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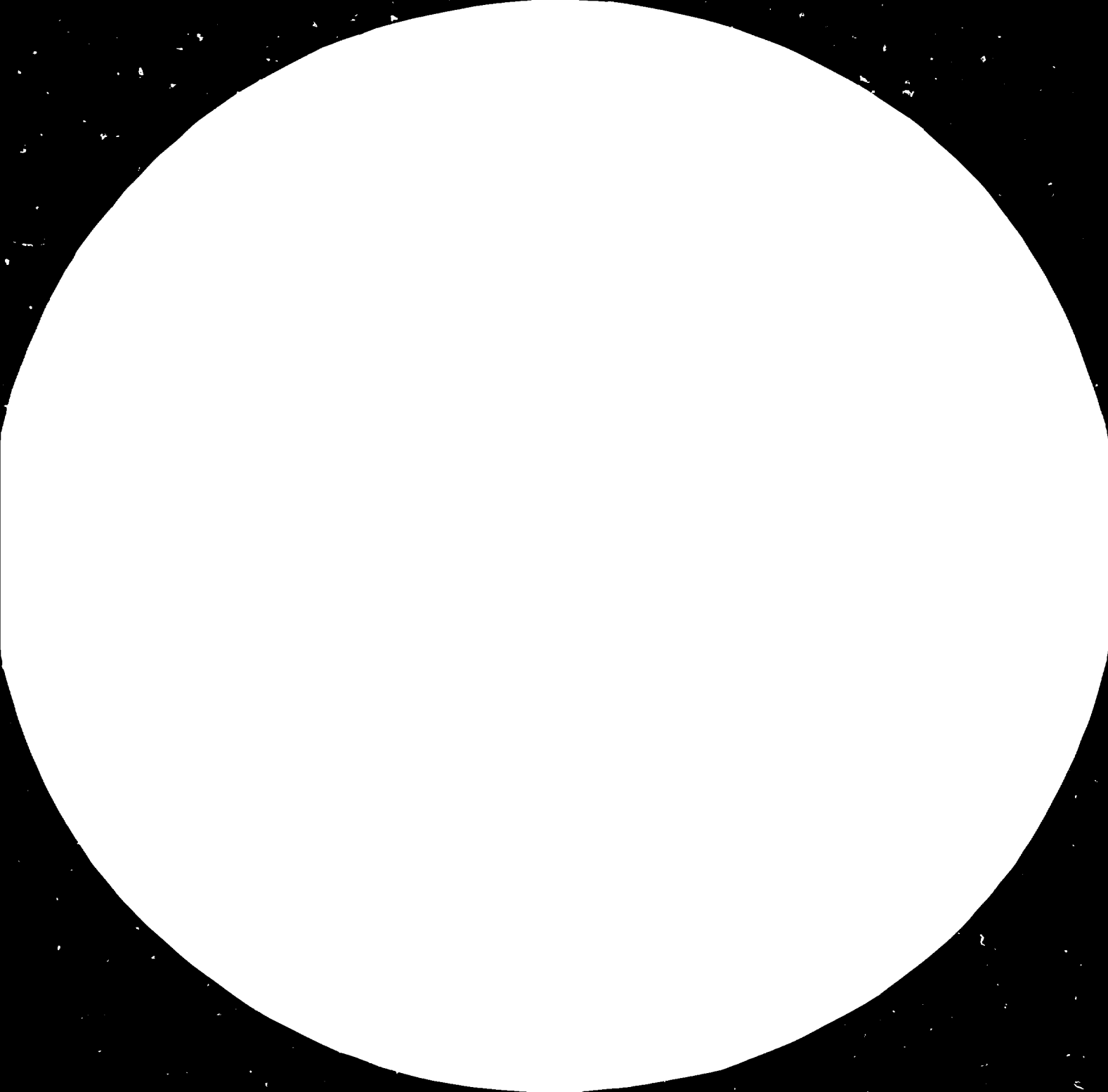
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ASSISTANCE TO THE CEMENT INDUSTRY

TF/JOR/80/002

JORDAN

Mission report: Assistance to the Jordan  
Cement Factories Company

Prepared for the Government of Jordan  
by the United Nations Industrial Development Organization

Based on the work of Mehmet A. Basman, cement expert

V.82-27316

Explanatory notes

Reference to tons is to metric tons.

