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ASSISTANCE TO THE LIBYAN CEMENT FACTORY, BENGHAZI

TF/LIB/82/002

LIBYAN ARAB JAMAHIRIYA

Mission report: Progress of projects TF/LIB/82/002, TF/LIB/81/008 and SF/LIB/83/002 from 1 July 1982 to 31 December 1983

Prepared for the authorities of the Libyan Arab Jamahiriya
by the United Nations Industrial Development Organization

Based on the work of A.R. Marei, chief co-ordinator

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Explanatory notes

References to dollars ($) are to United States dollars.

A full stop (.) is used to indicate decimals.

A comma (,) is used to distinguish thousands and millions.

The following forms have been used in tables:

A dash (-) indicates that the amount is nil or negligible.

A blank indicates that the item is not applicable.

The following abbreviations have been used in this report:

LCC	Libyan Cement Company
SRC	sulphate-resisting cement

Mention of the names of firms and commercial products does not imply endorsement by the United Nations Industrial Development Organization (UNIDO).

ABSTRACT

The project, "Assistance to the Libyan Cement Factory, Benghazi" (TF/LIB/82/002), is being carried out for the authorities of the Libyan Arab Jamahiriya by the United Nations Industrial Development Organization (UNIDO) under a trust-fund agreement. It is the continuation of project TF/LIB/75/002, which was approved in 1975, has been operating in the field since 1976 and is designed to give direct, long-term technical assistance to the cement industry.

The report covers the progress of the project from 1 July 1982 to 31 December 1983 as well as that of projects "Assistance to the Souk El Khamis Cement Company" (SF/LIB/83/002) and "Assistance to the El Fatayeh Cement Company" (TF/LIB/81/008) for which the expert acted as chief co-ordinator. Details are given of the technical-assistance team for Benghazi, of which 26 groups had been fielded up to the end of the period covered and the analysis of statistical data on the team is brought up to date. The co-ordinator took part in the selection of new candidates for the stand-by lists and continued to assist in the training of the national technical personnel at the Special Training Centre for Cement and Building Materials.

The expert recommends various avenues to overcome the difficulty of extending the contracts of certain Polish specialists whose experience and expertise is of great value to the Libyan Cement Company (LCC); to intensify the co-operation between the Training Branch of UNIDO and the Training Centre and to assist the Centre in the selection of suitable training and teaching staff; and to encourage other Arab countries to organize seminars on energy saving in the cement industry, similar to the one held at Benghazi.

CONTENTS

INTRODUCTION

This report covers the activities of the project co-ordinator and the progress of the project "Assistance to the Libyan Cement Factory, Benghazi" (TF/LIB/82/002) through the period 1 July 1982 to 31 December 1983. As the number of projects executed by UNIDO increased in 1983 to include the technical assistance requested by the El Fatayeh Cement Project (TF/LIB/81/008) and the Souk El Khamis Cement Company (SF/LIB/83/002), it was agreed between UNIDO and the authorities of the Libyan Arab Jamahiriya that the project co-ordinator of TF/LIB/82/002 would supervise all UNIDO projects in the field of cement and building materials, and in April 1983 he was appointed chief co-ordinator and development adviser for cement and building materials in the Libyan Arab Jamahiriya. All three projects are carried out under a trust-fund agreement.

This report covers the fourth period of the co-ordinator's mission. Progress reports on the first three periods have been issued as UNIDO/IO/R.33, UNIDO/IO/R.34 and UNIDO/IO/R.84.

Background of the projects

The cement industry started up in the Libyan Arab Jamahiriya in 1968 by erecting the El Khoms Cement Plant I east of Tripoli. Since that time the cement industry has been constantly expanding until it reached a capacity of about 6.4 million tonnes/year. About one third of this quantity (i.e. 2 million tonnes) is represented by the yearly cement production of the Libyan Cement Company (LCC) at Benghazi, which started its activities in April 1972 with one production line for 200,000 tonnes per year of normal Portland cement. Consecutive extensions followed with the erection of a second production line (400,000 tonnes/year) which started-up in August 1974 and a third production line, with a similar annual production capacity, which was taken over in January 1977. The last extension in the form of a new cement plant at Hawari with an annual capacity of 1 million tonnes, was provisionally taken over in August 1978. With that extension the total production in the Benghazi area was brought up to 2 million tonnes per year. Other building-material industries such as a lime plant with two production lines, a paper-bag factory, a concrete-block factory and a ceramic-brick factory were added over the years to constitute a great building-material complex in the Benghazi area. With that rapid expansion, LCC was confronted with a greatly increased need for experienced technical personnel to operate and maintain the various plants. Accordingly UNIDO was requested for assistance in supplying technical personnel and giving advice on the development and expansion of the industry.

UNIDO assistance to LCC began in 1976 with the appointment of a building-materials adviser who later on acted as a project co-ordinator. A technical-assistance team was built up including 52 experts, of which the first and second groups arrived in May and August 1978. Until the end of 1983, a total of 26 groups had arrived at the duty station. Up-to-date details of these groups are given and evaluated in the report.

