries and Natural Products Research), and by Egyptians who had participated in the DRI seminars.

The diversity in technical background and experience of the Egyptian participants, the management perceptions that each one brought to the workshop, the short duration of the workshop (one week), and the admittedly "experimental nature" of this overview of R&D management principles, brought mixed reactions during the workshop evaluation. As an introduction to a complex subject, the value of the workshop to the participants was evident. Unfortunately, it was not possible to include a series of follow-on exercises of a more in-depth nature.

However, additional R&D management training and institutionalization activities are included for Phase II. Development of actual Egyptian case studies (management experience in various industries) is expected as one element of the new program. Another element involves forming teams or task forces to work specifically on technical-economic studies and marketing studies at NRC/Cairo and on technology assessment studies at both NRC/Cairo and the ASRT.

PHOSPHATE ORE BENEFICIATION AND CHEMICAL PROCESSING

Within the NRC/Cairo's Central Metallurgical Research and Development Institute (CMRDI), the Ore Beneficiation and Chemical Processing Laboratory developed a core group concerned with development problems in Egyptian iron and steel production. This experienced group formulated the R&D proposal to evaluate the feasibility of using

low-grade Egyptian phosphate ores for fertilizers. The group included experienced chemical engineers, mineralogists, and chemists but none had specialized experience with complex phosphate minerals. The U.S. technical panel which began working with the Egyptian group early in the project made the following recommendations: that staffmembers participate in technical conferences which are regularly scheduled on an international basis in the phosphate fertilizer industry; that visits be made to commercial beneficiation and chemical conversion facilities in Western Europe and the United States, and that longer training and study assignments be undertaken at phosphate pilot-plant facilities of the International Fertilizer Development Center in Muscle Shoals, Alabama, USA (Table 3 presents a summary of these training and observation/study visits).

Three of the training activities are particularly relevant to the phosphate fertilizer development and evaluation capability of the CMRDI.

TABLE 3 Training and Observation/Study Visits

Date	Period/Place	Participants	Purpose	Principal Results
10/78	2 weeks, U.S.	Dr. Aziza	a)Orientation with U.S.phosphate fertilizer industry b)Inspect training site for Egyptian scientists/engineers	Selection of IFDC as principal training site for program
10/79	10 weeks, IFDC	Dr.S.I.Mostafa Dr.A.K.Ismail	Training on: a)Pilot-plant scale ore beneficiation b)Laboratory and pilot-plant scale wet chemical processing	Design of a wet chemical processing unit for NRC
10/79	4 weeks, IFDC, TVA IMC and Davy Mackee(Florida)	Dr.T.R.Boulos Dr.S.M.El-Nozahi	Study visit concerned with equipment (pilot-plant scale) and commercial beneficiation methods in phosphate industries	Equipment selection; flow-sheet design of of phosphate ores with pyrites
4/80	1 week, U.S. 2 weeks Europe	Dr. Aziza Dr. Boulos	U.S.: International Congress phosphorus materials. Europe: beneficiation/ processing ores	Information exchange; technical study and evaluation commercial system
9/80	2 weeks, U.S.	Dr.A.F.Sabry	Observation/study commercial phosphate processing	Link Egyptian and U.S industrial phosphate producers
9/80	8 weeks IFDC/TVA	Dr.S.El Afifi Dr. A. Saber	Training IFDC/TVA pilot plant, chemical conversion phosphate ores	Planning Phase II of R&D project
9/81	3 weeks	Dr.Aziza Dr. Boulos	Technical aspects of fertilizer manufacturing	New methods for calcinating Eastern Desert phosphate ores
11/81	3 weeks	Dr.S.F.Estefan Dr.T.A.Lawendy	Training--fertilizer granulation technology	Evaluation--Phase II (and post-Phase II) marketing of Egyptian phosphate materials

Beneficiation and Wet Chemical Processing Studies

In late 1979 two Egyptian chemical engineers spent 10 weeks working at the bench-scale and pilot-plant scale beneficiation and wet chemical conversion facilities of the International Fertilizer Development Center (IFDC). These facilities are perhaps unique in that they are a contract laboratory exclusively for phosphate ore materials. They are not associated with a particular type of ore or a single commercial enterprise. No university in the United States or elsewhere has developed the breadth of experience and training potential that presently are available at the IFDC and the corresponding fertilizer development division of the nearby Tennessee Valley Authority.

The 10-week training program helped the Egyptian participants broaden their perspective and apply what they learned to operational procedures at their laboratories in Cairo. A second result of this training experience was the adaptation of a bench-scale wet-processing design for incorporation into the CMRDI laboratory. A wet chemical conversion or processing unit based upon the U.S. design has been procured under the R&D project (estimated cost of $12,000) and is expected to be in operation in Egypt late in 1982.

Pilot-Plant Studies, Wet Chemical Conversion to Phosphate Materials

Although the CMRDI has a multipurpose ore beneficiation pilot plant, it has no pilot-plant scale facility for the conversion of beneficiated phosphate materials to fertilizers. Indeed, a multipurpose pilot plant for such wet chemical conversions is not considered feasible. At the same time there is the need for such studies if the low-grade Egyptian materials are to be evaluated for commercial upscaling. Economic feasibility studies simply cannot be made from bench-scale wet chemical processing data. (Bench-scale data are based upon a few tens of grams of through-put; reliable data for commercial evaluation requires a pilot plant capable of steady-state through-puts of 500 to 1,000 kg per day and an investment of $1.5 to $2.0 million in facilities.)

To understand more fully the parameters involved in pilot-plant wet chemical processing, two Egyptians spent eight weeks at the IFDC working at the pilot plant (including shift-work) in 1980. Their experience has enhanced the ability of CMRDI to judge this pilot-plant design and operation and participate in the long-range planning for a similar facility.

Fertilizer Granulation Studies

The proposed phosphate fertilizer development facility based at the CMRDI must include a capability for agronomic testing simulated on-farm conditions. Thus the physical form of the experimental fertilizer materials is all important. The center in Muscle Shoals has specialized in "granulation technology" and conducts 3 to 4 week training courses in

granulation of solids for fertilizer application. Two staff members of the Ore Beneficiation and Chemical Processing Laboratory, CMRDI, attended one of those sessions at Muscle Shoals, Alabama, in November 1981.

STUDY AND OBSERVATION VISITS

Since most of the Egyptian scientists, engineers, and other specialists are highly trained and experienced in their fields, the kind of training needed is best characterized as "continuing education," which includes updating in technical specialties that are advancing rapidly; short-term, hands-on experience with novel equipment or research techniques; participation in technical conferences where the breadth of experience exceeds that which would normally be associated with any one country; short-term research conferences in a leading laboratory or with highly specialized research teams; and comparative visits to several research laboratories to gain information that can be incorporated rapidly into the work of the visiting researcher. The Applied Science and Technology Research Program has sought to provide these opportunities through study and observation visits of Egyptians to the United States and elsewhere. The diversity, flexibility, and utility of this kind of training is highlighted in the following examples:

- More and Better Food. Study and observation visits have been undertaken to gather information on statistical evaluation techniques in nutrition experiments; pesticide management practices, with emphasis on integrated control systems; vegetable oil processing, with special concern for nutritional factors; soil fertility and micronutrients; and advances in plant genetic research.
- New Crops for Arid and Semi-Arid Zones. Concern has been given to new crops, such as jojoba, guayule, and the winged bean; irrigation practices for good water and salinity management; plant propagation; study of alleviation of heat stress in crops; and design of experiments.
- The Development and Application of Biogas Technology. An extensive visit was made to India, Thailand, and China to observe operational characteristics of rural biogas systems prior to fixing any designs for trial in Egypt; discussions were arranged in the United States on the biochemical characteristics of fermentation to apply newer principles and practices that make digesters more reliable; and conferences were arranged on engineering designs of biogas digester "hardware" with the goal to decrease costs and increase operational reliability.
- Evaluation of Egyptian Phosphate Ores. Study and observation visits were made for data gathering in the design of pilot-plant equipment, in the highly important area of mineral classification and characterization for process flow-sheet design, and in engineering aspects of chemical processors for fertilizer manufacturing.

- Corrosion Causes and Control. Specialized study was arranged for familiarization with the highly complex surface analysis equipment (ESCA/SAM) purchased and installed at NRC/Cairo, for study of corrosion inhibitors in petroleum refining, for experience in a major U.S. oil company development laboratory (a rare occurrence due to the constant tendency toward protecting "proprietary processes"), and interchanges of program data with industrial corrosion scientists and engineers.
- Improving the Processing of Wool Scouring and Wool Wax Recovery. One visit made entirely without financial remuneration from the project included New Zealand and Australia for a detailed review of the R&D in government-industry wool processing pilot plant facilities. Study-observation visits were made within the project funding to compare current U.S. and European scouring and recovery practices and to investigate market possibilities for wool wax by-products.
- Development of Red Sea Fisheries. One project scientist made a visit to the United States with funds from outside the project to participate in a world conference on fish population dynamics in major fishing areas. This scientist, the director of Egypt's Center for Oceanography and Fisheries, got from the conference new collaboration opportunities for the Red Sea Project. A second study-training mission, which was conducted with project funds, brought an Egyptian scientist to the Caribbean for hands-on training with the spiny lobster and for an extensive series of discussions with U.S. scientists who have had research projects in the Red Sea.

A complete list of institutions visited by Egyptian participants during Phase I is provided in Annex C, and a list of study and observation visits is provided in Annex E.

CHAPTER 4 OTHER ACTIVITIES

PHASE II PLANNING

Background

Both the government-to-government grant agreement for the Applied Science and Technology Research Program and the contract between the Agency for International Development (AID) and the National Academy of Sciences/National Research Council (NAS/NRC) established a requirement that the Academy of Scientific Research and Technology (ASRT) and the NAS/NRC assist AID in planning the second phase of the overall program. Phase I was considered to be the introductory period when equipment would be purchased, training would be undertaken, and the projects selected for inclusion in the program would move from data gathering and conceptual design to intensive implementation. By agreement among AID, ASRT, National Research Centre (NRC/Cairo), NAS/NRC and the National Science Foundation (NSF), the Joint Consultative Committee (JCC) was the focal point for Phase II planning. Very early in its work the JCC determined that it would conduct a review of Phase I activities during its fourth and fifth meetings (November 1979 and February 1980), with the view toward making recommendations to USAID/Cairo prior to a formal Phase I external evaluation, also provided under the terms of the original grant agreement.