In addition to the common abbreviations, symbols and terms, the following have been used in this report:

CRDC	Cement Research and Development Centre of Turkey
HMC	Holderbank Management and Consulting Limited Company
JCFC	Jordan Cement Factories Company

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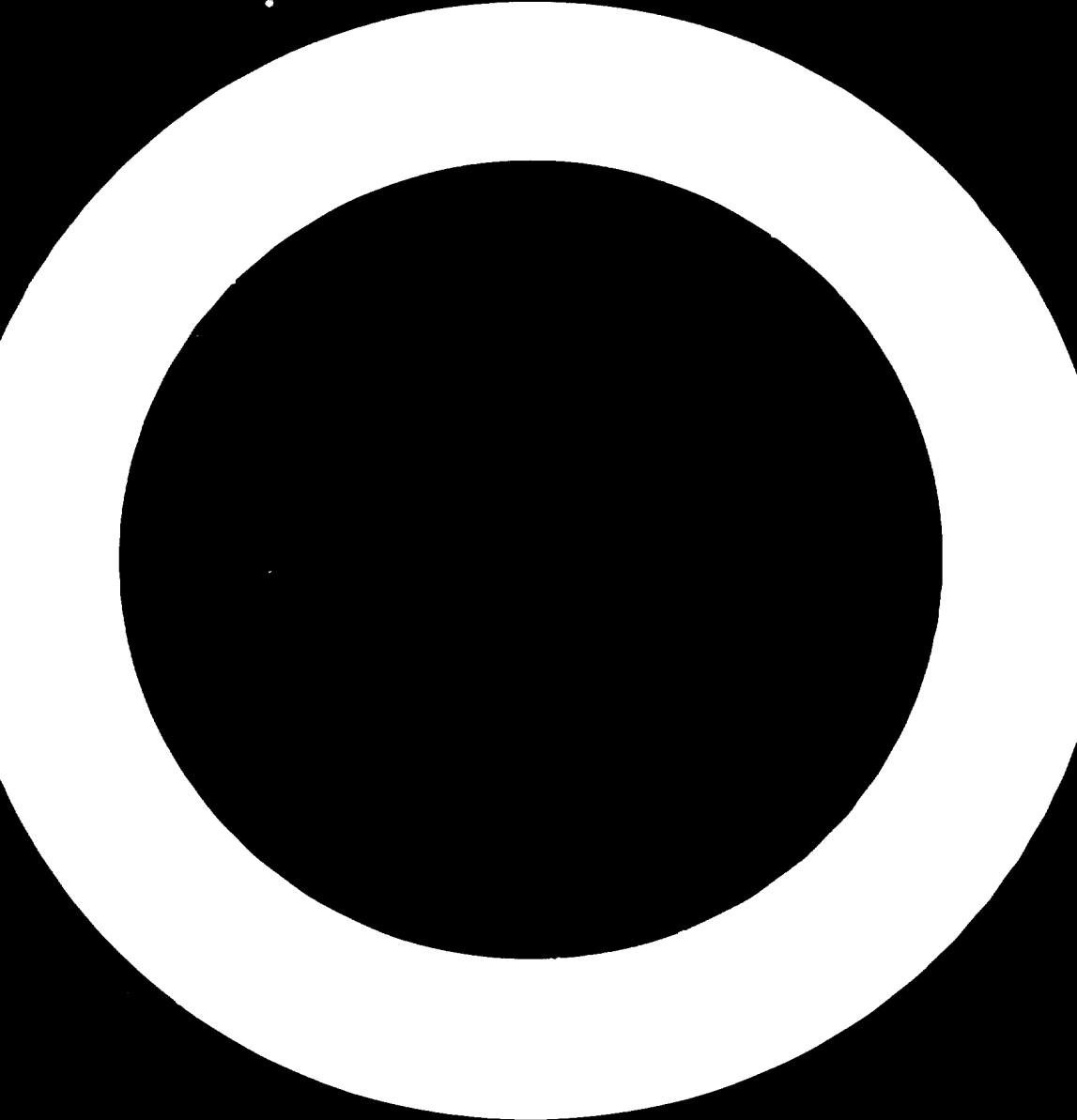
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ABSTRACT

The project "Assistance to the cement industry" (TF/JOR/80/002) was set up in 1980 under Funds-in-Trust, following a request submitted by the Jordan Cement Factories Company (JCFC) to the United Nations Industrial Development Organization (UNIDO). The purpose of the project was to implement and follow up the recommendations of a mission undertaken by the same expert in November-December 1979 under the project "Assistance to the Cement Factories Company" (SI/JOR/78/805), and to provide technical advice to the Company's management.