As far as project "Assistance to El Fatayeh Cement Company" (TF/LIB/81/008) is concerned, the plant's authorities asked UNIDO for technical assistance in 1982 and an agreement was signed between both parties in the same year. The first, second and third group of specialists arrived on 1 March, 22 April and 6 May 1983 respectively. These specialists attended the testing of the machinery and equipment starting in September 1983 The production capacity of this plant, based on two identical production lines, reaches 1 million

tonnes. The co-ordinator of that project, Romuald Rabajezyk, arrived at the duty station on 15 September 1983.

Concerning the Souk El Khamis Cement Company, which started its cement production in 1977 with a capacity of 1 million tonnes, based on two production lines identical to that of the Hawari Cement Plant, technical assistance was first provided through a company of the Federal Republic of Germany. In 1983 an agreement was signed between UNIDO and the authorities of the Souk El Khamis Cement Company to provide that Company with the specialists required to replace the contractor's staff under the project "Assistance to the Souk El Khamis Cement Company" (SF/LIB/83/002). These specialists started their work in October 1983.

The Special Training Centre for Cement and Building Materials was established to assist the cement and building materials companies in training and upgrading the Libyan personnel. In 1983 negotiations started with a view to provide the Training Centre with the instructors needed to cover such areas as cement production, technology and maintenance.

Concerning the duties and responsibilities described in the previous mission reports, they were carried out until 1 April 1983 when the project co-ordinator of TF/LIB/82/002 became chief co-ordinator for all UNIDO projects. The routine technical supervision and consultation in LCC was then left to the co-ordinator of that project and the chief co-ordinator has since been involved in the following duties and responsibilities:

(a) Acting as chief co-ordinator for the three UNIDO technical assistance projects TF/LIB/82/002, TF/LIB/81/008 and SF/LIB/83/002;

(b) Being responsible for the administrative, social and public-relations services for the Polish specialists assigned to those projects;

(c) Together with the national counterparts, overcome special technical problems by advising the technical personnel (managers) in the field of production and maintenance and tackle specific deficiencies like those encountered during the testing period of the El Fatayeh Cement Plant;

(d) Giving advice to the technical staff on raw materials, raw mix composition, quality control, laboratory testing and evaluation of test results;

(e) Preparing and organizing seminars in the field of cement and building materials (e.g. the one-week seminar held at Benghazi in December 1983 dealing with energy conservation in the field of cement and lime, which was conducted in the Arabic language);

(f) Studying some specific technical problems such as:

(i) Evaluation of the raw materials situation of El Khoms Cement Plant (UNIDO/IO/R.99);

(ii) Follow-up study on the introduction of sulphate-resisting cement production (UNIDO/IO/R.120);

(iii) Surveys, analyses and studies to find a solution to the problems in the ceramic bricks plants;

(g) Contributing to the training and up-grading of the Libyan personnel in the Specific Training Centre for Cement and Building Materials (Benghazi) through his own training courses in Arabic for trainees from the different cement companies and the students of the Training Centre;

(h) Accompanying the Financial Manager of LCC to UNIDO headquarters in December 1982 and May 1983 to review the project budget;

(i) Accompanying the LCC delegation to Poland in December 1983 to interview and select technologists for the stand-by lists and to fill some special posts in the brick plant;

(j) Carrying out some special missions on behalf of UNIDO, like that to Yemen in October 1983, to advise the Yemeni Government before signing the final acceptance certificate for the Amran Cement Plant. A report on that mission which also covered consultations on a new cement project at Mafraq was submitted.

FINDINGS AND RECOMMENDATIONS

A. Summary of findings

The success of the UNIDO assistance in consolidating and developing the Benghazi Cement Industry and Building Materials Complex through the project TF/LIB/82/002 since May 1978 is reflected in the fact that two new UNIDO projects were started in the Libyan Arab Jamahiriya, namely "Assistance to El Fatayeh Cement Company" (TF/LIB/81/008) and "Assistance to the Souk El Khamis Cement Company" (SF/LIB/83/002). Negotiations to set up a further new project with the Special Training Centre for Cement and Building Materials have started.

One hundred and twelve Polish specialists worked for the project TF/LIB/82/002, while 117 specialists were serving project TF/LIB/81/008 at Derna, and 14 specialists started their work, in two groups in October and December 1983, for SF/LIB/83/002. In 1983 there was therefore a total of 243 UNIDO specialists working in the Libyan Arab Jamahiriya. New jobs and posts for specialists appeared in 1983 in areas where there is a labour deficiency in the country, such as ceramic shift leader, ceramic maintenance mechanic or heavy-machine driver.

Periodically the project TF/LIB/82/002 meets the problem of extending the contracts of some Polish specialists, especially those occupying some critical positions in the project. This problem can be considered as the most serious one, as it puts UNIDO and the co-ordinator in a critical situation vis-à-vis the Libyan authorities, because the Polish specialist, if called back, is obliged to obey the orders of Polservice, and leave his duty station without prior notice and without replacement.