The staff of the implementing agencies, as well as all Egyptian project scientists and technicians, therefore prepared special background documentation for the JCC members and for the AID external evaluation team which examined:

- Activities in policy planning and management, including the role of the NAS/NRC resident program director in Cairo and of the management training element
- Status of the ongoing demonstration and R&D projects
- Status of the science and technology information services system design
- Activities of the participating institutions in the project for strengthening scientific equipment and instrumentation and maintenance and repair capabilities

Guidelines for Phase II Planning

Based upon experience gained during the first year of operation of the Applied Science and Technology Research Program, the JCC recommended the following guidelines (criteria) for inclusion of activities in Phase II:

- All projects must meet the criteria established by the JCC for Phase I. That is, projects must (a) be relevant to national development priorities of Egypt, (b) be geared to the solution of the most critical national development priorities, (c) involve substantial interdisciplinary effort and the mobilization of a variety of scientific specialties and Egyptian institutions, (d) provide a framework within which management and technical training could occur, (e) include participation by users (from villages or industries), and (f) use an appropriate technology.

- New activities should be planned with a knowledge of, and with the view to be coordinated with, other USAID projects in Egypt.

- Phase I projects of R&D management training, equipment repair and maintenance, and S&T information systems would be continued as well as ongoing demonstration and R&D activities.

- Establishment of an Egyptian national scientific and technical information network capable of serving efficiently a broad base of universities and research institutes.

- Continued strengthening of the infrastructure of national research institutes through upgrading of equipment, facilities, and access to consultant services.

Phase II Plan and Budget

As finally approved by AID and the government of Egypt, the Phase II plan contains the following elements:

- Policy, Management Training, and Support, consisting of a new science and technology policy planning, strategy, and study project at the national level undertaken by the ASRT; continuation and institutionalization of the R&D management training project; and services of an NAS/NRC program office in Cairo.

- Demonstration Projects, consisting of those initiated during Phase I (More and Better Food, Biogas Technology for Rural Areas, and New Crops for Arid Zones). Strong initiatives were to be undertaken to transfer results to end-user organizations beyond the demonstration villages and the industry partners.

- Research and Development (R&D) Projects, consisting of the four ongoing activities (Phosphate Fertilizers, Corrosion, Wool Scouring, and Red Sea Fisheries), plus the addition of one or two promising new projects.

- Support Systems, consisting of scientific and technical information (institutionalization of an Egyptian system), instrumentation technology (strengthening the maintenance and repair capabilities for instrumentation and equipment in the selected institutions), and establishment of a strengthened standards and measurement system in Egypt.

SUMMARY BUDGET

Element	AID Funding Dollars*	AID Funding LE**	GOE Funding LE**	Total In Dollars*
Policy, Mgt., & Support	1.750	0.867	0.715	3.332
Demonstration Project	1.807	0.931	1.144	3.882
R&D Project	2.070	0.778	1.144	3.992
Support Systems	6.010	1.971	3.432	11.413
Contingency	0.116	---	0.030	0.146
	11.753	4.547	6.465	22.765

*U.S. dollars (millions)
**Dollar equivalent (millions)

SCIENCE AND TECHNOLOGY POLICY MEASURES

Both the Joint Consultative Committee and an external ad hoc advisory committee to AID recommended that the ASRT be supported in its efforts to strengthen science and technology policy planning in Egypt. The Academy's Principal Committee on Science and Technology (S&T) Policies and its small staff had been engaged in overall planning studies, but these studies were largely independent of planning activities in other areas of the Egyptian government. The AID ad hoc group recommended that the ASRT strengthen its planning efforts by conducting policy and sectoral studies through research and use of the techniques of policy analysis that had been effective in other countires.

The Phase II grant agreement under the element of policy, management, and support provided approximately $250,000 for cooperative activities, including studies, consultants, joint consultation with other policy planning groups, and seminars. The activity has come to be known as the "Science and Technology Policy Measures Project." The ASRT's Principal Committee on S&T Policies is the group designated to propose the activities and has also undertaken the management responsibility. The JCC acts as an external advisory committee to assist in the effort when called upon to do so. When special S&T policy seminars are held, efforts are made to schedule the seminars prior to regularly planned JCC meetings so that as many of the Egyptian and American members may participate as possible.

The first policy seminar,"Towards a Technology Policy for Egypt: An International Seminar," was held in Cairo, November 10-12, 1981. The international meeting was preceded by an all-Egyptian national seminar on November 1-2, 1981. Both seminars offered a retrospective examination of previous S&T planning activities in Egypt and, with the assistance of visitors from India and Korea,

compared Egyptian experiences to those of other developing countries. Perhaps a principal result of the first policy seminar was the bringing together of policy and planning officials from many different program areas of Egypt (government ministries, industries from the public and private sectors, and the universities) with those concerned with the role that scientists and related disciplines can play in the planning process. The next seminar, planned for November 1982, is an in-depth study and analysis of several sectors of the Egyptian economy to suggest a more profound use of Egypt's considerable S&T manpower and institutional resources in solving national development problems. The challenge to the scientists is to ensure that their work is relevant to Egypt's social and economic development program. The challenge to the potential users of the scientists and their institutions is to appreciate and use the resources at home (rather than rely upon contracted foreign experts) and to grasp the long-term advantage in nurturing a stronger, more applied S&T system in Egypt.

STANDARDS AND MEASUREMENTS

Background

An objective of the Arab Republic of Egypt is to develop a strong independent industry for producing quality goods for domestic consumption and export. The government must also assure that imported products of various types are of high quality and meet acceptable standards for health and safety. Signicant, but often invisible, contributors to these goals are the establishment and implementation of standards and measurements in various sectors of the economy. If Egypt is to have realistic plans for achieving these requirements, the broad scientific and technological community dealing with standards and measurements should play an active role in an integrated infrastructure. Activities involve many institutions, laboratories, standard documents, and specialists (scientists, engineers, and technicians) and result in a system for reference, calibration, information, and quality control. This vast network is called the standards and measurements infrastructure. An increased interaction of the individu ' institutions and industries in Egypt, within this network, is indispensable for industrial and scientific progress.

Egypt already has in place the basic standardization institutions; however, the system must be strengthened and must develop links with similar institutions in other countries and with the worldwide standards and measurements system.

The principal institutional elements of the Egyptian system are:

- The National Institute of Standards (NIS), established in 1963 as an affiliated institute of the ASRT, which maintains the national primary standards for Egypt for science, technology, and industry.

- The Egyptian Organization for Standardization and Quality Control (EOS), which maintains the secondary standards for calibration of measuring instruments for manufacturing industries. The EOS was established in 1957 under the Ministry of Industry.

- The Assay and Weights Department, also of the Ministry of Industry, which has sole responsibility for assuring the quality and reliability of all gold and silver in commerce. This activity has been maintained by the Egyptian government for nearly 100 years.

Phase II Project

At the specific request of Dr. Hassan Ismail when he served as the ASRT president, the JCC included in its agenda the planning for a standards and measurements project. U.S. National Bureau of Standards (NBS), long associated with standards organizations throughout the world, was invited to assist NIS and EOS in proposing a cooperative project.

The first step in the planning process was an exchange of visits among technical experts from Egypt and the United States. Early in 1980 Egyptian officials, including the directors of the NIS and EOS, visited the National Bureau of Standards in Washington, D.C., and in Boulder, Colorado, as well as other standards-producing organizations in the United States. The U.S. system is a decentralized one which has government support and leadership, but the role of industry and private organizations is both unique and complex. To a very large degree the system is self-regulating and self-adapting to changing needs for standardization. Many of the elements of the U.S. system are not applicable to the Egyptian environment. However, to maintain links with the considerable expertise built up over the years in the United States, Egypt must understand the roles of both the U.S. government and of private standards and measurements organizations.

The Phase I planning activities for a standards and measurements project were coordinated under the overall NAS/NRC contract. During Phase II the actual project implementation is directly between the ASRT, acting through the NIS and EOS, and the U.S. National Bureau of Standards. The project is budgeted for $1.8 million over a three-year period

ANNEX A

NATIONAL ACADEMY OF SCIENCES/NATIONAL RESEARCH COUNCIL

PROGRAM STATISTICS

1978-1981

ANNEX A

NAS/NRC Program Statistics
Phase I (1978-81)

POLICY PLANNING AND MANAGEMENT, TRAINING, AND OTHER TECHNICAL ASSISTANCE

- 600 person-days of time furnished pro bono by U.S. panelists and specialists recruited by NAS/NRC. This includes 158 person-days of time given by U.S. panel members of the JCC. (If the 600 person days were consultants on a fully reimbursable basis, the dollar value would have been no less than $120,000 to $200,000.)

- 41 person-days of paid U.S. consultants.

- 178 person-months of fully reimbursed NAS/NRC personnel services consisting of:

  30 person-months, professional staff time continuously in Egypt, principally the NAS/NRC resident program director

  105 person-months, Washington-based professional staff time managing such activities as recruiting panelists and consultants; planning training programs and observation/study visits to the United States; and serving as technical staff for the U.S. JCC panel.

  43 person-months, Washington-based support staff time.

The division of the 178 person-months of NAS/NRC personnel time, although not precisely recorded for cost accounting purposes, was allocated as follows:

- 55.7 person-months, support of training activities

- 38.5 person-months, support for demonstration and R&D projects other than training (recruiting panelists, consultants, report preparation, etc.)

- 20.3 person-months, support for the R&D management activity

- 20.3 person-months, support of JCC meetings and activities including Phase II planning

- 43.2 months for general management services, including those required by AID for technical and fiscal reports; for contract administration; and for services required by NAS/NRC, such as recruitment and staff support of the NAS/NRC resident program manager in Cairo, preparation of contractual and fiscal reports, program liaison, and general reporting.

Training Activities, Including Short Term Specialized Courses in R&D Management, Technical Training, and Observation and Study Visits to U.S. and Other Research Institutions

The estimated 55.7 person-months of direct personnel time was instrumental in planning for the following kinds of training and other activities:

- 1467 person-days spent by Egyptians in training programs. This represents a total of 55 Egyptians selected by the ASRT from its staff, its associated research institutes, and from Egyptian public sector industries.

- 757 person-days spent by Egyptians in study/observation/orientation visits in the U.S. and Canada (a total of 49 persons).

- There were also 4 Egyptians (50 person-days) in special visits in the area of standards and measurements.

- The total number of person-days spent by Egyptians in U.S. travel status was 2336. (If the estimated cost of travel within the U.S. is U.S. $300 per visitor, a conservative figure, and per diem $60, then the dollar cost of intra-U.S. travel was greater than $150,000).

- 310 institutional visits were made by Egyptians in the U.S., consisting of:

  109 university visits*
  71 industry visits*
  54 federal and state government R&D laboratories*
  76 other visits to private, non-profit R&D laboratories; associations, and professional and scientific meetings.*

  * NOTE: A listing of the universities, industrial R&D laboratories, federal and state government agencies and laboratories, and other institutions visited by Egyptians in the program is provided in Annex B to this report. Also included in the same Annex are technical meetings and conferences attended by Egyptian participants in the Applied Science and Technology Research Program.