The main achievements of the present mission, which lasted for 19 months, are the establishment and implementation of a plant operating costs system, including relevant training of the staff involved; the establishment and implementation of environment pollution level surveys; and the training of the plant's technical personnel in production and maintenance planning and follow-up.

The expert's most important recommendations concern the implementation of a personnel-keeping policy to avoid continuous drain of valuable, experienced manpower; the gradual promotion of the company's Training Centre to national and interregional level; and the conducting of a thorough review of all implications connected with the implementation of a planned extension project. He further made detailed recommendations regarding specific production lines of the Company.



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#### INTRODUCTION

The project "Assistance to the cement industry" (TF/JOR/80/002) was set up by the United Nations Industrial Development Organization (UNIDO) upon a request submitted by the Jordan Cement Factories Company (JCFC) in 1980.

The purpose of the project was to implement and follow up the recommendations of a mission undertaken by the same expert in November-December 1979 under the project "Assistance to the Cement Factories Company" (SI/JOR/78/805) and to advise the Company's management on technical matters.

Due to the non-availability of UNDP and UNIDO funds it was decided by JCFC and UNIDO to finance the project under Funds-in-Trust made available by the Company and to limit its duration to six months. Since then, the project has been extended three times, under same financing, two times for six months and the third time for one month, bringing its total duration up to 19 months.

The expert started his work for the project on 1 August 1980 and finalized it on 14 May 1982. During that period of 21.5 months and with the concurrence of JCFC and UNDP Jordan, he undertook two missions, of one and a half and of one month duration respectively, for other UNIDO projects in India as well as in Democratic Yemen, Jordan, Turkey and Yemen.

### SUMMARY OF RECOMMENDATIONS

The expert's recommendations which are contained in chapter III of this report, can be summarized as follows:

1. In order to ensure continuity of its technical staff and to stop further drain of valuable manpower, JCFC should establish a personnel-keeping policy including incentives such as benefits geared to the production level achieved.

2. The Company's recently established Training Centre should gradually be promoted from factory level to national and interregional level. For this purpose the co-operation with other Jordanian cement plants, under construction or planned, and the support of the Government and international organizations such as UNIDO, should be sought.

3. Before taking a final decision, the Company should review the planned extension project considering all implications it will have on the present production capacity, on the region's infrastructure, on environment pollution etc. Alternative solutions such as using part of the production of the new export-aimed government-sponsored cement factories, under construction or in study phase, for the home market should be investigated.

4. In order to ensure a successful operation of its new production line which is under construction, the Company should seek training for its technical personnel in a similar plant abroad, and train them further on site by a team having uncontestable experience with comparable production units.

5. The Company should also completely overhaul the equipment that the new line will share with the other production lines of the plant. Potential bottle-necks existing in the shared equipment should be eliminated.

6. To secure its production line 5, JCFC should as soon as possible replace the patched kiln section and realign the kiln.

7. For a successful rehabilitation of its production line 4, the Company should closely co-operate with the supplier of that production line.

8. To get maximum benefit of its semi-dry process production lines, JCFC should operate them until they cease to contribute to the cash generation of the Company, and should organize practical maintenance and operation training on these production lines.

## I. THE DEVELOPMENT OF THE JORDANIAN CEMENT INDUSTRY OVER THE PAST TWO YEARS

The expert witnessed over the past two years a rapid development of the Jordanian cement industry and, specifically, the fast expansion of the Fuhais works of JCFC. The latter company has in that period of time:

(a) Commissioned and put into operation a new dry-process production line for 2,000 t/d of clinker;

(b) Studied the techno-economic feasibility of adding a dry-process production unit, equipped with precalciner, for 3,000 t/d of clinker;

(c) Awarded the construction of the above-mentioned 3,000 t/d unit under a turn-key contract to Mitsubishi Corporation, Japan. This production line should be commissioned towards the end of 1982;

(d) Studied and implemented an updating project for its existing dry-process production line for 700 t/d of clinker;

(e) After its updating, studied a rehabilitation project for the same line, which is being implemented at present;

(f) Investigated the techno-economic feasibility of adding a further production line, similar to that under construction. The implementation of this new project is under consideration;

(g) Studied and implemented the reorganization of the plant's technical management;

(h) Established a training centre in its plant;

(i) Decided to shut down, one by one, the existing three semi-dry process production units of 300, 350 and 350 t/d, respectively.

