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APPLIED SCIENCE AND TECHNOLOGY RESEARCH IN EGYPT
Quarterly Report No. 12 - Phase II
July-September 1984

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INTRODUCTION

This is the twelfth quarterly report, Phase II of the Applied Science and Technology Research Program in Egypt covering the period July-September 1984. The program is supported under Contract NEB-0016-C-00-1058-00 of the United States Agency for International Development (AID) with the National Academy of Sciences/National Research Council (NAS/NRC).

This report gives a summary of principal activities for the period July-September 1984. An overview of each project for Phase II (July 1981-March 1984) was given in the tenth quarterly report (January-March 1984); a summary for Phase I (1978-81) was prepared in June 1982.

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APPLIED SCIENCE AND TECHNOLOGY RESEARCH PROGRAM IN EGYPT
PHASE II: TWELFTH QUARTERLY REPORT
July - September 1984

MAJOR ACTIVITIES

A. Policy Planning and Management

1. Joint Consultative Committee (JCC)

The JCC did not meet during the July-September quarter; the next scheduled meeting, JCC XIV, is to be held in Cairo at the ASRT, October 21-23, 1984. The JCC Executive Committee, Drs. Hassan Ismail and Gilbert White, last met in late June 1984. At that time they asked staff members in Cairo and in Washington to insure that a number of activities and reports were completed for the Executive Committee to review prior to the October meeting of the full JCC. These are:

- Land Reclamation Program Description. With the assistance of Dr. Hassan Wahby, Director, Ministry of Irrigation Water Distribution Research Institute and project director for the Irrigation Systems and Land Reclamation Project of the ASRT 5-Year R&D Plan, a project design document is to be prepared. The document will provide a concise statement of the scope of work, level of effort, overall budget, implementation schedule and should differentiate between the already approved ASRT technical activities and the proposed supporting activities which need funding from unused sums of the arid lands demonstration project. The activities will emphasize socio-economic studies and evaluation of irrigation and management systems in the new lands.

- More and Better Food (MBF). Two reports were requested. The first is a summary report outlining MBF accomplishments since the inception of the demonstration program. This report should also contain a section describing activities that the National Research Centre (NRC) recommends doing within the time and budget constraints of the Applied Science and Technology Research Program. The second report should give an analysis of the existing MBF data and suggest directions for a longer-term NRC program of integrated rural development.

- Research and Development (R&D) Management. This report for JCC XIV should be prepared by the high-level R&D Management Committee appointed by Dr. Fadry from the Egyptian Academy for Scientific Research and Technology (ASRT) and from NRC. Separate plans for strengthening R&D management systems in each institution are expected with recommendations on which types of activities should be undertaken during the 1984-86 period and which should be developed over a longer time (1986-1990).

- Program and Budget Reallocations. With the above three activities reported and with the addition of short presentations on remaining activities in the R&D projects on bentonite clays, pharmaceutical chemicals, and Red Sea fisheries, a comprehensive program and budget reallocation plan for 1984-1986 should be presented for review and recommendations at JCC XIV.

2. Science and Technology Policy Measures

Some activities in the S&T Policy Measures Project continue under the direction of the ASRT Council's S&T Policy Committee. A

draft technology policy statement for Egypt was prepared for discussion at a projected meeting of ASRT with President Mubarak. The Academy has also been an active force behind sectoral S&T policy planning efforts in the Ministries of Agriculture, Industry, Construction, Energy, and Irrigation. All of the activities at the sectoral level and of the ASRT S&T Policy Committee are currently supported by the Ministries and ASRT; the formal conclusion of the joint project within the Applied Science and Technology Research Program was Seminar III in November 1983. Dr. Leo Packer is preparing a summary report which will be included in the October-December 1984 quarterly report.