- In addition, 9 Egyptians participated in orientation/study/training visits to third countries for a total of 169 person-days in travel status. The countries involved were the U.K., Italy (FAO), India, Thailand, and the People's Republic of China. (Third country travel costs were approximately $14,000 for transportation and $16,000 for per diem for a total of $30,000.)

- There were also 26 special visits, conferences, and consultations arranged for Egyptian JCC panelists while in the U.S.

NAS/NRC CONTRACT COST ALLOCATIONS

Measured in U.S. Dollars
(43-month period: January 1978 - August 1981)

1. Demonstration and R&D projects 94.2 person-months of training, consultants, and all support costs	$ 439,700
2. Joint Consultative Committee (Four meetings in the U.S. and four meetings in Egypt, including 20.3 person-months of support costs)	$ 104,800
3. R&D Management Training (Denver Research Institute subcontract plus support costs)	$ 295,800
4. NAS/NRC Administration (Technical and fiscal management including 43.2 person-months of support costs)	$ 137,000
5. Direct Costs (Communications, materials, supplies and insurance)	$ 64,000
6. NAS/NRC Overhead	$ 324,900
TOTAL:	$1,366,200

*Original contract $1.2 million plus $166,000 supplement granted in 1981.

Measured in NAS/NRC-Managed Egyptian Pounds (LE)
(43-month period: January 1978 - August 1981)

1. Local salaries (Cairo)	LE	18,500
2. International travel	LE	182,400 (a)
3. In-Egypt per diem	LE	43,900 (b)
4. In-Egypt transportation	LE	7,900
5. Local supplies, materials, communications, office equipment, shipping costs & services	LE	26,900
TOTAL:	LE	279,600*

* NOTE: U.S. AID budgeted LE 307,400 for NAS/NRC managed costs. The difference between the budgeted amount and the actual expenditures (LE 307,400 - 279,600) was LE 27,800 which was returned to AID. During the period January 1978 - July 1981 the official rate of exchange was 1 U.S.$ = 0.7 LE.

(a) All international travel was paid in LE. The number of tickets was 128 Egypt to U.S., 81 U.S. to Egypt and 10 to third countries.

- -- 24 JCC to U.S.; 16 JCC to Egypt
- -- 104 Egyptians for training, observation, and study to U.S.
- -- 9 Egyptians and 1 American panelist for observation/study in third countries
- -- 33 U.S. panelists, 10 consultants, and 22 NAS staff to Egypt

(b) The corresponding figure for U.S. dollar per diems paid to Egyptians in the U.S. was $120,700.

ANNEX B

JOINT CONSULTATIVE COMMITTEE

Membership and Summaries of Meetings

Phase I (1978 -1981)

I. Membership of the Joint Consultative Committee (JCC)

Chairman: Dr. Ibrahim Badran, President, Academy of Scientific Research and Technology (ASRT). (Surgeon, formerly Dean of the Medical School, Cairo University; President of Cairo University; and Minister of Public Health)
JCC member, November 1979-November 1980
JCC chairman, November 1980-present

Egyptian members:

Dr. Hassan Ismail, Private consultant in the Egyptian construction industry (Civil Engineer, Ph.D., California Institute of Technology; formerly President of Cairo University, President of ASRT, and Minister of Higher Education and Scientific Research)

Dr. Ibrahim H. Abdel-Rahman, Economic Counselor to President Mubarak (Astronomer, former Minister of Planning, first Director-General of the United Nations Industrial Development Organization)

Dr. Mostafa El-Gabaly, Counselor to the Minister of Agriculture (Agronomist, Ph.D., University of California/Berkeley, former Minister of Agriculture)

Dr. Aly El-Gretly, Retired (Economist, formerly Dean of Economics at Cairo University, President of the Egyptian Central Bank, Director of the Suez Canal Authority)

Dr. Mohamed El-Kassas, Professor of Botany, Cairo University; Counselor to the ASRT President (Botanish-Ecologist, Ph.D., Cambridge University; Egyptian consultant widely called upon by U.N. agencies; member of the Shura Council of the Egyptian Government)

American members:

Dr. Gilbert White, Chairman of the U.S. panel of members, NAS member (Geographer, Ph.D., University of Chicago; formerly President, Haverford College; Director, Institute for Behavioral Studies, University of Colorado)

Dr. George Bugliarello, President, New York Polytechnic Institute (Doctorate in Engineering from University of Padua, Italy, and from Massachusetts Institute of Technology; former Dean of Engineering, University of Illinois at Chicago)

Dr. Mary E. Carter, Associate Administrator, Agricultural Research Service, U.S. Department of Agriculture (Biochemist, Ph.D., Edinburgh University, polymer R&D in industry and former Director, USDA Southern Regional Laboratory, New Orleans)

Dr. James Hillier, Consultant, NAE member (Ph.D., physics, Toronto University; former Vice President for Research and Engineering, RCA Corporation)

Dr. F. Karl Willenbrock, Professor of Engineering, Southern Methodist University, Dallas, Texas (Ph.D., applied physics, Harvard University; NAE member; former Department Chairman, Southern Methodist University; former Director, Institute for Applied Technology, U.S. National Bureau of Standards)

Former JCC members:

Dr. A.M. Abou El-Azm, Chairman, July 1978-July 1979; President of ASRT (former Under-Secretary of State, Ministry of Science Research)

Dr. Osama El-Kholy, member, July, 1979-November 1981, Arab Organization for Industrialization (former Science and Technology Advisor to the Minister of Education and Scientific Research)

Dr. Mohamed H. El-Nashar, member, July 1978-July 1979; Counselor, ASRT, and Director, Nile Water Quality Studies Program (former Secretary-General, National Research Centre)

Dr. Hassan Hamdi, member, July 1978-1979; Vice President, Cairo University

Dr. Mahmoud Riad, member, July 1978-March 1980; Secretary-General, Arab Telecommunications Union

Dr. Yussuf Wally, member, July 1978-1979; Minister of Agriculture, January 1982-present

Dr. H. Guyford Stever, member and chairman, U.S. panel, 1978-1981; consultant; NAS and NAE member (Ph.D., physics, California Intitute of Technology; former President, Carnegie-Mellon University; Director, National Science Foundation; Science Advisor to President Ford)

II. Meetings of the JCC

A. General

The Joint Consultative Committee (JCC) is an advisory body created under the terms of the Applied Science and Technology Research Project Agreement between the Academy of Scientific Research and Technology (ASRT) and the Agency for International Development (AID). Originally limited to 3 members each from Egypt and the United States, membership was raised to 5 from each country in 1979. In addition, the ASRT president serves as the JCC chairman.

The committee provides program policy oversight, sets goals, reviews and evaluates progress, and makes its recommendations directly to the ASRT president. It is an advisory body whose influence depends upon the experience of its members and their powers of persuasion rather than its operational responsi-

bilities. The JCC meets at approximately six-month intervals in Egypt or the United States.

B. First JCC Meeting, Cairo, May 6-9, 1978

The first JCC meeting was held at the ASRT in Cairo. It provided Egyptian and American panelists an opportunity to become acquainted with one another, to discuss the development and present status of the Egyptian research and development system, and to review goals of the Applied Science and Technology Research Program.

Criteria for selection of specific research and development (R&D) and demonstration projects were decided upon as follows:

- Projects must be relevant to critical Egyptian national development priorities.
- Design of projects must be geared to the solution of critical development problems (food security, housing, manpower development and utilization for national needs, etc.).
- Projects must involve a substantial interdisciplinary effort and the mobilization of a variety of scientific specialties and institutions (multidisciplinary participation and cooperation among research institutions).
- Projects must provide an explicit framework within which management and technical training and experience can take place, and through which the ASRT can develop recognition of its role as coordinator and stimulator among research and user communities.
- User participation (from villages and industries) must be provided so that practical applications are built into the objectives.
- Appropriateness of technology must be considered; e.g., labor-intensive adaptation to local materials, applicability to existing skills.

The More and Better Food Demonstration Project was selected to be included in the program; several other potential R&D and demonstration projects were reviewed with instructions that they be included on the agenda for further consideration at the second JCC meeting.

The general mechanism of a joint technical panel for each R&D and demonstration project was decided upon. These joint technical panels will be asked to report to the JCC periodically on the progress of the work, problems encountered, and the status of recommended actions.

C. Second JCC Meeting, Washington, D.C., November 3-4, 1978

The second meeting was held at the National Academy of Sciences in Washington, D.C. The following major decisions were made:

- Two additional demonstration projects were determined to meet program criteria and were selected for the program. The new demonstration projects are (a) "The Development and Application of Biogas Technology for Rural Areas of Egypt," and (b) "New Crops for Arid and Semi-Arid Zones."

- Four R&D projects were also determined to meet the criteria for selection and were chosen for the program. They are (a) "The Evaluation of Egyptian Phosphate Ores for Wet Processing of Phosphoric Acid and Phosphate Fertilizer Production," (b) "Corrosion Causes and Control," (c) "Improving the Processing of Wool Scouring and Wool Wax Recovery," (d) "Development of Red Sea Fisheries."

- The JCC accepted the basic plan for an R&D management training project proposed by the Denver Research Institute in Denver, Colorado, U.S.A. Three-week seminars with approximately twelve Egyptian participants (each) were organized to include (a) general principles and methods of R&D management, (b) technology assessment for R&D planning, (c) technical economics as a tool in R&D planning, and (d) marketing of R&D results to the user community.

In addition to the above, the JCC received reports on the activities of the National Science Foundation/ASRT in the areas of training for scientific instrumentation and equipment repair and maintenance and in the design of a scientific information system for Egyptian needs.

D. Third JCC Meeting, Cairo, March 28-29, 1979

The third meeting, held in Cairo, Egypt, was primarily concerned with a project review of the status and overall management plan for the Applied Science and Technology Research Program which now consisted of (a) three demonstration projects (More and Better Food, Biogas Technology. New Crops for Arid Zones), (b) four R&D projects (Phosphate Fertilizers, Corrosion, Wool Scouring and Wool Wax, and Development of Red Sea Fisheries), (c) equipment procurement/training for maintenance and repair capabilities, (d) scientific and technical information, (e) R&D management training, and (f) Phase II planning.

The JCC requested that the staff from each participating organization (ASRT, National Research Centre. National Science Foundation, and National Academy of Sciences/National Research Council) jointly prepare a comprehensive plan looking toward Phase II, which would summarize achievements of Phase I, evaluate the progress of each project, recommend priorities for Phase II, and summarize the financial aspects of ongoing and proposed new projects.

E. Fourth JCC Meeting, Cairo, November 6-8, 1979

At the request of the new president of the JCC, Dr. Hassan Ismail, the fourth meeting was held in Cairo rather than in Washington as originally planned. With the agreement of all major parties, the termination date for Phase I of the Applied Science and Technology Research Program was moved from October 1979 to October 1980.