In September 1983 a Libyan delegation attempted to select some Yugoslavian specialists for the Souk El Khamis Cement Company through INGRA, Belgrade. Two hundred and eighteen specialists were examined in Zagreb, Pula, Belgrade, Skopje and other Yugoslav cities, but unfortunately the result of those interviews was negative. The reasons stated by the Libyan delegation for the failure were the quality of the specialists offered and language problems.

Before the arrival of the co-ordinator for the Derna project in September 1983, the chief co-ordinator gave special attention to the responsibilities, behaviour and problems of UNIDO specialists assigned to that project at the critical time of testing the plant's equipment, as well as to the technical problems that had arisen during the testing period, by discussing them with both parties, the Libyan engineers and the Japanese contractor.

The chief co-ordinator continued to train Libyan nationals in the Special Training Centre for Cement and Building Materials by presenting training courses in Arabic on the following topics:

(a) Chemistry of cement;

(b) Types of cement;

(c) Raw materials;

(d) Fuels, combustion, heat transfer etc.;

(e) Crushing;

(f) Preblending and homogenization;

(g) Grinding;

(h) Burning (kilns, burnability etc.);

(i) Packing of cement.

These courses were given to students from the Faculty of Technology of the El Najm El Sateh University and to students from the Training Centre who were in their third year. He also participated in the upgrading of staff members of Libyan cement companies.

The development of the Training Centre was discussed and a UNIDO proposal submitted. It was agreed that at the present time the Training Centre was not in such bad need of highly-qualified international experts to warrant the high salaries it would have to pay to them. More important was to employ Arabic-speaking instructors and teachers who would deal with students who have no command of English, and, accordingly, the authorities of the Training Centre agreed to sign an agreement with UNIDO to provide the Training Centre with 15 Egyptian instructors. Their salaries will range between $1,000 and 1,500.

An interregional seminar dealing with energy saving in the cement industry, sponsored by the French Government and UNIDO, was held in France (Paris and Nancy) from 13 June to 1 July 1983. Unfortunately the Libyan delegation could not attend the seminar. The subjects dealt with were extremely useful; the topics presented at Nancy were of a theoretical nature, while the lectures given at Paris dealt with the efforts of French scientists and industrial economists since the oil crisis to develop energy-saving techniques for the cement production. The results achieved were very impressive.

Given the absence of the Libyan delegation at that seminar, the chief co-ordinator found that the most suitable way of informing the Libyan authorities in the field of cement and building materials about new trends in energy savings was to organize a similar seminar in the Libyan Arab Jamahiriya. He prepared the subjects to be presented and organized the seminar in co-operation with the authorities of the Training Centre which was held in the name of UNIDO and the Training Centre from 10 to 15 December 1983. According to the evaluation by the Libyan participants and the staff of the Training Centre, this seminar, which for the first time covered 12 topics on cement and building materials in the Arabic language, was a great success.

A protocol was signed on 15 December 1982 between UNIDO and LCC concerning the final situation of the project TF/LIB/75/002, as the disbursement for the years 1976 to 1981 (phase I) were agreed upon. Another protocol was signed on 27 May 1983 concerning the project delivery of TF/LIB/82/002 for the year 1982 (phase II).

The chief co-ordinator furthermore evaluated the raw material situation of the El Khoms Cement Plant I. The relevant report (UNIDO/IO/R.99) also includes an evaluation of the raw material investigation carried out by Polservice.

The chief co-ordinator submitted two reports concerning the possibility of introducing the production of sulphate-resisting cement (SRC) at LCC. The first report (UNIDO/IO/R.17) deals with the feasibility of producing SRC, while the second one (UNIDO/IO/R.120) covers research into possible raw-mix designs within a range of selected values for certain parameters, which were calculated on a computor, and the results of laboratory investigations evaluating the behaviour of the proposed raw materials. Steps were taken by the authorities of LCC and the chief co-ordinator to initiate the production of SRC which started at the beginning of 1983. At present there are two types of cement being produced in the Libyan Arab Jamahiriya.

In 1983 the chief co-ordinator directed part of his activities towards tackling the problems of the ceramic-brick plant, an affiliated plant of LCC. As the raw materials used in the production of ceramic bricks constitute the main problem, he started to investigate and assess them, since there were no technical data available concerning these raw materials. A separate report was submitted which contains the co-ordinator's findings.