3. Research and Development Management

In July Dr. I. Badran appointed a Committee on R&D Management Planning whose members are representative of the management systems of the Academy and the National Research Centre. The Committee members are:

- o Dr. M. Kamel, Director, National Research Council
- o Dr. A.F. Abdel Latif, Vice President, ASRT and Coordinator, 5-Year R&D Program
- o Dr. A.S. El Nockrashy, ASRT Coordinator, Foreign Technical Assistance Programs.
- o Dr. A.A. Abdul Azim, Director, Central Metallurgical Research and Development Institute (CMRDI)

- Dr. Osman Galal, Director, Nutrition Institute (Ministry of Health) and Child Health Division, NRC
- Dr. M.M. El Halwagi, Head, Pilot Plant Division, NRC
- Dr. H. Samir Abdel Rahman, Plant Protection Laboratory, NRC
- Dr. M. Kassem, Pharmaceuticals Laboratory, NRC
- Dr. A.I. Naguib, 5-Year R&D Program, ASRT
- Dr. M. Hillal, Technical Office of the President, ASRT

To assist the Committee in its work, Dr. A.A. Abdul Azim spent several weeks in the United States in June and July 1984 gathering background information on R&D project management systems and organizational structure. His report proposes a series of steps to strengthen management and R&D marketing systems for NRC and a broader outline of management development initiatives for ASRT.

A. Strengthening R&D Management Systems in NRC

Two areas were stressed: (a) Continuation of training opportunities for NRC scientific and technical staff in R&D project management principles and practice and, (b) Strengthening of already existing NRC-industry links to utilize the R&D capabilities of NRC for problem solving on topics identified by the industry.

The first area, training in R&D management principles, would continue via in-house 3-week seminar/workshops for NRC scientists and engineers (project leaders) which have been established and are beginning to show an effect upon management methods in NRC divisions and laboratories. The goal is to systematize the holding of training

activities so that a much larger number of persons may attend and to provide continuing education that will stimulate the application and extension of innovations in management.

The second area is R&D marketing or R&D extension services within public sector industries of Egypt to improve quality, reliability of product, reduce costs, and stimulate technology transfer. NRC is an important resource that is currently under-utilized for problem solving by Egyptian industries. The Central Metallurgical Research and Development Institute has instituted a broad program of cooperation within its sector by having its technical staff serve on industry-organized R&D committees. From these committees problems have been identified and referred back to the Institute for solution. This system works well and can serve as a model for NRC divisions/laboratories.

To assure that training and outreach-extension (or marketing) activities are pursued vigorously the NRC could well use a focal point or coordinating office with sufficient staff and resources for its problem solving activities. The plan of Dr. Abdul Azim suggests how this could be accomplished within NRC.

B. Strengthening Management Systems in ASRT

Because the ASRT is a grant-making agency as well as having general policy authority for S&T in Egypt, and particularly for its own affiliated research institutes, its R&D management development plan would be quite different from that of NRC. Dr. Abdul Azim recommended that it formulate its own R&D management development plan. One large

area of common concern, however, is that of R&D project management. ASRT, like NRC, might wish to make more training opportunities available for principal investigators from its affiliated institutes and from research teams that have been awarded ASRT grants.

B. Summary of Project Status

1. More and Better Food

During the July-September 1984 reporting period the MBF Executive Committee described its plan for the remaining two years of the Applied Science and Technology Research Program (September 1984-September 1986). That plan consists of the following major elements:

- Work at the village level to: (a) review and analyze the original base-line data for the two villages to trace its adequacy as a predictive instrument and suggest modifications for future data gathering, (b) document experience gained and lessons learned in 8-12 specific areas such as corn production, tomato production and poultry husbandry, (c) conduct a limited number of new multidisciplinary projects in health and sanitation, nutrition education, and income generating activities where women play a key role.

- Work at the governorate level by utilizing NRC staff as "trainers of trainers." Those to be trained would be staff persons from governorates in agriculture, water use, pest control, etc. The NRC staff would use their experience from Omar Makram and Kafr al Khadra villages to diffuse problem-solving methodologies among staff from one or more governorates with the goal to influence crop production, nutrition, sanitation and family income generation in 8-10 villages.

- Work at the national level by incorporating lessons learned from the peanut and corn projects (and others) on a wider level of application with the appropriate ministries concerned with food and agriculture. In addition, cooperation with the private sector in agriculture can be initiated with crops that are more or less limited to private producers (mango, grapes, tomatoes, medicinal crops) and are not being studied at the Agricultural Research Centre.