To carry out all the above-mentioned jobs, JCFC has hired the consulting and management services of the Holderbank Management and Consulting Limited Company (HMC) of Switzerland.

During the same period of time, the National Planning Council of Jordan has:

(a) Reviewed and finalized the techno-economic feasibility study of a new cement plant in the south of the country, near Reshadiya, for 2 million t/a of cement. The entire production of that plant will be exported. Initially, the envisaged capacity was 1 million t/a, but this has been doubled during the review of the project;

(b) Awarded the construction of the above-mentioned cement plant, under a turn-key contract, to Mitsubishi Corporation of Japan. The commissioning of the plant is scheduled for the end of 1983;

(c) Undertaken a techno-economical feasibility study for another new cement plant for 2 million t/a, situated in the north of the country. At present raw material surveys are being carried by a contractor;

In the above-mentioned studies and implementations the National Planning Council has been assisted by its consultant, Kaiser Engineers, Oakland, United States of America.

Furthermore, the intergovernmental Syrian-Jordanian Industrial Company has finalized studies for its 300,000 t/a White Cement Project. The construction of that plant has been awarded, under a turn-key contract, to BKMI Industrieanlagen GmbH, Federal Republic of Germany, and the commissioning is scheduled for the beginning of 1984.

## II. PROJECT ACTIVITIES

As mentioned in the introduction of this report, the objective of this mission was to implement recommendations of the expert's previous exploratory mission and to advise the Company's management on technical matters.

Upon request of the Company, the expert concentrated his efforts primarily on the establishment and implementation of a comprehensive plant operating costing system, but also on the training of the plant's technical personnel and on the surveying of the environment pollution caused by the plant - all matters which were among the recommendations of the exploratory mission.

### A. Establishment and implementation of a plant operating cost system

The establishment and the implementation of a comprehensive plant operating cost system providing to the Company monthly and yearly cumulative results of its plant performance was achieved in four successive steps.

#### 1. The preparation of the system

For a period of two months the expert has, while training his counterpart, (one mechanical engineer and two cost accountants) achieved the following:

(a) Established the actual and future cost centres of the plant and of the Company's management;

(b) Tailored to the Company's needs a comprehensive and flexible plant operating cost system which will provide to the Company, on a monthly basis for the month concerned, and cumulatively for the current year including the month concerned, the cost components separately for all intermediate and final products;

(c) Set up the rules for data gathering of personnel, material and other costs;

(d) Set up the rules for cost computing;

(e) Prepared the costing tables of the plant's main and auxiliary services.

#### 2. The training of the personnel

During the second step which again covered a period of two months, the expert and his counterparts have:

(a) Lectured the technical personnel of the plant in order to acquaint them with production and maintenance planning and the implementation, analysis and benefits of a plant operating cost system;

(b) Trained them in production and maintenance planning as well as in cost centre allocation and data collecting routines.

3. The trial run of the system

In the third phase which lasted four months, the expert and his counterparts have:

(a) Followed up the implementation of the plant operating cost system;

(b) Organized meetings in the various sections of the plant to discuss and clarify possible misunderstandings in cost centre allocations of jobs and materials;

(c) Supervised the preparation of the manually-computed monthly and cumulative costing tables;

(d) Made final adjustments and modifications to the costing tables.

4. The definitive implementation and the computerizing of the system

The definitive implementation started on 1 April 1981, the first day of the Company's 1981-1982 financial year. The expert has since:

(a) Supervised the implementation of the system carried out by his counterparts;

(b) Assisted the plant's personnel registry and payroll services in their restructuring efforts;

(c) Co-operated with the Company's electronic data processing section which has gradually computerized the entire plant operating cost system.

This system, like all systems, should from time to time be adjusted, amended and improved parallel to any technical and structural changes in the factory and the Company's management.

B. Pollution survey

In order to know exactly the level of environment pollution caused by the plant and the effect on its surroundings, and to identify the areas where corrective action has to be taken, a dust emission survey has been carried out in the Company's plant since the beginning of 1981.