B. Recommendations

1. As the problem of terminating or extending the contracts of the Polish specialists is the most serious one affecting the development of the UNIDO projects, the following is recommended:

(a) The decision of the Polish authorities to extend or terminate the contracts of Polish specialists should be announced at least four months before they expire in order to give the other parties (UNIDO and the Company) enough time to select a replacement and to send that replacement to the duty station before the departure of the terminated specialist;

(b) Clear-cut terms of reference and procedures concerning the control of the UNIDO specialists should be established and both parties, UNIDO and Polservice, should be required to follow them, as there are many conflicts in that respect which have a bearing on the relationship between the project co-ordinator and the Polish team leader (a representative of Polservice);

(c) Because LCC have the impression that new instrument specialists need time to aquaint themselves with the electrical equipment in the factory, they have been particularly concerned about keeping these experts as long as possible (for instance five years) once they are familiar with the technique. This was explained many times to the Polish authorities; it should be discussed again and a decision formulated which should constitute the basis for similar cases in the future;

(d) As there are some specially effective personnel in every department, the Libyan directors can not agree easily to release such personnel at once when this is requested by the Polish authorities. To overcome that problem, five per cent of the Polish specialists should be left under the control of the Libyan authorities, a proposal which was discussed on many occasions with the Polish authorities;

(e) Polservice should provide the project with a translator as communication with the team leader is otherwise somewhat difficult;

(f) Specialists who have resigned or have been repatriated should not be recruited for other UNIDO projects, whether in or outside Libya, before one year in order to avoid problems and misunderstandings with the concerned Libyan authorities;

(g) It was observed that the Polish authorities prevented some specialists, carrying a valid Letter of Appointment by UNIDO, from returning to their duty station after home leave or family visit. This should be discussed with the Polish authorities and pointed out that the Letter of Appointment has to be respected.

2. The Special Training Centre for Cement and Building Materials can be considered the most suitable institution through which UNIDO can offer its support and assistance in the training and upgrading of the Libyan personnel in the field of cement and building materials. One should therefore proceed to obtain entry visas for the Libyan delegation to select the requested Egyptian instructors, who should take up their work as early as possible. Furthermore, the UNIDO Training Branch should establish contacts with the Training Centre to initiate a mutual co-operation and to acquaint the Training Centre with the relevant activities of that Branch (seminars, lectures, training programmes etc.).

3. Bearing in mind the success of the first seminar in Arabic on energy saving, organized by UNIDO and the Training Centre in December 1983 at Benghazi, it is recommended to contact concerned authorities in Arab countries with a view to invite them to organize cimilar seminars in their countries for the benefit of their cement and building materials industries.

4. Detailed recommendations concerning the El Khoms Cement Plant I are contained in report UNIDO/IO/R.99 and those for the ceramic bricks plant in a separate report.

I. PROGRESS OF THE PROJECT "ASSISTANCE TO THE LIBYAN CEMENT FACTORY, BENGHAZI" (TF/LIB/82/002)

May 1978 was the beginning of UNIDO's assistance in consolidating and developing the Benghazi Cement Industry through project TF/LIB/75/002, and that assistance was continued under project TF/LIB/82/002. A first group of 25 Polish specialists, skilled in different areas of cement production, was fielded then, and until 1 January 1984, another 25 groups followed.

As this report covers mainly the situation of the Polish specialists in 1983, the chief co-ordinator provided an overview concerning the periods served by each specialist according to his contract and prepared extensive lists indicating annual leave, home leave, sick leave, injury at work, as well as date of arrival and repatriation. In all, 112 specialists were assigned to the project during 1983.

Upon the request of the Libyan authorities some new specialized jobs (like ceramic shift leader, ceramic maintenance mechanic, heavy-machine operator) which could not be filled by local staff, were included in those lists.

An assessment of the 26 groups of Polish specialists that were assigned to the project since May 1978 was carried out and updated until the end of 1983. This list, which was submitted to UNIDO, indicates the field of activity of the specialist, his name, the budget line, the post title, the duration and extension of his contract, whether he was reassigned, the period of his residence at the duty station and his promotion, if applicable. From that list the chief co-ordinator extracted the statistics reproduced in annex I, which show the number of specialists of each of the 26 groups, whether still working or already repatriated, arranged according to their total period of assignment of up to 6, 12, 18, 24, 30, 42, 54, 66 or 72 months respectively.

From those statistics it can be concluded that there are only 11 specialists (i.e. about 10 per cent the total number assigned to the project) who served the Libyan Cement Company longer than three years and are still working there. These specialists, with their experience and background, are the nucleus upon which the effectiveness and development of the project depends heavily. However, there are often problems when the Libyan authorities ask to extend the contracts of those specialists and the Polish side refuses an extension. The chief co-ordinator has through a number of meetings and discussions with the Polish authorities tried to convince them to accept the extensions, as the personnel in question are crucial for the support of the whole Polish team.

Moreover, since in many instances a Polish specialist needs three to six months to get acquainted with the instruments and equipment, it is understandable that the Libyan authorities have a vested interest in keeping him as long as possible so as to profit from his experience and to avoid discontinuity.

Annex II contains the stand-by candidates from the interviews conducted in March 1981, March 1982, December 1982 and October 1983. A number of interviewed candidates were requested, but were not available: 34 from those selected in March 1981 are not available, seven from the March 1982 interview, and nine of those chosen in December 1982. Annex III gives the names and posts of specialists who arrived in January 1984 as well as those expected to arrive in February 1984.