- Strengthening of NRC's internal ability to plan, market, and manage multidisciplinary projects such as the More and Better Food Project.

2. Development and Application of Biogas Technology

The principal activity remaining in the Biogas Technology demonstration project is the November 17-24, 1984 international conference dealing with experience in developing countries on biogas systems (state-of-the-art review on biogas technology, its "technology transfer" and information diffusion). The conference is sponsored by the ASRT and the NRC with NAS/NRC and the Office of Bioenergy Systems and Technology of the U.S. Agency for International Development cooperating. Emphasis is upon the interplay of technical, socioeconomic, and managerial factors in biogas system design, operation, and diffusion.

Approximately 100 foreign (non-Egyptian) participants are expected and at least 60 will be from developing countries. As of September, travel support had been assured for participants from India, China, the Philippines, Thailand, Nepal, Ecuador, Peru, Costa Rica, Guatemala, Kenya, Tunisia, Sudan, and Indonesia.

Major technical sessions have been scheduled as follows:

(a) engineering design of simpler biogas units, (b) engineering design of more complex biogas systems, (c) bioconversion experience using alternative raw materials, and (d) economic use of digested materials and pathogen/parasite control. Multidisciplinary, or thematic sessions, include: (a) sociocultural realities of biogas development, (b) financial and institutional infrastructure and, (c) cost-benefit analysis.

The Conference Coordinator is Dr. M.M. El Halwagi, principal investigator for the biogas technology demonstration project and head of the NRC Pilot Plant Division.

3. Arid Zones/Land Reclamation

The ASRT under the 5-Year R&D Program funded by the government of Egypt has already committed LE 385,000 for a four-year effort (May '84-April '88) to evaluate irrigation technologies in new (reclaimed) lands and to study their effects upon crop production, soil properties and water requirements.

The basis of the R&D proposal of Dr. Hassan Wahby (Director, Water Distribution Research Institute, Ministry of Irrigation) and his team is evaluation of technologies on reclaimed lands.

Given the need in Egypt to diffuse lessons learned from water use technologies on reclaimed lands and apply the techniques widely, the project also includes a training component.

The focus of the proposed assistance package from the Applied Science and Technology Research program would be upon those

nontechnical, sometimes nonquantitative, elements of the irrigation-land use system which involves:

- Management of water use both by provider (GOE through its ministries and governorates) and the consumer (farm authority or individual user),
 - Economic constraints pertaining to the system, and
 - Social network within which the new water technology system operates.

A comprehensive R&D plan has been proposed for three sites:

a) west of the delta at El Nubariya, b) along the Cairo-Ismailia road at El Salhia, and c) at the Inshass Experimental Station 60 km north east of Cairo. At each site the factors to be measured include:

- Operational efficiency of the irrigation system
- System inputs of energy, water use, land leveling, and labor and measurements of to water losses, water logging, and other parameters
- Maintenance experience (costs, manpower, complexities)
- Agronomic factors such as soil salinity, fertilizer user, seedbed preparation, weed/pest control, etc.
- Economic costs (land, establishing the irrigation system, annual investment value for land use, etc.)
- Social network aspects (how the irrigation system is managed by the government, private companies, farmers)

- Settlement studies (sociological elements such as reasons farmers moved to the new lands, their perceptions of institutional support, change in role of women in new settlement, etc.)

Over a three-year period, data will be collected, ordered, analyzed, and periodic reports made concerning the data measured and experiences observed in the study.

4. Evaluation of Phosphate Ores

Because of the time availability for the chemical engineering consultant from the International Fertilizer Development Center in Muscle Shoals, Alabama, and the schedule of the principal staff in the phosphate project at the NRC, the start-up of the wet acid phosphate conversion unit using beneficiated ore samples from the three test areas is now planned for early November rather than October 1984.

5. Improving the Process of Wool Scouring and of Wool Wax Recovery

No new information to report.