A draft Phase II plan was presented to the JCC, discussed, and acted upon. The committee directed that Phase II planning should proceed with the following major thrusts:

- Inclusion of a program element designed to strengthen activities of policy planning, R&D management and control

- Inclusion of an element for infrastructure development in the areas of (a) science and technology information, (b) maintenance and repair of instrumentation and equipment, (c) standards and measurements, and (d) manpower development

- Continuation of the three demonstration projects, with particular attention to applications in the user communities

- Completion of the four R&D projects selected in Phase I and implementation of two or three new projects, depending upon availability of Phase II funding.

The fourth JCC meeting also provided the first occasion for a review of each ongoing project (R&D, demonstration, S&T information, equipment maintenance and repair training, and R&D management training) with the participation of the new Egyptian JCC panel appointed by Dr. Hassan Ismail, who became ASRT President in July 1979.

F. Fifth JCC Meeting, Washington, D.C., February 25-27, 1980

The Fifth JCC meeting was advanced by several weeks because of the time needed within USAID/Cairo to conduct its independent evaluation of Phase I and to review the proposed plan for Phase II before the end of the fiscal year, September 30, 1980. The major agenda item for the meeting was a program evaluation by the JCC members aided by four background documents prepared by the staff:

- "Overview and Inputs for Evaluation," prepared by ASRT, giving a status report on all activities as of February 1980

- "Phase II Planning," prepared jointly by ASRT, NRC/Cairo, NAS/NRC, and NSF with input from USAID/Cairo.

- "Project-by-Project Summaries" of ongoing Phase I activities and of the proposed new or continuing projects for Phase II.

- "Overview and Inputs for Evaluation" as prepared by the NAS/NRC for demonstration projects and R&D projects and by NSF for the instrumentation technology and S&T information components.

The JCC members concluded that "Phase I of the program was highly successful as the initiating effort to address Egypt's desire to strengthen its national research and development management capabilities and to utilize its R&D resources in solving critical economic and social problems."

The JCC recommended that the Applied Science and Technology Program during Phase II consist of the following major elements:

- o National Policy Measures for Science and Technology
- o Program Management and Control
- o Demonstration Projects
- o R&D Projects
- o Infrastructure Development

G. Sixth JCC Meeting, Cairo, November 3-6, 1980

Prior to the formal meetings in Cairo, the JCC members visited Omar Makram Village, a demonstration site for the More and Better Food and Biogas Technology projects. The group also visited the Wool Scouring and Wool Wax Recovery R&D project at the Misr Beida Dyers Corporation near Alexandria, Egypt. These field visits and discussions contributed to a review of overall progress during Phase I.

Considerable attention was given by JCC members to the proposed new Phase II project titled "National Policy Measures for Science and Technology," designed to support the work of the ASRT Committee for Science and Technology Policies. The project is basically designed to help build a capacity within the ASRT for in-depth policy studies of issues faced by the Egyptian community as it addresses development targets.

In reviewing the ongoing R&D projects, the JCC expressed satisfaction with progress of the Phosphate Ores, Wool Scouring and Corrosion projects and concern about the slower progress in Red Sea Fisheries. For Phase II, the JCC recommended that, within the limited resources available for new starts in R&D, priority be given to (a) A New Scheme for Better Land Use to Increase Food and Food Production in Egypt (this project was later passed to the AID-Ministry of Agriculture program for consideration and funding), (b) Preparation of Selected Pharmaceutical Chemicals, and (c) Investigation and Evaluation of Egyptian Bentonites for Industrial Application.

The JCC also reviewed ongoing demonstration projects, the Science and Technology Information Project, and received a progress report on planning for the proposed new Standards and Measurements project.

H. Seventh JCC Meeting, Washington, D.C., April 1-2, 1981

The seventh JCC meeting in Washington sought a broad review of all ongoing projects grouped as follows: (a) Science and Technology Information Systems, (b) Instrumentation Technology, and (c) Demonstration and R&D Projects.

In addition the JCC members held an in-depth review of the National S&T Policy Measures project, a new component for Phase II, with Dr. Ibrahim Helmy Abdel-Rahman (JCC member and chairman, ASRT Committee on S&T Policy) and Dr. Princeton Lyman (USAID/Washington, who led a group of American S&T policy planners in Cairo in an overview of Egyptian S&T policy planning institutions and methodologies). The JCC concluded that their body (i.e., the JCC itself) should be the "technical panel" which would interface with the ASRT principal committee on science policy and would participate in the annual meetings on S&T policy scheduled in Cairo in November 1981, and late 1982 and 1983.

The JCC suggested that the methodological development of the new National S&T Policy Measures project take place gradually and, during the first year of implementation, that it include the following activities:

- Analytical and evaluative studies in sectors such as construction, pharmaceuticals, and the food industry

- A comparative study of decision making on technology choices in Egyptian public and private industries, factors that influence the choices, and policy implications of these choices for future industrial development

- A small working seminar to be held in 1981 to analyze the experience gained from preparatory studies, with the goal of making recommendations for 1982 and 1983

I. Eighth JCC Meeting, Cairo, November 14-16, 1981

Immediately before the eighth JCC meeting, two seminars sponsored by the ASRT, one national and a second of an international scope, were held in Cairo on "Towards a Technology Policy for Egypt." These activities represent a first step under the Phase II program component on National S&T Policy Planning. This activity represents the beginning of a much-needed process to increase the dialogue between high-level officials responsible for science and technology and for planning fiscal policies in Egypt.

The National Bureau of Standards (NBS) has been selected to work with the Egyptian Organization for Standardization and Quality Control (affiliated with the Ministry of Industry). A program involving training, observation, and study at the NBS facility in the United States will be instituted as well as on-site training in several areas of standardization and metrology important to Egyptian industries. Some upgrading of equipment is included, but the emphasis is upon technical exchange and training activities.

It was agreed that ASRT and USAID/Cairo will carry out Phase II plans for Instrumentation Technology and S&T Information. The University of Wisconsin, National Institutes of Health, Georgia Institute of Technology, and Catholic University of America will be the implementing agencies.

JCC members again visited Omar Makram Village and the various laboratories within the National Research Centre to discuss progress in the demonstration and the research and development projects with the projects' principal investigators and their staff scientists.

ANNEX C

INSTITUTIONS VISITED BY EGYPTIAN PARTICIPANTS

Phase I (1978-1981)

- Universities
- U.S. Federal and State Governments and/or Laboratories
- Private Industries and Corporations
- Other Organizations
- Technical Meetings and Conferences Attended

UNIVERSITIES VISITED BY EGYPTIANS DURING PHASE I

American University
Center for Technology and Administration
Washington, D. C.

Colorado School of Mines Research Institute
Golden, Colorado

Concordia University
Montreal, Quebec, Canada

Cornell University
Ithaca, New York
- Department of Food Science
- Department of Animal Science
- Vegetable Crops Department
- Division of Nutritional Sciences
- Department of Agronomy

Duke University
Marine Laboratory
Beaufort, North Carolina

George Washington University
Program on Science, Technology, and Public Policy
Washington, D. C.

Georgia Institute of Technology
Atlanta, Georgia
- Office of International Programs
- Engineering Experiment Station
- School of Information and Computer Science

Harvard University
Program for Science and International Affairs
Kennedy School of Government
Cambridge, Massachusetts

Iowa State University
Ames, Iowa
- Department of Animal Science
- College of Veterinary Medicine

Massachusetts Institute of Technology (MIT)
Cambridge, Massachusetts
- Center for the Study of Policy Alternatives
- Technology Adaptation Program
- Energy Laboratory
- Department of Nutrition and Food Science

Michigan State University
East Lansing, Michigan
- Department of Food Science and Human Nutrition
- Department of Dairy Science

North Carolina State University
Asheville, North Carolina
Minerals Research Laboratory
Textile Chemistry Department, School of Textiles

Texas Tech University
Lubbock, Texas
Department of Chemical Engineering

Texas A&M University
College Station, Texas
Food Protein Research and Development Center
Department of Entomology
Plant Science Department

Tufts University
Nutrition Institute
Medford Massachusetts

Tulane University
New Orleans, Louisiana
Nutrition Department
Tropical Medicine Department
School of Public Health

University of Arizona
Tucson, Arizona
Office of Arid Land Studies
Department of Plant Science
Environmental Research Laboratory
Department of Soils, Water, and Engineering

University of British Columbia
Vancouver, British Columbia, Canada

University of California at Davis
Davis, California
College of Agriculture
Vegetable Crops Department
Agronomy and Range Science Department
Department of Food Science

University of California, Berkeley
Berkeley, California
Department of Chemical Engineering
Department of Nutrition Sciences
Department of Soil and Plant Nutrition

University of California at Los Angeles
School of Public Health
West Los Angeles, California

University of California at Riverside
College of Natural and Agricultural Sciences
Riverside, California

University of Florida
Gainesville, Florida
Department of Entomology
Fruit Crops Department
Vegetable Crops Department

University of Illinois
Department of Microbiology, Urbana, Illinois
Department of Pharmacognosy and Pharmacology, Chicago, Illinois

University of Iowa
Department of Botany
Iowa City, Iowa

University of Miami
Clean Energy Research Institute
Coral Gables, Florida

University of Minnesota
Department of Animal Sciences
St. Paul, Minnesota

University of Nebraska
Department of Animal Sciences
Lincoln, Nebraska

University of North Carolina
School of Public Health
Department of Nutrition
Chapel Hill, North Carolina

University of Oklahoma
Pediatric Department
Oklahoma City, Oklahoma

University of Southern California
School of Pharmacy
Los Angeles, California

University of Utah
Department of Metallurgy
Salt Lake City, Utah

University of Wisconsin
Madison, Wisconsin
Department of Food Science
Department of Dairy Science
Department of Bacteriology

FEDERAL AND STATE GOVERNMENT AGENCIES/LABORATORIES VISITED BY EGYPTIANS DURING PHASE I

Environmental Protection Agency
- Washington, D.C.
- Denver, Colorado
- Gulf Breeze, Florida
- Athens, Georgia

Florida Department of Natural Resources
Marine Research Laboratory
- St. Petersburg, Florida
- Marathon, Florida

Food and Drug Administration
Washington, D.C.
- Division of Nutrition
- Division of Chemistry and Physics
- Epidemiology Unit

National Fertilizer Development Center
Tennessee Valley Authority (TVA)
- Muscle Shoals, Alabama

National Institutes of Health (NIH)
Bethesda, Maryland
- National Institute of Child Health and Human Development
- National Institute of Arthritis, Metabolism, and Digestive Diseases
- National Institute of Allergy and Infectious Diseases

National Oceanic and Atmospheric Administration (NOAA)
National Marine Fisheries Service (NMFS)
- Northeast Fisheries Center
  - Highlands, New Jersey
- Southeast Fisheries Center
  - Miami, Florida
  - Panama City, Florida
  - Gulf Breeze, Florida
  - Beaufort, North Carolina

National Technical Information System (NTIS)
Springfield, Virginia

Office of Science and Technology Policy (OSTP)
Executive Office of the President
Washington, D.C.