Dust emissions are collected on the pre-set established spots (e.g. areas along the fence of the factory and close to dust-generating equipment) by means of simple collectors manufactured in the plant's workshop according to the British Standard. The dust collector consists of a specially-designed funnel and bottle combination supported by a tripod.

Every month the collected dust is being removed, dried, weighed and analysed. From these data one can derive and evaluate the average daily dust emission quantity at a given checking point or area and the sources of the dust.

This survey not only provides to the Company a basis for comparison of its own dust pollution level with other countries' maximum admissible levels (countries which have adopted dust emission survey methods in their environment pollution regulations), it also indicates the state of maintenance of the plant's dedusting equipment and the performance of the plant operations.

The survey method and routine duties have been established by the expert together with the head of the laboratory who was assigned to carry out and follow up on the survey under the guidance of the expert.

#### C. Training of the plant's technical personnel

The expert's activities related to training comprised the training of his counterparts and of the technical personnel in the implementation of the plant operating cost system, as already described in the previous section; the seeking of training arrangements for the technical staff under the UNIDO technical assistance programme; and, contributing to the Company's training programmes organized by the HMC.

#### Arrangements for in-plant group training

During the briefing for his mission the expert was informed that Chemical Industries and Training branches of UNIDO are preparing in-plant training programmes for national groups of engineers in the facilities of the Turkish Cement Research and Development Centre (CRDC).

JCFC showed considerable interest in such a training programme, and the expert informed UNIDO and CRDC accordingly, indicating the number and the qualification of the participants proposed by JCFC. In spite of the efforts of all parties concerned this training programme has not yet been implemented

due to lack of funds in UNIDO and due to the financial constraints of the Company at that time. UNIDO, however, granted to two Jordanian nationals training of six weeks duration. They participated in an in-plant training programme organized by CRDC for the less developed countries' cement industries. In addition, two Jordanian engineers participated during the same period in another UNIDO in-plant training programme on welding techniques which lasted for three months and was held in the Union of Soviet Socialist Republics.

Contribution of the expert to in-house training

In order to train its technical personnel and to upgrade their management skills, JCFC assigned in November 1981 to its consultant, EMC, under a one year contract, the task to establish and organize a training centre at the plant site and to carry out training programmes.

Upon request of the Company the expert has contributed to the training programme organized by EMC by giving lectures and by assisting the manager of the training centre, a Jordanian engineer, in his work.



### III. FINDINGS AND RECOMMENDATIONS

#### A. Drain of skilled manpower

The drain of Jordan's skilled and experienced manpower to the oil-producing countries also affects JCFC which has great difficulties to retain its experienced technicians and engineers. Recent incentives of the Company to keep its personnel (free housing near the factory for key personnel, salary increments etc.) could not stop or even slow down that general trend. One of the prerequisites, however, for an efficient and regular production is the availability of experienced workers, foremen and engineers who are familiar with the plant's equipment.

It is therefore, strongly recommended to establish and follow up a personnel-keeping policy and to offer additional pecuniary and moral incentives, particularly to the pillars of the Company. These incentives could be e.g. extra benefits related to the monthly or yearly clinker or cement output, and recreational or study tours.

#### B. Staff training

To meet its training needs, JCFC has established its own training centre. The Fuhais works offer an excellent potential for training: there exist adequate facilities for the theoretical training, which can still be expanded; and for the practical part of the training the plant's production units are ideally suitable, as they range from the simplest to the most sophisticated, are of different capacities and use different production processes. In addition it is staffed with experienced engineers who are being trained by HMC to carry out the programmes of the training centre.

This centre should, in a first step be promoted from factory level to national or even interregional level to cover the training requirements of Jordan and other Arabic-speaking countries. This could be achieved by a joint effort of the country's new cement plants, and with the support of the Government as well as international organizations.

In a further step, and again with the help of the Government and international organizations, the centre should also incorporate research and development activities.

In order to materialize this step by step promotion of the centre, technical assistance and material support through UNDP and UNIDO should be sought.

C. Plant extension project

JCFPC has the monopoly of cement within Jordan. All cement is either produced in its plant or imported by the Company.

In order to cover the local demand which is increasing at an annual rate of 12.5%, the Company plans to add a new production line for 1 million t/a of clinker, similar to the one under construction and to be commissioned at the end of 1982. The feasibility study for this new line, carried out by HMC, shows that such an extension is possible, but also indicates a number of problems which the Company would have to solve during and after the implementation of the project, such as raw material investigations, the establishment of a better cement distribution system promoting the sale of cement in bulk, and improvement of the roads connecting the Company's plant to Amman and main consumption centres.