6. Corrosion Causes and Control

The second visit by Dr. M.T. Thomas, Battelle Pacific Northwest Laboratories, on surface science related projects is now scheduled for October 6-26, 1984. He will be joined during the initial two weeks by Mr. Werner Behr, Perkin-Elmer maintenance engineer who operates out of Munich, Germany, for an intensive maintenance-repair training program on the ESCA Model 550 surface science system. Mr. Behr and Dr. Thomas

will use the scheduled maintenance visit as part of the training activity. A video tape of the equipment disassembly and assembly will be made and left at NRC for future use by the corrosion group.

7. Red Sea Fisheries

No report for this period.

8. Investigation and Evaluation of Egyptian Bentonites for Industrial Applications

A series of orientation and study visits in the United States began in September for:

- a. Dr. Adel Kamal Ismail, Head, Hydrometallurgy Section and Pilot Plant Supervisor, Central Metallurgical Research and Development Institute (CMRDI),
- b. Dr. Nabil S. Felix, Head, Moulding Material Laboratory, CMRDI, and
- c. Dr. Sabah Nassif Boulos, Professor of Earth Sciences, CMRDI.

Drs. Ismail and Felix are primarily concerned with the conversion of bentonite clay minerals into industrial end products such as binders for construction and for metal castings, drilling materials for deep oil exploration, bleaching clays for food products, and soil conditioners for agriculture. Their U.S. visits include bentonite production mines in Wyoming, oil drilling fluid formulation facilities in Texas, a clay minerals commercial testing laboratory in Louisiana, R&D facilities at Indiana University, a continuous metal and a casting

facility (foundry) in Michigan. They also visited a bentonite production facility and laboratory in Germany to contrast the mining and processing techniques there with those in the United States.

Dr. Boulos is a geologist primarily concerned with extraction of bentonite clays from ore bodies and rapid, accurate analytical techniques for clay materials. His visit to the United States consists of study of mining and processing methods in Wyoming, training on analytical methods at Indiana University, and attending the 1984 annual meeting of the American Clay Minerals Society at Louisiana State University. He arrived with about 50 samples of bentonite materials taken from the deposit along the Cairo-Alexandria road. The analyses will be run under his supervision while he is at Indiana University.

9. Preparation of Selected Pharmaceutical Chemicals

Both Ciba Geigy and the Upjohn Company have expressed a willingness to permit one of their chemical engineers to spend two weeks in Egypt assisting NRC in the pilot plant and "production" phases of the pharmaceutical chemicals project. Scheduling cannot be done at this time because shipment of chemical intermediates, ordered through the University of Wisconsin procurement contract, remains incomplete. One of the factors which causes delay in the procurement of chemical intermediates is that catalog items are not necessarily "on-shelf" and ready for delivery. Some materials have 90 days or more procurement delays for preparation of those intermediates. Additional delays in delivery of the intermediates have been experienced in shipping because of the hazardous nature of some materials.

Others are controlled by export-license and this process often requires 30 days or more to obtain the permission to ship. It is expected that it will be March 1985 before the pilot plant/production runs can be scheduled with a high degree of certainty.

DISCUSSION

A. General Status

The July - September quarterly reporting period came at a time of transition for the Applied Science and Technology Research program.

The projects - More and Better Food, Arid Zones/Land Reclamation, and R&D Management - are undergoing review and program design modifications prior to the final months of implementation of Phase II.

The NAS/NRC Contract extension through January 1985 includes specific goals in the scope-of-work action. Progress through September 1984 may be summarized as follows:

<u>Project</u>	<u>Goals</u>	<u>Status</u>
1. S&T Policy	a. Complete all activities for Seminar III b. Final report	a. NAS/NRC Cairo working with ASRT to document all expenses prior to payments for Seminar III. b. Report in draft
2. R&D Mgt.	a. Assess mgt practices/needs in ASRT and NRC b. Recommend 1984/86 (short term) R&D Mgt Program for ASRT and NRC c. Conduct long-range R&D Mgt program review for S&T sector and prepare operational plan	a. Initial reviews taken for NRC only b. Draft Report of Dr. A.A. Abdul Azim under review by Special R&D Mgt. Committee c. Special R&D Mgt Committee will give report to JCC XIV