Office of Technology Assessment (OTA)
U.S. Congress
Washington, D.C.

Smithsonian Institution
National Museum of Natural History
Washington, D.C.

Smithsonian Science Information Exchange (SSIE)
Washington, D. C.

U.S. Bureau of Mines
Salt Lake City, Utah

U.S. Department of Agriculture
Beltsville Agricultural Research Center
Beltsville, Maryland

Cotton Insects Research Laboratory
College Station, Texas

Eastern Regional Research Center
Philadelphia, Pennsylvania

Forest Products Laboratory
Madison, Wisconsin

Human Nutrition Research Laboratories
Grand Forks, North Dakota

Insects Attractants Laboratory
Gainesville, Florida

Insects Affecting Man and Animals Research Laboratory
Gainesville, Florida

Lake Alfred Agricultural Research and Education Center
Lake Alfred, Florida

National Animal Disease Center (NADC)
Ames, Iowa

National Veterinary Services Laboratory
Ames, Iowa

Northern Regional Research Center
Peoria, Illinois

Quincy Agricultural Research and Education Center
Quincy, Florida

Science and Education Administration (SEA)
Hyattsville, Maryland

Soil Conservation Service
Washington, D. C.
Phoenix, Arizona

Southern Regional Research Laboratory
New Orleans, Louisiana

U.S. Salinity Laboratory
Riverside, California

U.S. Water Conservation Laboratory
Phoenix, Arizona

U.S. Department of Agriculture (cont.)
Western Cotton Research Laboratory
Phoenix, Arizona

U.S. Department of State
Office of the Coordinator for the U.N. Conference on Science and Technology for Development
Washington, D.C.

Virgin Islands Department of Conservation and Cultural Affairs
Division of Fish and Wildlife
Charlotte Amalie, Virgin Islands

PRIVATE INDUSTRIES/CORPORATIONS VISITED BY EGYPTIANS DURING PHASE I

Agrico International
Tulsa, Oklahoma
Urea ammonium nitrate solutions plant, Verdigris, Oklahoma
Faustina fertilizer production complex, Donaldsonville, Louisiana
Fort Green mine and plant, South Pierce, Florida

Amerchol Company
Edison, New Jersey

Amoco Research Center
Naperville, Illinois

Aquafine Corporation
Brunswick, Georgia

Burlington Industries
Clarksville, Virginia

Carnation Research Corporation
Van Nuys, California

Cargill Inc.
Wayzata, Minnesota
Flax Sunflower Department
Domestic Soybean Processing Division

Cotton Inc.
Technical Research Services Department
Raleigh, North Carolina

Davy McKee Engineering Design Co.
Lakeland, Florida

Del Monte Research Center
Walnut Creek, California

Denver Equipment Division
Joy Manufacturing Company
Colorado Springs, Colorado

Eastern Artificial Insemination Cooperative
Ithaca, New York

Farmland Industries Inc.
Bartow, Florida

Foremost-McKesson Company
Gilroy, California

Gardinier Inc.
(formerly U.S. Phosphoric Products)
Tampa, Florida

General Foods Corporation
Tarrytown, New York

Gerber Products
Fremont, Michigan

Grande Cheese Co.
Brownsville, Wisconsin

Hazen Research
Golden, Colorado

Hunt-Wesson Foods
Research and Development Department
Fullerton, California

International Minerals and Chemicals Corporation
Lakeland, Florida

Mobil Research and Development Corporation
Materials Engineering Section, Paulsboro, New Jersey
Mobil Field Research Laboratory, Dallas, Texas

Pfizer Genetics
Doniphan, Nebraska

Plains Cooperative Oil Mill
Lubbock, Texas

Ranchers Oil Company
Fresno, California

Stauffer Chemical Company
Vernal, Utah

Tetra Tech International
Arlington, Virginia

Unichem International
Hobbs, New Mexico

U.S.S. Agrichemicals
Bartow, Florida

U.S. Steel Corporation
Engineers and Consultants, Pittsburgh, Pennsylvania
Research Laboratory, Monroeville, Pennsylvania

Webster International
Los Angeles, California

OTHER ORGANIZATIONS VISITED BY EGYPTIAN DURING PHASE I

American Chemical Society
Washington, D. C.

Battelle Memorial Institute
Columbus, Ohio

The Bio-Energy Council
Washington, D. C.

Burke Rehabilitation Center
Nutrition and Metabolic Research Division
White Plains, New York

Denver Research Institute
Office of International Programs
Denver, Colorado

Fertilizer Institute
Washington, D. C.

Institute of Gas Technology
Chicago, Illinois

International Bank for Reconstruction and Development
Washington, D. C.

International Center for Arid and SemiArid Land Studies
Lubbock, Texas

International Fertilizer Development Center
Muscle Shoals, Alabama

Nutrition Foundation
New York, New York

Volunteers in Technical Assistance (VITA)
Mt. Rainier, Maryland

The Wool Bureau
Woodbury, Long Island, New York

MEETINGS ATTENDED BY EGYPTIANS DURING PHASE I

American Society for Microbiology Annual Meeting
Miami Beach Florida
May 11-17, 1980

Bio-Energy '80 World Congress
Atlanta, Georgia
April 21-23, 1980

Fertilizer Industry Roundtable
Atlanta, Georgia
October 31-November 1, 1978

Fourth International Symposium on Livestock Wastes
Amarillo, Texas
April 14-18, 1980

Institute of Food Technologists Annual Meeting
New Orleans
June 8-11, 1980

Institute of Food Technologists Annual Meeting
Atlanta, Georgia
July 7-10, 1981

National Association of Corrosion Engineers (NACE) Corrosion '80 Symposium
Chicago, Illinois
March 3-7, 1980

Second International Congress on Phosphorus Compounds
Boston, Massachusetts
April 21-25, 1980

Third Miami International Conference on Alternative Energy Sources
Bal Harbour, Florida
December 14-17, 1980

ANNEX D

EGYPTIAN PARTICIPANTS, RESEARCH AND DEVELOPMENT MANAGEMENT TRAINING PROGRAMS

DENVER RESEARCH INSTITUTE

DENVER, COLORADO

1979

- R&D Management Methods, June 18-July 7, 1979
- Technical Economics, July 9-27, 1979
- R&D Marketing, August 20-September 7, 1979
- R&D Marketing, August 20-September 7, 1979
- Technology Assessment, September 10-28, 1979

PARTICIPANTS IN RESEARCH & DEVELOPMENT MANAGEMENT TRAINING PROGRAMS

Denver Research Institute
Denver, Colorado

NAME	PRESENT POSITION	PRINCIPAL FIELD
RESEARCH & DEVELOPMENT MANAGEMENT METHODS (June 18-July 7, 1979)		
Adel A. Abdel-Azim	Director, Central Metallurgy Research Institute, NRC	Physical Chemistry
Hatem M. Ali	Head, Department of Animal and Poultry Nutrition, NRC	Biochemistry of Nutrition
Ahmed Bakr	Professor, Faculty of Agriculture, Cairo University	Agriculture and Botany
Fathy Mossad Ebeid	Director, Egyptian Petroleum Research Institute	Chemical Engineering
Mohamed M. El-Halwagy	Head, Chemical Engineering & Pilot Plant Department, NRC	Chemical Engineering
Mohamed El-Husseiny	Professor of Food Technology, NRC	Dairy Science
Anas El-Naggar	Program Manager, Research and Development Department, ASRT	Radiation Biology
Mohamed H. Fadl	Professor of Pulp and Paper, NRC	Applied Chemistry
Sami H. Fayed	Program Manager, Environmental Research, NRC	Water and Wastewater Technology
Fahmy Ramadan	Secretary General, NRC	Biochemistry
Nabil A. Saleh	Professor of Organic Chemistry, NRC	Chemistry
Gamila Wassel	Professor of Pharmacognosy, NRC	Pharmacognosy
Mahmoud I. Younis	Head, Systems and Information Sciences Unit, NRC	Electrical Engineering
TECHNICAL ECONOMICS (July 9-27, 1979)		
Nour El-din Abdel-Aziz	R&D Division, Industry & Technology Transfer Program, National Institute of Standards, ASRT	Physics
Hussein Badawy	Head, Department of Marine Biological Reference Collection, Institute of Oceans & Fisheries, ASRT	Marine Biology

Mohamed Said Mustafa Badawy	Agricultural Economics Research Group, More & Better Food Project NRC	Agricultural Economic
Hanafy Aly Deebes	Technical Office of ASRT and Institute of Geophysics and Astronomy	Geophysics
Attia Abd El-Kader	Assoc. Professor of Mechanical Engineering, NRC	Mechanical Engineerin
Mohamed Ali Ghobashi	Head, Optics Division, Scientific Instruments Centre, and Technical Office, ASRT	Technical Optics
Ahmed Labib Hussein	Head, Refractories & Building Materials Laboratory, NRC	Chemistry
Shadia Ragheb Tewfik	Pilot Plant Division, Biogas Project, NRC	Chemical Engineering
Hammam Abdel Rahman El-Abd	Pilot Plant Division, Biogas Project, NRC	Chemical Engineering
Aziza Yousef	Head, Mineral Beneficiation and Extractive Metallurgy Dep., NRC; Principal Investigator, Phosphate Ore Project	Mineral Beneficiation

RESEARCH AND DEVELOPMENT MARKETING (August 20-September 7, 1979)

Mostafa Al-Fouly	Head, Marketing Office, NRC	Agriculture
Ali Hebeish	Marketing Office, NRC; Professor of Textile Chemical Technology, NRC	Textile Chemical Technology
Mamdouh Kamel	Marketing Office, NRC, Head, Biochemistry Laboratory, NRC	Biochemistry
Effat Abu Mustafa	Marketing Office, NRC; Research Professor, Natural Products Laboratory, NRC	Applied Organic Chemistry
Hussein Nasr	Assoc. Professor of Textiles, NRC	Applied Organic Chemistry
Mahmoud Saada	Head, Pilot Plant Laboratory, Professor of Chemical and Biomedical Engineering, NRC	Chemical Engineering

Fouad Osman	Professor, Applied Organic Chemistry, Fats and Oils Laboratory, NRC	Applied Organic Chemistry
Nabiel Eid	Research Assoc. Professor, Medicinal & Aromatic Plants Unit, NRC	Medicinal & Aromatic Plants
Hamdi Abd El-Aziz	Assoc. Professor of Plant Physiology NRC	Plant Physiology

TECHNOLOGY ASSESSMENT (September 10-28, 1979)