As all the stand-by lists showed a shortage of specialists for certain posts and jobs, it was decided to conduct further interviews at Wroclaw, Poland. UNIDO was informed accordingly, and interview sessions were arranged to take place from 3 to 14 December 1982. The Libyan delegation, consisting of six members and accompanied by the chief co-ordinator and a UNIDO official, met also with representatives of Polservice as well as with the Director of the Export Bureau of Wroclaw. In the latter meeting the following was discussed:

(a) The Polish authorities were requested to co-operate in releasing specialists for whom an extension of their contracts has been requested, considering that LCC pays for the training of those specialists for a period of 1 1/2 years or more, especially in the electrical department;

(b) It was agreed that the request of the Polish authorities not to transfer the Polish specialist to the barracks erected nearby the cement plant, but to let them stay in the Benina buildings, would be conveyed to the Libyan authorities.

On 6 December 1982 the delegation visited a ceramic brick plant (Srods Slaska) in the vicinity of Wroclaw. The production capacity of that plant is 40,000 t/y. Some of the plant's staff was interviewed and selected.

On 10 December 1982, the delegation met Prof. Kurdowski of the Faculty of Mining at Krakow University. The production of sulphate-resisting cement was discussed, and Prof. Kurdowski recommended to appoint chemist and three burners who have experience in production of SRC. The delegation met those specialists and as the interview meeting was most satisfactory, they were selected to take care of the production of SRC in LCC.

II. TECHNICAL ASSISTANCE TO THE SOUK EL KHAMIS CEMENT COMPANY (SF/LIB/83/002)

Negotiations between Mohamed Gannour, Secretary of the People's Committee of the Souk El Khamis Cement Company, and the chief co-ordinator started at the beginning of 1983 with a view to provide to that company specialists through a technical assistance trust-fund project similar to TF/LIB/82/002, and UNIDO was informed that the Souk El Khamis Cement Company would be interested in receiving 65 Yugoslav or Polish specialists.

An agreement was signed between the authorities of the Souk El Khamis Cement Company and UNIDO, and the Project Personnel Recruitment Section of UNIDO was requested to start preparations for interviews to be conducted in Yugoslavia and Poland.

The chief co-ordinator accompanied El Mahdi Haffaf, Works Manager, to Vienna on 26 July 1983 to carry out the interviews as arranged by UNIDO, but due to the holiday season in Europe, INGRA asked to postpone the interviews until 14 September 1983. Polservice agreed to start the interviews on 6 August 1983 at Wroclaw.

Between 6 and 12 August 1983, 150 specialists were interviewed. Souk El Khamis asked UNIDO to contract 20 of them in the following fields of specialization:

1 shift leader
5 burners
1 mechanical engineer
1 water station specialist
2 welders
4 fitters
2 electricians
4 instrumentation specialists

Only 14 specialists from the total number requested arrived at their duty station, in two groups.

During the interview period a telex was received from Izzeddin El Ghadamsi, Secretary of People's Committee of the Libyan Cement Company, asking the chief co-ordinator to interview also heavy-machine operators and truck drivers, which LCC needed urgently, and 26 drivers were selected.

Concerning the interviews to be held in Yugoslavia, it was agreed that the Libyan delegation would first go to Vienna where two UNIDO officials would join them. The chief co-ordinator, who was supposed to accompany the Libyan delegation and the UNIDO representatives could not participate because his missions to Yemen had been extended by one week.

Between 10 and 14 October 1983 the delegation interviewed 218 specialists in four different cities. The chief co-ordinator was informed by El Mahdi Haffaf of the following results:

(a) The quality of most of the specialists was fair and only about 20 could be selected;

(b) Most of the specialists spoke no other language but Serbo-Croatian.

As the Souk El Khamis Cement Company is in bad need of more specialists, especially after the termination of the contract with the contractor who is still providing them with the specialists, it was agreed to continue to select Polish specialists. A telex was sent to UNIDO asking them to hold another interview in Poland in March 1984, and it is expected that within one year the number of UNIDO specialists will reach 65 or more.

The chief co-ordinator visited the Souk El Khamis Cement Company several times. He met with the specialists in order to settle any problems arising in connection with their assignments and he discussed with the technical staff of the Company problems concerning the production.

III. TECHNICAL ASSISTANCE TO THE EL FATAYEH CEMENT COMPANY (TF/LIB/81/008)

In 1982 UNIDO was requested by the Libyan authorities to provide the El Fatayeh Cement Plant, located 17 km west of Derna, with the specialists needed, in a similar manner and under the same conditions as for the project TF/LIB/82/002. An agreement was signed between UNIDO and the Libyan authorities, represented by Mr. El Ghazali, according to which an interview was held at Wroclaw, Poland, on 20 September 1982, and on 1 March 1983 the first Polish group (28 specialists) arrived at the duty station, followed by the second group (54 specialists) on 22 April 1983, and the third group (23 specialists) on 6 and 13 May 1983. The fourth group (6 specialists) arrived on 10 June 1983 while the fifth and sixth groups (3 specialists each) arrived on 20 October and 10 December 1983 respectively.