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| 3. More and Better Food | a. Design of MBF program within revised framework of more comprehensive rural development plan | a. In process by MBF Steering Committee |
| | b. Continue training/orientation and consultant activities | b. Specific technical assistance from Un. Arizona in place and functioning |
| | c. Planning for final report | c. Included in scope of work for 1984-86 plan of MBF Steering Committee |
| 4. Biogas Technology | a. Orientation and Study for two Egyptians from biogas team | a. Completed |
| | b. Plan and conduct international biogas users seminar (Nov. 1984) | b. Planning and implementation on schedule |
| | c. Final meeting of U.S. Panel | c. Scheduled during November seminar in Cairo |
| | d. Planning final report | d. Included as a task for the November 1984 seminar |
| 5. Arid Zones/
Land Reclamation | a. Preparation of design plan for L.R. project | a. Design plan completed and under review by AID. Will be discussed at JCC XIV Oct. 1984 |
| | b. Implementation of local training programs | b. Dependent upon approval of 5a |
| 6. Phosphate Ores | a. Consultant visit start-up of wet acid phosphate conversion unit | a. Scheduled for November 1984 |
| | b. Preparation of final summary report | b. In process |

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| 7. Wool Scouring | a. Consultant for wool scouring line at Bada Dyers facility | a. Deferred, may not be required |
| | b. Preparation of final summary report | b. In process |
| 8. Corrosion | a. Consultant for M&R training, ESCA surface science equipment | a. Arranged for Oct. 6-26, 1984 |
| | b. Consultant for R&D applications of surface science | b. Same consultant as 8a to serve |
| | c. Final Report | c. In process |
| 9. Red Sea Fisheries | a. Training/study travel to USA | a. and b. Pending instructions from principal investigator |
| | b. Consultant, equipment operation and use | |
| | c. Final Report | c. In process for late calendar 1985 |
| 10. Bentonite Clays | a. Training for up to 5 team members | a. Three training and study programs began in Sept. 1984 |
| | b. Visit of U.S. consultant panelist during contract period | b. Tentatively scheduled for January 1985 |
| | c. Final Report | c. In process for late calendar 1985 |
| 11. Pharmaceutical Chemicals | a. Training, observation and study (5) persons in U.S. Pharmaceutical facilities | a. Completed late 1984 |
| | b. Consultant, pilot plant operations | b. Deferred until all chemical intermediates have been shipped |
| | c. Final Report | c. In process for late calendar 1985 |

12. Joint Consultative Committee	Arrange for Oct 84 meeting in Cairo	In process and on schedule for Oct. 21-23, 1984
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B. Comment on Training/Observation/Study Activities

In the April-June 1984 quarterly report reference was made to training, observation and study activities in the pharmaceutical chemicals R&D project. Five Egyptian chemists and chemical engineers were given access to pilot plant operations in Merck, Sharpe and Dohme Research Laboratories (Rahway, New Jersey); Ciba-Geigy Corporation (Summit, New Jersey); and the Upjohn Company (Kalamazoo, Michigan) which could accurately be classified as "specialized training". Activities were supervised by experienced group leaders in pilot plant operation who translate bench-scale laboratory R&D into semi-production and full-scale production operations. The techniques of scale-up, the factors of plant safety and quality control, the necessity for efficiency and high yield and the over-layer of product assurance within environmental constraints are subjects which can be demonstrated only in operating firms working within market demands. Usually firms are reluctant to share "know-how" in these areas because of the highly competitive nature of modern industry. The three firms, however, were forthcoming and generous in their response to the NAS/NRC on behalf of the program with Egypt. The principal investigator of the Pharmaceutical Chemicals R&D Project, Dr. M.B.E. Fayez who is also Vice President of the ASRT, expressed appreciation for this cooperation in

special letters addressed to the many individuals of the companies who made the "specialized training" possible. Dr. Frank Press, President of the National Academy of Sciences, also sent letters of thanks to each company.

In marked contrast to the excellent and generous cooperation of Merck, Ciba-Geigy, and Upjohn was the response for training, observation and study for Egyptian scientists and engineers in the bentonite (clay minerals) R&D project. For example:

- One U.S. firm that mines, processes and markets bentonite clay minerals refused to receive the Egyptian visitors because they considered their operations proprietary.