Mohamed Nabil Aboul-Enein	Professor of Medicinal & Pharmaceutical Chemistry, NRC	Pharmaceutical Chemistry
Ahmed Allam	Asst. Professor, Head, Department of Seismology, Helwan Institute of Astronomy and Geophysics	Geophysics
Mohamed Dia Eldin Hassanein Aly	Professor of Agriculture, NRC	Agriculture
Nadim A. Ghanem	Head, Laboratory of Polymers and Coatings, NRC	Chemistry
Ramzi M. Habib	Professor, Petroleum Chemistry Egyptian Petroleum Research Institute, ASRT	Fluorine Chemistry
Faiza Hammouda	Professor of Phytochemistry, Pharmaceutical Sciences Laboratory, NRC	Phytochemistry
Mahmoud Mohamed Hassanein	Professor of Inroganic Chemistry, NRC	Inorganic Chemistry
Mohamed Hilal	Professor of Petrochemical Technology; Head, Petrochemical Department, Egyptian Petroleum Research Institute, ASRT	Chemical Technology
Mohamed M. Khoder	Asst. Professor, Electrical Engineering; Head, Electrical Metrology Division, National Institute for Standards	Engineering Photometry
Mahmoud Sidky	Head, Chemical Industries Division, Chemical Pesticide Laboratory, NRC	Chemistry
Mahmoud Abdel Halim Saleh	Professor of Electrical Engineering, NRC	Electrical Engineering

ANNEX E

EGYPTIAN STUDY AND OBSERVATION VISITS

Phase I (1978-1981)

Demonstration Projects

- o More and Better Food
- o Development and Application of Biogas Technology
- o New Crops for Arid and Semi-Arid Zones

Research and Development Projects

- o Evaluation of Egyptian Phosphate Ores
- o Corrosion Causes and Control
- o Wool Scouring and Wool Wax Recovery
- o Development of Red Sea Fisheries

TRAINING AND OBSERVATION/STUDY VISITS
1979 through 1981
MORE AND BETTER FOOD

DATE	NAME	PURPOSE	PLACES VISITED
Nov 29-Dec 19, 1979	Fakhria Taha Researcher, Fats & Oils Laboratory, NRC	Color fixation and nutrient qualities of cottonseed oil	USDA Southern Regional Research Laboratory, New Orleans, LA Food Protein R&D Center, Texas A&M University, College Station, Texas Plains Cooperative Oil Mill, Lubbock, TX Texas Tech University, Lubbock, TX Ranchers Oil Co., Fresno, CA Cargill Co., Minneapolis, MN
May 15-June 8, 1980	Abdel-Hamid Talaat Higazi Head, Botany Laboratory NRC	Crop production, weed control, crop rotation, photo-synthesis, plant physiology	University of California, Davis University of Arizona, Tucson University of Florida, Gainesville USDA Agricultural Research Center, Beltsville, MD Cornell University, Ithaca, NY
June 4-26, 1980	El-Sayed Mohamed Hegazi Professor of Food Sciences, Dept. of Nutrition & Food Sciences, NRC Ibrahim D. Rifaat Head, Food Technology & Dairy Research Laboratories NRC	Food industry R&D needs, participate in meeting	Institute of Food Technologists Annual Meeting, New Orleans University of Wisconsin, Madison Del Monte Research Center, Walnut Creek,CA University of California, Davis Carnation Research Corp., Van Nuys, CA Utah State University, Logan Food Protein R&D Center, Texas A&M University, College Station, TX
June 8-26, 1980	Sabry Riad Morcos Head, Dept. of Nutrition & Food Sciences, NRC	Protein-rich food mixtures for infants and children	Food & Drug Administration, Div. of Nutrition, Washington, D.C. Gerber Products Co., Fremont, Michigan University of California, Berkeley University of California, Davis Carnation Research Corp., Van Nuys, CA
June 15-29, 1980	Fayez S. Hanna Head, Soils & Water Use Laboratory, NRC	Soil survey methodology, soil conservation techniques irrigation & drainage methods	USDA Soil Conservation Service, Washington and Phoenix U.S. Salinity Laboratory, Riverside, CA University of California, Berkeley University of Arizona, Tucson U.S. Water Conservation Laboratory, Phoenix, AZ

DATE	NAME	PURPOSE	PLACES VISITED
Jun 23-Jul 12, 1980	Mohamed El Beltagy Assoc. Professor, Botany Dept., NRC	Vegetable crop production	USDA Agricultural Research Center, Beltsville, MD Texas A&M University, College Station University of Arizona, Tucson University of California, Riverside University of California, Davis Cornell University, Ithaca, NY
August 10-22, 1980	Zebaa Motagally Assoc. Professor of Animal Nutrition, NRC	Use of green fodder & agricultural by-products for animal feed	USDA Agricultural Research Center, Beltsville Michigan State University, East Lansing University of Nebraska, Lincoln University of Minnesota, St. Paul University of Wisconsin, Madison
Sept 8-26, 1980	Onsi Metwalli Professor of Nutritional Biochemistry, NRC	Micro-methods for estimating nutrients in biological fluids, biological evaluation of foodstuffs used on experimental animals, nutritional survey methodology	Food & Drug Administration, Division of Nutrition, Washington, D.C. USDA Human Nutrition Center, Beltsville, MD and Grand Forks, ND National Institutes of Health, Bethesda: Center for Research for Mothers & Children National Institute for Arthritis, Metabolism, & Digestive Diseases National Institute of Allergy and Infectious Diseases University of North Carolina, Chapel Hill USDA Northern Regional Research Center, Peoria, IL MIT Dept. of Nutrition & Food Science, Cambridge, MA
Sept 8-26, 1980	H. Abdel-Rahman Salama Chairman, Pest Control & Plant Protection Laboratory, NRC	Integrated pest management, field trials, extension activities	USDA Science & Education Administration, Hyattsville, MD USDA Insects Attractants Laboratory & Insects Affecting Man & Animals Lab, Gainesville, FL University of Florida, Gainesville USDA Agricultural Research & Education Center Quincy, FL USDA Western Cotton Research Laboratory, Phoenix University of Arizona, Tucson USDA Cotton Insects Research Lab, College Station, TX Texas A&M University, College Station, TX

MORE AND BETTER FOOD (continued)

DATE	NAME	PURPOSE	PLACES VISITED
Oct 30-Nov 19, 1980	Mahmoud Nawito Head, Division of Animal Resources, NRC	Animal infertility, artificial insemination	USDA Animal Science Institute, Beltsville Michigan State University, East Lansing University of Wisconsin, Madison Iowa State University, Ames National Animal Disease Center, Ames, IA Cornell University, Ithaca, NY Eastern Artificial Insemination Cooperative, Ithaca, NY
Jan 8-Feb 4, 1981	Zeinab H. Ahmed Director, Food Canning Development Centre, El Nasr Co. for Preserved Foods Sayed A. Salem Professor, Food Science, Food Technology Lab, NRC	Food processing & quality control	Wisconsin Better Process Control School, University of Wisconsin, Madison Grande Cheese Co., Brownsville, WI University of California, Davis Factory of Innovative Foods, South San Francisco, CA Ed Hirschberg Freeze Drying Co., South San Francisco, CA Foremost-Gentry Factory, Gilroy, CA Central Valley Water Project, Los Banos, CA Compack Foods Co., King City, CA California Polytechnica State University, San Luis Obispo Carnation Research Center, Van Nuys, CA Hunt-Wesson Research Center, Fullerton, CA Institute for Food Science & Technology, University of Washington, Seattle Michigan State University, East Lansing Gerber Products Co., Fremont, MI Continental Baking Co., Rye, NY General Foods, CO., Tarrytown, NY The Nutrition Foundation, New York, NY
June 7-10, 1981	El Sayed M. Hegazi Professor, Food Science, Dept. of Nutrition & Food Sciences, NRC	Food Technology meeting	Institute of Food Technologists Annual Meeting, Atlanta, GA (airfare paid by another source)

TRAINING AND OBSERVATION/STUDY VISITS
1979 through 1981
DEVELOPMENT AND APPLICATION OF BIOGAS TECHNOLOGY IN RURAL AREAS OF EGYPT

DATES	NAME	PURPOSE	PLACES VISITED
Nov 2-29, 1979	Fatma El-Gohary Head, Environmental Sciences Division, NRC Adel M. El-Dayem Professor of Chemical Engineering Pilot Plant Laboratory, NRC Mohiy E. Abdel-Samie Microbial Chemistry Laboratory, NRC Hoda Mohamed Megahed Head, Rural Research Unit National Center for Social & Criminological Research Said M. Badr El-Din Soil laboratory, NRC	State-of-the-art examination of biogas research & applications; economic & social aspects of Asian biogas programs	People's Republic of China (visit coordinated by Chinese Academy of Sciences) Thailand (visit coordinated by the Economic & Social Commission for Asia & the Pacific) India (visit coordinated by the Dept. of Agriculture & the Water Pollution Control Board, Gujarat State)
Apr 10-30, 1980	Mohamed M. El-Halwagi Head, Chemical Engineering & Pilot Plant Lab, NRC	Attend two symposia; biogas for community-scale digesters	4th International Symposium on Livestock Wastes, Amarillo, TX Bio-Energy '80 World Congress, Atlanta Clean Energy Research Institute, University of Miami, Coral Gables, FL Fiat Co., Total Energy Module System (TOTEM), Rome, Italy.
May 10-Jun 4, 1980	Mohiy Abdel-Samie Microbial Chemistry Laboratory, NRC	Anaerobic digestion for methane production	American Society of Microbiologists Annual Meeting, Miami Beach, FL University of Illinois, Urbana, IL University of Wisconsin, Madison, WI USDA Forest Products Laboratory, Madison, WI Institute of Gas Technology, Chicago, IL Dr. T.B.S. Prakasam, Chicago, IL (NAS advisory committee member)

BIOGAS TECHNOLOGY (continued)

DATES	NAMES	PURPOSE	PLACES VISITED
Dec 5-17, 1980	A.M. Abdel-Dayem Professor of Chemical Engineering, NRC	Present a paper at international meeting; meet with U.S. advisory panel members	3rd Miami International Conference on Alternative Energy Sources, Bal Harbour, FL Dr. T.B.S. Prakasam, Chicago, IL (NAS advisory committee member) Dr. Philip Goodrich, University of Minnesota (NAS advisory committee chairman)
Nov 29-Dec 18, 1981	Mohamed A. Hamad Assoc. Professor, Pilot Plant Laboratory, NRC	Present a paper at international meeting; current biogas R&D activities	4th Miami International Conference on Alternative Energy Sources, Miami Beach, FL Clean Energy Research Institute, University of Miami, Coral Gables, FL ReICOM, Pompano Beach, FL Institute of Gas Technology, Chicago, IL Dr. T.B.S. Prakasam (NAS advisory committee member) Cornell University, Ithaca, NY University of Illinois, Urbana, IL
Dec 13-23, 1981	Fatma El-Gohary Head, Environmental Sciences Division, NRC	Present a paper at international meeting; current biogas R&D activities	4th Miami International Conference on Alternative Energy Sources, Miami Beach, FL Clean Energy Research Institute, University of Miami, Coral Gables, FL ReICOM, Pompano Beach, FL Institute of Gas Technology, Chicago, IL Dr. T.B.S. Prakasam (NAS advisory committee member)