These specialists covered all required fields of specialization in all the departments of the cement plant. Since their arrival at the duty station they have been sharing the tasks of the Japanese contractor's personnel, i.e. they participated in the final adjustment and preparation of the machinery for testing.

As during that critical period no co-ordinator was assigned to the project, the chief co-ordinator visited the plant periodically to advise the Libyan and UNIDO specialists. Several meetings were held during which the following was discussed:

(a) The UNIDO specialists should be required, a few months before the testing period, to take care of all machinery, equipment and instruments from the operational point of view, as they will be responsible for that equipment after it has been commissioned, tested and taken over from the contractor;

(b) Every specialist should open a special booklet in which he would record all the defects, problems and deficiencies emerging during the period of time he dealt with the machinery or tested it. Such deficiencies should be reported immediately to the Libyan authorities and thoroughly explained to the Libyan engineers. If there was no response by the Libyan engineers, the deficiencies would have to be reported to the chief co-ordinator who would take care of them through the authorized Libyan personnel.

The chief co-ordinator also discussed with the UNIDO specialists problems concerning air tickets, accommodation, transportation etc. and solved them through the Libyan authorities.

When the testing operations started at the beginning of September 1983, all the deficiencies were recorded by the specialists and submitted through the new project co-ordinator, Romuald Rabajczyk, who arrived at the duty station mid-September 1983, to the Libyan authorities.

Romuald Rabajczyk was briefed by the chief co-ordinator about the background of the project and his responsibilities. He was asked to submit a report covering the project activities during 1983 and to follow the same principles as for project TF/LIB/82/002. Accordingly he submitted a list of UNIDO specialists who worked in 1983 in the El Fatayeh Cement Plant.

Below some technical information concerning El Fatayeh Cement Plant is given:

The Plant has been constructed between 1979 and 1983 by the Mitsubishi Heavy Industry Corporation, a contractor from Japan.

The clinker production is based on the local raw materials, limestone and marl. Iron additives have been foreseen, but until now they have not been used. For the cement production gypsum from the El Mabrouk gypsum quarry, near Benghazi, is utilized.

The plant operates with machinery and equipment manufactured in Japan (about 65%) and in the Federal Republic of Germany (approximately 35%).

It comprises the following production departments:

(a) Limestone quarry. Located at a distance of 1 km from the cement plant. The limestone is exploited in two benches, each of 10 m height. The material is transported by heavy trucks and a special road was constructed for that purpose;

(b) Marl quarry. Located 24 km from the cement plant. The marl is excavated in one bench of 10 m height below surface and transported to the plant by heavy trucks. A special road is under construction. The total yearly requirement of limestone and clay is 1,600,000 t. The utilized ratio of limestone and clay is 58:42 (1.4:1.0);

(c) Crushing plant

Limestone crusher:	Hammer crusher, output 500 t/h Maximum size 1,200 mm Size of crushed materials 20 mm Power of driving engine 750 kW
Marl crusher:	Roll crusher, output 300 t/h Size of material fed 200 mm Size of material crushed maximum 20 mm Power of driving engine 2,090 kW
Gypsum crusher:	Hammer crusher, output 40 t/h;

(d) Raw materials storage. Storage capacity for a 20-day production:

Limestone	67,000 t
Clay	39,000 t

Equipped with primary homogenization system and a reclaimer for the pre-homogenizing of raw materials. Average output of reclaimer 300 t/h;

(e) Raw materials department. Consisting of two raw mills with drying system. Ball mill, total weight of grinding media 167 t.

Output of each mill: 140 t/h.
Two driving engines of 1,500 kW each, with 585 rpm;

(f) Homogenization silos and raw-meal silos. Each production line comprises two homogenizing silos with a capacity of 2,100 t (total 4,200 t) and two storage silos for raw meal with a capacity of 4,300 t (total 8,600 t);

(g) Rotary kilns. Two rotary kilns for production lines "A" and "B" each with an output of 1,600 t/h.

Diameter 4.5 m, length 75 m, inclination 3.5%.

Two driving engines 580 kW. Cooling system with planetary coolers (10 tubes each of 1.8 m diameter and a length of 18 m.
Preheater system, 4 stages, using fuel oil.
Heat consumption 870 kcal/t of clinker.
Each kiln with a hammer crusher with an output of 50 t/h and a driving engine of 55 kW;

(h) Clinker storage. Capacity 64,000 t;

(i) Cement milling department. Two tube mills (two chambers with water injection to each chamber). Output 95 t/h, Blaine 3,000 cm^2/g. Weight of ball mills grinding media 237 t each. Cement transport by elevator, belt conveyors air slides and screw conveyor;

(j) Cement silos. Four silos with a capacity of 18,000 t. Diameter 23 m, height 40 m;

(k) Packing plant. Four machines with an output of 100 t/h, eight autopacers, each for 100 t/h and one palletizing machine for 100 t/h;

(l) Fuel storage. Two containers with a capacity of 5,900 m^3 each;

(m) Dedusting system. Electrofilters for raw mill department, rotary kilns and cement milling department. With by-pass system for alkali removal.