- One U.S. and one German firm would allow a visit to clay minerals mining (extraction) operations but not to their analytical laboratories.

- One U.S. firm allowed access to R&D personnel and facilities only after intervention of the U.S. advisor for the bentonite project. That U.S. firm is seeking a partner in the Middle East for a joint venture and obviously is interested in the work being done at NRC.

- An official from one firm asked the NAS/NRC to give the rationale for a visit when such a visit would obviously "make the Egyptians more competitive in the future in clay minerals and thus

diminish U.S, opportunities to market those materials." (In fairness to this individual and his firm, a visit was allowed and the Egyptians reported it to be highly informative.)

• To gain an insight into clay minerals analytical and quality control operations on an industrial scale, a visit was made to an independent laboratory (contract analytical services) rather than a laboratory within a clay minerals firm.

One could ask "why the difference" between the two sets of industries. Perhaps the major difference is in the level of technology involved and in the management perspective of those industries. One might compare the two industries in the following manner:

<u>Clay Minerals Industry</u>	<u>Pharmaceutical Chemicals Industry</u>
1. Traditional extractive industrial operation, low value-added to product	1. Manufacturing operation dependent upon high value-added
2. Static technology in processing raw materials	2. Highly dynamic technology
3. Little R&D, primarily a quality assurance operation	3. R&D is the dynamo which keeps firm competitive in a changing industrial environment
4. Primary industry with traditional, conservative management philosophy	4. Industry characterized by management innovation and risk taking
5. Gradually expanding markets	5. Industry of high growth potential

To add some credence to this observation that the more dynamic the industry and the more it is "driven" by S&T, the more open it is to cooperation and sharing, one should note that the area in clay minerals that was most forthcoming for the visit was that dealing with oil-well drilling fluids. Bentonites are very important as drilling muds and innovations in this field have permitted deep drilling to become more nearly routine. Two U.S. companies engaged in this application of bentonite clays were the most cooperative in the clay minerals industry.

Based upon the above observations one might ask if there is not a lesson to be learned for Egypt in developing a national industrial development strategy. A guideline might be that preference given to investments in more dynamic industrial sectors not only targets markets that are expanding but entry into the field through technical assistance is more readily available.

Annex A

TRAVEL FROM EGYPT

July 1 - September 30, 1984

NAME	DATE	PURPOSE	PLACES VISITED
<u>PROGRAM PLANNING AND MANAGEMENT</u>			
A.S. El Nockrashy Coordinator, International Program Activities, ASRT	August 3-17	Program planning and budget discussions	NAS/Washington AID/Washington National Bureau of Standards, Washington
<u>INVESTIGATION AND EVALUATION OF EGYPTIAN BENTONITES</u>			
Abdel K. Ismail Head, Hydrometallurgy Section, Central Metallurgical R&D Institute (CMRDI), NRC	Sept. 6-Oct. 9	Study/orientation re preparation of bentonites for metals casting and oil well drilling fluids, and scale-up of acid/alkali activation processes from pilot plant to production level.	Sud-Chemie, Munich, Germany Magcoar Division, Dresser Industries, Houston, Texas, and Greybull, Wyoming Weintritt Testing Laboratories, Lafayette, La. Southern Clay Products, Gonzalez, Texas George Fischer Foundry Systems, Inc., Holly, Michigan Indiana University, Dept. of Geology, Bloomington, Indiana International Fertilizer Developm Center, Muscle Shoals, Alabama (Dr. Ismail only)
Nabil Sobhy Felix Head, Moulding Material Laboratory, CMRDI	Sept. 6-27	Project progress discussions with advisor Dr. Haydn Murray Review equipment operation and maintenance procedures for chemical conversion of phosphate materials	
Sabah N. Boulos Professor of Earth Sciences, CMRDI	Sept. 17-Oct. 6	Study/observation re bentonite mining and production Analysis and testing of Egyptian bentonite samples in Dr. Haydn Murray's laboratory	Magcoar Division, Dresser Industries, Greybull, Wyoming Indiana University, Dept. of Geology, Bloomington, Indiana