TRAINING AND OBSERVATION/STUDY VISITS
1979 through 1981
NEW CROPS FOR ARID AND SEMI ARID ZONES OF EGYPT

DATE	NAME	PURPOSE	PLACES VISITED
July 8-29, 1979	Adel El-Beltagy* Faculty of Agriculture, Ain Shams University	Meet with members of NAS advisory committee and U.S. arid lands specialists	Utah State University, Logan, UT Plant Resources Institute, Salt Lake City, UT University of Arizona, Tucson University of California, Riverside University of California, Davis
Jan 22-Feb 13, 1981	Adel El-Beltagy Faculty of Agriculture Ain Shams University	New techniques for development of salt- and drought-tolerant crops; determine suitable sites for Phase II training activities	USDA Agricultural Research Center, Beltsville, MD University of Wisconsin, Madison University of California, Davis University of California, Riverside University of Arizona Texas Tech University, Lubbock, TX Texas A&M University, College Station, TX
Nov 29-Dec 20, 1981	Abdel R. Sharaf Professor, Horticulture, Faculty of Agriculture Ain Shams University	Arid zone salinity problems, plant nutrition, soil fertility	University of California, Davis U.S. Salinity Laboratory, Riverside, CA University of California, Riverside, CA University of Arizona, Tucson Texas Tech University, Lubbock, Texas USDA Agricultural Research Center, Beltsville, MD

* Trans-Atlantic airfare provided by another source.

TRAINING AND OBSERVATION/STUDY VISITS
1978 through 1982
EVALUATION OF EGYPTIAN PHOSPHATE ORES AND PHOSPHATE FERTILIZER PRODUCTION

DATES	NAME	PURPOSE	PLACES VISITED
Oct 22-Nov 4, 1978	Aziza Yousef Head, Mineral Beneficiation & Extractive Metallurgy Dept., NRC	Orientation with U.S. phosphate fertilizer industry	National Fertilizer Development Center, TVA, Muscle Shoals, AL International Fertilizer Development Muscle Shoals, AL U.S. Bureau of Mines, Tuscaloose, AL Aquafine Corp., Brunswick, GA International Minerals & Chemicals Corp., Lakeland, FL Fertilizer Roundtable, Atlanta, GA
Sep 29-Oct 27, 1979	Tawfic Boulos Research Professor, Metallurgy Dept., NRC Samir El-Nozahy Researcher, Metallurgy Dept., NRC	Pilot plant scale equipment and commercial beneficiation methods	Denver Equipment Division of Joy Mfg. Co., Colorado Springs, CO Hazen Research, Golden, CO Colorado School of Mines Research Institute U.S. Bureau of Mines, Salt Lake City, UT International Fertilizer Development Center, Muscle Shoals, AL International Minerals & Chemicals Corp. Lakeland, FL U.S.S. Agrichemicals, Bartow, FL Cardinier Inc., Tampa, FL Davy McKee Inc., Lakeland, FL
Oct 5-Dec 15, 1979	Selim I. Moustafa Assoc. Professor, Metallurgy Dept., NRC Adel K. Ismail Researcher, Metallurgy Dept., NRC	Training on pilot plant scale ore beneficiation & wet chemical processing	International Fertilizer Development Center, Muscle Shoals, AL
Apr 19-26, 1980	Aziza Yousef Head, Mineral Beneficiation & Extractive Metallurgy, Dept., NRC Tawfik Boulos Research Professor, Metallurgy Dept., NRC	Attend meeting	2nd International Congress on Phosphorus Compounds, Boston, MA

PHOSPHATES (continued)

DATE	NAME	PURPOSE	PLACES VISITED
Sep 6-Nov 8, 1980	Samy El-Afifi Senior Research Officer, Pilot Plant Laboratory, NRC Abdel Gwade Saber Manager of Laboratories & Quality Control, Societe Financiere et Industrielle d'Egypte	Training on chemical conversion of phosphate ores	International Fertilizer Development Center, Muscle Shoals, AL International Minerals & Chemicals Corp., Lakeland, FL Gardinier, Inc., Tampa, FL U.S.S. Agrichemicals, Bartow, FL
Sep 7-21, 1980	A. F. Sabry Chairman, Societe Financiere et Industrielle d'Egypte	Commercial phosphate processing	World Bank, Industrial Projects Dept., Washington, D.C. Tetra Tech International, Washington, D.C. Agrico International, Tulsa, OK, and South Pierce, FL International Fertilizer Development Center, Muscle Shoals, AL National Fertilizer Development Center TVA, Muscle Shoals, AL
Sep 26-Oct 10, 1981	Aziza Yousef Head, Mineral Beneficiation & Extractive Metallurgy Dept., NRC Tawfic Boulos Research Professor, Metallurgy Dept., NRC	Technical aspects of fertilizer manufacturing; calcination of phosphate ores	North Carolina State University, Asheville, NC Texas Gulf Chemicals Co., Aurora, NC J.R. Simplot Co., Pocatello, ID Becker Industries, Conda, ID U.S. Bureau of Mines, Albany, OR
Nov 28-Dec 19, 1981	Selim F. Estefan Professor of Metallurgy, Central Metallurgical Research & Development Institute (CMRDI), NRC Talaat A.B. Lawendy Assoc. Professor of Metallurgy, CMRDI, NRC	Training in fertilizer granulation technology	International Fertilizer Development Center, Muscle Shoals, AL

TRAINING AND OBSERVATION/STUDY VISITS
1979 through 1981
CORROSION CAUSES AND CONTROL

DATES	NAME	PURPOSE	PLACES VISITED
March 1-23, 1980	Venice Gouda Chairman, Physical & Inorganic Chemistry Dept. NRC	Monitoring & control of corrosion; attend symposium	National Association of Corrosion Engineers (NACE) Corrosion '80 Symposium, Chicago Amoco Research Center, Naperville, IL Mobil Research & Development Corp., Paulsboro, NJ Mobil Field Research Laboratory, Dallas, TX Unichem International, Hobbs, NM
Oct 20-Nov 7, 1980	Sayed M. Sayed Corrosion Laboratory, Physical Chemistry Dept., NRC	Corrosion monitoring techniques, refinery failure analysis	Amoco Research Center (Standard Oil Co., Indiana), Naperville, IL and Whiting Refinery, Whiting, IN
Feb 12-Mar 29, 1981	Talaat M.H. Saber Research Professor, Corrosion Laboratory, Physical Chemistry Dept., NRC Abdel G.A. El-Hosary Research Assist. Professor, Corrosion Laboratory, Physical Chemistry Dept., NRC	Training on Electron Spectroscopy for Chemical Analysis (ESCA) equipment	Perkin-Elmer, Physical Electronics Division, Eden Prairie, MN University of Minnesota, Minneapolis Battelle Northwest Laboratories, Richland, WA

TRAINING AND OBSERVATION/STUDY VISITS
1980 through 1981
WOOL SCOURING AND WOOL WAX

DATE	NAME	PURPOSE	PLACES VISITED
Jan 6-26, 1980	Adel A. Kantouch Research Professor of Textile Chemical Technology, Textile Research Division, NRC Ahmed N. El-Bendak Professor, Textile Research Division, NRC	U.K.-study "Lo-Flo" & "WRONZ" wool scouring systems U.S.-marketing & R&D management methods; processing of wool wax into lanolin & other derivatives	International Wool Secretariat, Ilkley, Yorkshire, UK Sir James Hill & Son, Ltd., Bradford, Yorkshire UK Croda, Inc., Rawcliff Bridge, Yorkshire Jarmain & Co., Huddersfield, Yorkshire, UK University of Leeds, Textile Dept., Yorkshire, UK Burlington Industries, Clarksville, VA North Carolina State University School of Textiles, Raleigh, NC Cotton Incorporated, Raleigh NC The Wool Bureau, Long Island, NY Amerchol, Inc., Edison, NJ

TRAINING AND OBSERVATION/STUDY VISITS
1979 through 1981
DEVELOPMENT OF RED SEA FISHERIES

DATE	NAME	PURPOSE	PLACES VISITED
Jan 15-Feb 1, 1981	A.R. Bayoumi Director, Institute of Oceanography & Fisheries Academy of Scientific Research & Technology (ASRT)	Meetings with NAS advisory committee	Ben Jones, National Marine Fisheries Service, Seattle, WA Alonzo Pruter, Consultant, Seattle, WA Harvey R. Bullis, Consultant, Princeton, FL
Feb 22-Apr 24, 1981	Sherif Ramadan Assistant Lecturer, Institute of Oceanography & Fisheries, ASRT	Training in spiny lobster fishery development & research management	National Marine Fisheries Service, Miami, FL; Panama City, FL; Beaufort, SC; Highlands, NJ Florida Dept. of Natural Resources, St. Petersburg & Marathon, FL Virgin Islands Dept. of Conservation & Cultural Affairs, Division of Fish & Wildlife, Charlotte Amalie, VI U.S. Environmental Protection Agency, Gulf Breeze, FL Duke University Marine Laboratory, Beaufort, ND Museum of Natural History, Smithsonian Institution, Washington, D.C.