IV. ASSISTANCE TO THE SPECIAL TRAINING CENTRE FOR CEMENT AND BUILDING MATERIALS (SF/LIB/83/003)

A proposal for the development of the Training Centre was submitted and discussed in April 1983 between representatives of the Heavy Industries Secretariat, the Training Centre and UNIDO. The proposal was further discussed in the Managing Committee of the Training Centre and the following conclusions were reached:

(a) At present the Training Centre does not need highly-qualified international experts for its development. An important point for renouncing international experts at this stage were their relatively high salaries as compared to Holderbank's experts still working under a contract in the Training Centre;

(b) What the Centre needed were normal instructors who would train the students. These instructors should speak Arabic.

After several meetings with the Director of the Training Centre and the Libyan authorized personnel, agreement was reached on the following:

(a) UNIDO should be requested to assist in consolidating the activities of the Training Centre by providing it with training specialists in various fields of cement industry. These specialists have to speak Arabic as well as English;

(b) These specialists (instructors), who should have practical experience of several years, will be responsible for the training of the Libyan students in cement technology, physics, chemistry, mathematics etc. Fifteen instructors will be needed in the following areas:

Qualifications and experience	Field of experience	Number required
B.Sc. Eng. or B.Sc. plus 3 years experience	Cement technology	1
B.Sc. Eng. plus 3 years experience	Cement equipment	1
Diploma of industrial school plus 5 years experience	Welding	1
Diploma of industrial school plus 5 years experience	Milling	1
Diploma of industrial school plus 5 years experience	Workshop equipment	1
Diploma of industrial school plus 5 years experience	Cement processing	1
Diploma of industrial school plus 5 years experience	Electrics	2
Diploma of industrial school plus 5 years experience	Operation and maintenance of photocopying machines	1
B.Sc. plus 3 years experience	Physics	1
B.Sc. plus 3 years experience	Mathematics	1
B.Sc. plus 3 years experience	Electricity	1
Graduate plus 3 years experience	English language	1
Total		15

(c) The Libyan authorities would prefer that these specialists and instructors be selected from Egypt;

(d) Their salaries will range between $1,000 and $1,550.

The chief co-ordinator continued to assist the Training Centre in its activities by implementing different training courses and programmes. During the period covered by this report, he trained the following Libyan personnel:

(a) Students in the second year at the Faculty of Technology of the El-Najm El-Sateh University. These students were sent to LCC to be trained in cement technology and LCC asked the chief co-ordinator to take care of them for a period of four months;

(b) Students in their third year at the Training Centre;

(c) Selected national staff from all Libyan cement factories were upgraded by a course on cement technology.

All training courses and programmes were presented in Arabic and the lectures covered the following topics:

(a) Chemistry of cement. Classification of cement, chemical composition, mineralogical composition, properties of major constituents (C_3S, C_2S, C_3A, C_4AF), gypsum, free lime, magnesia, alkali oxides. titanium oxide, phosphorous pentaoxide, potential composition by Bague method, factors influencing the compound contents, cooling of the clinker, composition of the ferrite phase, composition of major compounds, determination of compound composition by direct methods, optical microscopy, X-ray diffraction, cement and hardening of cement pastes, hydration of cement, development of structure in cement paste, factors affecting the rate of hydration, age of paste, cement composition, fineness of the cement, W/cement ratio and temperature admixtures;

(b) Types of cements. Normal Portland cement, sulphate-resisting cement, super-sulphate-resisting cement, high-alumina cement, slag cement, mixed and pozzalanic cements;

(c) Cement raw materials. Types of rocks, igneous, sedimentary and metamorphic rocks, origin of all types of rocks with special reference to cement raw materials, e.g. limestones, clays, marls, gypsum, sand etc., structure, prospecting, development, planning for the quarrying operations, overburden removal, quarrying, drilling operations, blasting, explosives, quality control of raw materials, transport equipment;

(d) Fuels and combustion. Types of fuel (solid, liquid and gas), composition, calorific value of each type, gas laws, combustion, techniques of combustion and kiln control, CO_2 in the kiln exit gases, flame characteristics (length of the flame, ignition of the fuel, shape of the flame, direction of flame, corresponding temperatures for observed colours), oxygen enrichment, heat transfer in the kiln, heating the feed, heat losses, the kiln feed, chemical and physical properties of raw materials, burnability, influence of raw materials on burnability, the burnability factor, burning: charging and drying, calculation, clinkerizing, cooling, coating formation in burning zone, nature of the coating, operating conditions, movement of raw materials in the kiln, the cooled air circuit, the kiln air circuit, the discharge air circuit, movement of feed through the kiln;