The study does not take into consideration the effects of the new production line on the environment pollution level of the factory and its surroundings and on the performance of the existing production lines during the implementation and the run-in period of the new line.

In fact, after the commissioning of the production line which is at present under construction, the Fuhais Works will require at least two years to stabilize the output of that production line close to the anticipated level, and to rehabilitate its other production lines, which due to many constraints, have not been working at their rated capacity since their commissioning. A further extension project is likely to increase that period considerably.

Although the new line, as the one under construction, will be provided with efficient dedusting equipment, the overall level of environment pollution will augment because of the considerable increase of the plant's production capacity.

It is therefore recommended that, before taking a final decision, a thorough study be made considering all implications - including financial ones - which the extension project might have on the factory as a whole. In addition, all above-mentioned points not dealt with in the feasibility study of HMC should be investigated. As alternatives, the establishment of a new cement plant in another part of the country, or the co-operation with government-sponsored export-aimed cement plants under construction or in study phase, for using part of their production for internal consumption should be considered.

D. Commissioning of line 6

The commissioning of production line 6 is scheduled to start on 18 November 1982. Line 6 represents the latest technical design. It is a large, energy-saving dry-process unit for 3,000 t/d of clinker, equipped with double-string four-stage suspended cyclone heat exchangers, precalciner, roller mill, computer control etc. It also has an efficient dedusting equipment.

The new production line shares the raw material preparation and the clinker conveying equipment with two other units for 2,000 and 700 t/d respectively. The handling capacity of the shared equipment and also the storing or blending capacity are marginal for the three production lines to be served. In addition, the stickyness of raw materials due to their moisture content, causes irregular operation and a decrease in production. Although many modifications have been made, particularly in the outlets of the silos, no satisfactory result has been obtained.

HMC, who has designed production line 6, brings some solutions in its new extension project, line 7, which, however, could be materialized only after three years from now. To ensure the successful commissioning and the smooth operation of line 6, the Company should:

(a) Seek training for the key technical personnel working on the new line, for at least four months and prior to the commissioning of the line, in a plant using machinery of similar size, make and process;

(b) Continue to train them on-the-job, together with the other personnel of the line, for at least one year (including the commissioning period) by a team comprising engineers and foremen who will be responsible for the operation and the maintenance of the new line. The members of that team should have uncontested experience with comparable production lines. Such a team could be hired, under an operation and training contract, through the contractor of the production line;

(c) Overhaul the raw material and clinker handling equipment of the three production lines, before the commissioning of the new line, and start now to train the responsible staff to ensure a smooth and efficient operating of the common equipment;

(d) Independently of the implementation of production line 7, find and implement solutions to the bottle-necks of the common material handling equipment and the problems caused by sticky raw materials.

E. Production line 5

Since the beginning of 1982 when the kiln shell of the burning section burnt out partially due to faulty kiln operation, line 5 has been operating with patched kiln shell. The burnt area, located under the kiln's tyre,

was removed and patched with a bent steel plate of approximately 1 m<sup>2</sup>. Because of the patch and the distorted kiln alignment, a crack in the shell of the kiln's burning section can be expected at any time.

Therefore, a new kiln section should be ordered without delay, the burnt section replaced and the kiln realigned.

#### F. Production line 4

In order to complement the updating project of the line 4 carried out in 1981, JCFC has engaged HMC to implement the rehabilitation project for the same line.

The updating of line 4 comprised the rationalizing of the raw material and clinker transport systems, the upgrading of the line's dedusting equipment and a modification of the kiln gas piping enabling the raw mill to be operated independently

The rehabilitation project of line 4 consists of a complete overhaul and the recommissioning of the production line.

It is recommended to co-operate closely with the supplier of line 4 during implementation and recommissioning as this would shorten the time for project implementation and bring better results.

#### G. Semi-dry process production lines

In line with a recommendation by its consultant, JCFC has decided to shut down one by one, its three semi-dry process production lines for 300, 350 and 350 t/d of clinker. At present the Company stops any one of these lines and operates the other two kilns due to shortages of ground raw material.

It is recommended to keep these semi-dry production lines till they cease to contribute to the cash generation of the Company and to put them at the disposal of the Training Centre for practical plant operation and maintenance training.