ANNEX F

PROGRAM PLANNING AND MANAGEMENT TRAVEL

1978 - 1981

APPLIED SCIENCE AND TECHNOLOGY RESEARCH PROGRAM

PROGRAM PLANNING AND MANAGEMENT TRAVEL

1978

DATE	PERSONS	PURPOSE	PLACES VISITED
May 1-27	Jay Davenport, Staff Officer, BOSTID	Staff officer, 1st Meeting, JCC Background Discussions NAS/NRC Office in Cairo	Cairo, Egypt
May 5-10	Victor Rabinowitch, Director, BOSTID	1st Meeting, JCC Background Discussions NAS/NRC Office in Cairo	Cairo, Egypt
May 5-10	U.S. JCC Panel H. Guyford Stever, Chairman George Bugliarello, Member James Hillier, Member	1st Meeting, JCC	Cairo, Egypt
July 1-27	M. Kamel, Director, NRC	General Prog. Mgt. Planning R&D Mgt. Training Programs Equipment Procurement	Washington, D.C. Denver Research Inst. U. Wisconsin
July 1-Aug. 15	A.S. El Nockrashy, Dir., Foreign S&T Program, ASRT	General Prog. Mgt. Planning R&D Mgt. Training Programs Equipment Procurement More & Better Food Proj.	Washington, D.C. Denver Research Inst. U. Wisconsin
Sept. 2-15	Osman A. Galal, Dir., Int'l. Programs, NRC	More & Better Food Proj.	U. North Dakota U. Oklahoma Tufts U., Newton, Mass.
Sept. 15-30	Jay Davenport, Staff Officer, BOSTID	Program Mgt. (Recruitment Advisor, NRC) More & Better Food Project	Cairo, Egypt Cairo/Damietta, Egypt

1978, continued

DATES	PERSONS	PURPOSE	PLACES VISITED
Sept. 5-14	A. Nasmith, Staff Officer, BOSTID	Nile Soil & Water Panel Program Planning: Biogas Technoloty	Cairo, Egypt
Sept. 15-21	H. Weldes, Candidate, Advisor, NRC	Program Planning, prior to appointment as NRC Advisor and NAS Resident Program Director	Cairo, Egypt
Oct. 26-Nov. 10	A. S. El Nockrashy, Dir., Foreign S&T Program, ASRT	Program Mgt. 2nd JCC Meeting More & Better Food	Washington, D.C. Columbus, Ohio Washington, D.C.
	Osman A. Galal, Dir., Int'l Programs, NRC	(Same as above.)	(Same as above.)
Oct. 26-Nov. 5	M. Kamel, Director, NRC	2nd JCC Meeting R&D Mgt. Training	Washington, D.C. Columbus, Ohio
Nov. 1-4	A.M. Abou El-Asm President, ASRT	2nd JCC Meeting	Washington, D.C.
Nov. 1-6	Moustafa Hafez Member, JCC	2nd JCC Meeting	Washington, D.C.
	Mahmoud Riad Member, JCC	"	"
	Yusef Waly Member, JCC	"	"
Oct. 26-Nov. 10	Abdel Fattah Rizk Staff Officer, ASRT	2nd JCC Meeting Program Coordination for ASRT	Washington, D.C.

APPLIED SCIENCE AND TECHNOLOGY RESEARCH PROGRAM

PROGRAM PLANNING AND MANAGEMENT TRAVEL

1979

DATES	PERSONS	PURPOSE	PLACES VISITED
Jan. 2	H. Weldes, Dir., NAS Program	Report to Post for assignment at NRC	Cairo, Egypt
Jan. 5-26	A. Nasmith, Staff Officer, BOSTID	Assist in establishing NAS NRC office in Cairo Staff Officer for visit of Biogas Technology panel Staff Officer for visit of Arid Lands panel	Cairo, Egypt
March 24-30	U.S. JCC Panel		
	H. Guyford Stever, Chairman George Bugliarello, Member Mary Carter, Member Victor Rabinowitch Dir., BOSTID	3rd Meeting, JCC	Cairo, Egypt
March 24-April 6	Jay Davenport, Staff Officer, BOSTID	3rd Meeting, JCC Program planning Serve as staff officer for Phosphate Ore panel	Cairo, Egypt
March 24-April 6	A. Nasmith Staff Officer, BOSTID	3rd Meeting, JCC Red Sea Fisheries	Cairo and Alexandria, Egypt
May 11-18	Don Evans, Denver Research Institute (DRI)	DRI was a subcontractor for R&D seminars. Visit was to plan Egyptian participation in the seminars which occurred during June-Sept., 1979	Cairo, Egypt

1979, continued

DATES	PERSONS	PURPOSE	PLACES VISITED
June 13-July 5	A.S. El Mockrashy, Dir., Foreign S&T Program, ASRT	Program coordination discussions with NAS and NSF, Phase II Planning	Washington, D.C.
	Osman A. Galal, Dir., Int'l. Programs, NRC	Program planning, equipment and instrumentation	National Institutes of Health Scientific Instruments Center, U. Wisconsin
		R&D Mgt. Seminars, site visit	Denver Research Institute
		New Crops for Arid Lands proj. planning meeting	Costa Mesa, Calif. Los Angeles, Calif.
		Nutrition activities, MBF project (Galal only)	New York City, N.Y. Tufts U., Newton Mass.
June 18-29	H. Weldes, Dir., NAS Program	Program coordination meetings Phase II Planning	Washington, D.C.
Sept. 15-Oct. 11	Jay Davenport, Staff Officer, BOSTID	Preparations for JCC-IV Phase II Planning Program Coordination Staff officer, Phosphate Ore R&D project	Cairo, Egypt
Oct. 26-Nov. 15	A. Nasmith, Staff Officer, BOSTID	Staff Officer, Biogas Technology Project Staff Officer, 4th JCC Meeting	Cairo, Egypt
	U.S. JCC Panel		
Nov. 4-12	H. Guyford Stever, Chairman	4th Meeting, JCC	Cairo, Egypt
Nov. 2-10	George Bugliarello, Member	"	"
Nov. 4-10	Mary Carter, Member	"	"
Nov. 4-10	James Hillier, Member	"	"
Nov. 3-9	Victor Rabinowitch, BOSTID	"	"
Nov. 1-16	Jay Davenport, Staff Officer, BOSTID	Staff Officer, 4th JCC Meeting Program Coordinator	Cairo, Egypt

1979, continued

DATE	PERSONS	PURPOSE	PLACES VISITED
Nov. 9-13	David Williams, Comptroller, NAS	Financial Mgt., NAS Accounts, Cairo	Cairo, Egypt

APPLIED SCIENCE AND TECHNOLOGY RESEARCH PROGRAM

PROGRAM PLANNING AND MANAGEMENT TRAVEL

1980

DATES	PERSONS	PURPOSE	PLACES VISITED
Feb. 11-March 8	H. Weldes, Dir., NAS Program	Phase II Program Planning 5th Meeting, JCC	Washington, D.C.
Feb. 17-March 16	A.S. El Nockrashy, Dir., Foreign S&T Programs, ASRT Osman A. Galal, Dir., Int'l Programs, NRC	Phase II Program Planning 5th Meeting, JCC Food Technology, More & Better Food Nutrition, More & Better Food Food Technology Pilot Plant Design Planning R&D Mgt. Training	Washington, D.C. Tulane U., New Orleans U.S. Dept. of Agriculture Southern Laboratory, New Orleans Food Protein R&D Center, Texas A&M U. U. Calif./Davis Denver Research Inst.
Feb. 24-28	Hassan Ismail, President and Chairman, ASRT Mostafa Al-Gabaly, Member, JCC Osama Al-Kholy, Member, JCC Ibrahim H. Abdel Rahman, Member, JCC	5th Meeting, JCC	Washington, D.C.
Jan. 8-11	A. Nasmith, Staff Officer, BOSTID	Biogas Technology Panel New Crops for Arid Zones Panel Red Seas Fisheries	Cairo, Egypt " " Cairo, Al Burghada & Alexandria, Egypt
March 22-April 15	A. Nasmith, Staff Officer, BOSTID	Program Mgt., NAS/NRC in Cairo (during sick leave of resident program director.)	Cairo, Egypt
June 10-July 1	Jay Davenport, Staff Officer, BOSTID	Phase II Program Planning & Mgt.	Cairo, Egypt

1980, continued

DATES	PERSONS	PURPOSE	PLACES VISITED
July 15-Aug. 2	A. S. El Nockrashy, Dir., Foreign S&T Programs, ASRT	Program Planning with NAS, NSF, and AID/Washington Equipment procurement and Instrumentation maintenance/repair training R & D Mgt. Training follow-up discussions	Washington, D.C. U. Wisconsin, Madison Denver Research Inst.
Nov. 3-6	U. S. JCC Panel H. Guyford Stever, Chairman George Bugliarello, Member Mary E. Carter, Member James Hillier, Member Gilbert White Member	6th JCC Meeting	Cairo, Egypt
Nov. 3-6	Victor Rabinowitch, Director, BOSTID	6th JCC Meeting	Cairo, Egypt
Nov. 3-21	Jay Davenport Staff Officer, BOSTID	6th JCC Meeting Food Technology Panel, More & Better Food Program Planning	Cairo, Egypt Alexandria, Egypt
	Mary Alice Risdon Staff Officer, BOSTID	6th JCC Meeting Training Program follow-up for 1980 and planning for 1981	Cairo, Egypt
Nov. 30-Dec. 16	A. Nasmith, Staff Officer, BOSTID	Program Mgt., NAS/NRC in Cairo (during sick leave of resident program director)	Cairo, Egypt

APPLIED SCIENCE AND TECHNOLOGY RESEARCH PROGRAM

PROGRAM PLANNING AND MANAGEMENT TRAVEL

1981

DATES	PERSONS	PURPOSE	PLACES VISITED
Jan. 15-Feb.2	Jay Davenport, Staff Officer, BOSTID	Program Mgt., NAS/NRC in Cairo (during sick leave of resident program director)	Cairo, Egypt
March 20-April 12	A.S. El Nockrashy Dir., Foreign S&T Program, ASRT	Program Mgt. and Planning 7th JCC Meeting	Washington, D.C. Texas A&M U.
	Mohamed Fadl Staff Officer, ASRT	"	"
March 29-April 4	Ibrahim Badran President, ASRT & Chairman, JCC	7th JCC Meeting	Washington, D.C.
	Hassan Ismail Member, JCC	"	"
	I. H. Abdel-Rahman Member, JCC	"	"
	Mostafa Al Gabaly Member, JCC	"	"
	Osama Al Kholy Member, JCC	"	"
	Mohamed Kamel Director, NRC	"	"
March 12-April 4	H. Weldes, Dir., NAS Program	7th JCC Meeting 7th JCC Meeting	Washington, D.C. Washington, D.C.
June 12-July 4	Jay Davenport	Program Mgt. & Planning	Cairo, Egypt
June 18-26	James Hillier	Program Planning, Nat'l Policy Measures for S&T	Cairo, Egypt
Aug. 14-Oct. 8	A. Nasmith Staff Officer, BOSTID	NAS/NRC Program Mgt. (After departure of H. Weldes)	Cairo, Egypt

1981, continued

DATES	PERSONS	PURPOSE	PLACES VISITED
Nov. 6-25	Jay Davenport, Staff Officer, BOSTID	NAS/NRC Program Mgt. 8th JCC Meeting 1st S&T Policy Seminar	Cairo, Egypt
	U.S. JCC Panel		
Nov. 9-17	Gilbert White, Chairman	8th JCC Meeting	Cairo, Egypt
	George Bugliarello Member	"	"
	Mary E. Carter, Member	"	"
	James Hillier Member	"	"
	Leo Packer, NAS/NRC Resident Program Director (designate) in Cairo	"	"
Nov. 13-17	Victor Rabinowitch, Director, BOSTID	8th JCC Meeting	Cairo, Egypt
Nov. 9-25	Maryalice Risdon, Staff Officer, BOSTID	8th JCC Meeting 1st S&T Policy Seminar Training program follow up for 1981 and planning for 1982	Cairo, Egypt