(e) Crushing, homogenization and grinding of raw materials. Proportioning of total production, methods of prehomogenization, stacking of blending beds, line-type stacking reclaiming of stock pile, the reclaiming bucket wheel, blending effect. Homogenization of raw mix (Fuller Airmerge system, Polysius homogenization system, Geyser, Spring method, Moller Shearing stream process, Wiba continuous discharge blending), types of crushers (jaw crushers, hammer crusher, Gyratory crusher, Symons crusher, roll crusher, impact crusher), types of mills (open circuit, closed circuit), grinding ball charge, grinding work index according to bond, ball mill power demand, hardness of grinding balls, wear rates of grinding balls, girth ring drives, modifications of girth ring drivers, mill shell, liners, partitions and diaphragms, grinding, coating of grinding media, elimination of coating, admixtures, additives.

V. SEMINAR ON THE ROLE OF GOVERNMENTS AND PERSONNEL IN ENERGY SAVING IN THE CEMENT AND LIME INDUSTRIES

The Interregional Seminar on Energy Saving in the Cement Industry held at Nancy and Paris, France, from 13 June to 1 July 1983 dealt with new trends and experiences in the conservation of energy, both in industrial processes in general, and in the cement industry in particular. 1/ This topic is of great interest to developing countries, and particularly to the personnel of Libyan cement companies. Since the Libyan delegation could not attend that seminar, the chief co-ordinator found that the most suitable way to inform the concerned Libyan authorities about the new trends in energy saving was to organize a similar seminar in the Libyan Arab Jamahiriya.

He suggested that the lectures should be given in Arabic language and discussed the matter with the responsible personnel of the Special Training Centre for Cement and Building Materials Industries in July 1983 and it was agreed that such a seminar should be organized with the active co-operation of UNIDO (represented by the chief co-ordinator) and the Specific Training Centre.

The seminar was scheduled to last for six days, from 10 to 15 December 1983, and the chief co-ordinator did all the necessary preparatory work between July and November 1983. Inspite of various difficulties and problems met, and thanks to the co-operation and the assistance offered by the staff of the Training Centre, the seminar could start as planned and was attended by 25 participants from all Libyan cement companies.

Although the subjects dealt with in the seminar were of great importance to the Libyan cement industry, the main value of the seminar was found to lie in the technical discussions and explanations given by the chief co-ordinator when presenting the lectures. Also, bilateral meetings and discussions between the participants were of great importance. The lectures which were presented by the chief co-ordinator, except one by M.A. Berrwin, covered the following topics:

(a) Influence of the quality of cement raw materials on energy savings;

(b) Energy saving in lime manufacture and lime plants;

(c) The influence of using hydraulic materials in cement production and energy savings.

(d) Energy saving in preblending and homogenization of raw materials and raw mix;

(e) Fuels "types - characteristics - uses" and the different systems applied in cement industry to conserve energy;

(f) Transformation of existing cement plants to reduce energy consumption;

(g) Clinker coolers and their effect on energy saving;

1/ A separate report on that Seminar has been issued under the symbol UNIDO/IO.595.

(h) Additives and their role in energy conservation;

(i) The role of precalciners in energy saving;

(j) The world-wide strategy of energy conservation;

(k) The situation of the cement industry in the Arabic countries;

(l) The situation of the cement industry in the developing and developed countries.

Annex I

STATISTICS OF PROJECT PERSONNEL FROM MAY 1978 TO 31 DECEMBER 1983

A. Length of stay at the duty station

Length of stay	Group number 1	2	3	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	Total
Less than six months																										
Still assigned	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	10	13	1	24
Repatriated	4	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–	1	–	–	–	–	–	–	7
Total	4	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–	1	–	–	–	10	13	1	31
6-12 months																										
Still assigned	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	5	3	1	–	–	–	12
Repatriated	6	8	1	1	1	1	–	3	2	1	–	–	2	–	–	1	–	–	1	–	–	–	–	–	–	28
Total	6	8	1	1	1	1	–	3	2	1	–	–	2	–	–	1	–	–	1	3	5	3	1	–	–	–	40
13-18 months																										
Still assigned	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	7	–	–	–	–	–	–	–	11
Repatriated	5	4	2	6	7	5	5	1	1	1	–	–	2	1	1	1	1	1	–	–	–	–	–	–	–	–	44
Total	5	4	2	6	7	5	5	1	1	1	–	–	2	1	1	1	1	8	4	–	–	–	–	–	–	–	55
19-24 months																										
Still assigned	–	–	–	–	–	–	–	–	–	–	–	–	–	2	6	6	–	–	–	–	–	–	–	–	–	–	14
Repatriated	2	4	1	1	–	1	5	3	1	1	1	1	–	7	–	–	–	–	–	–	–	–	–	–	–	–	28
Total	2	4	1	1	–	1	5	3	1	1	1	1	–	7	2	6	6	–	–	–	–	–	–	–	–	–	42
25-30 months																										
Still assigned	–	–	–	–	–	–	1	–	–	–	1	4	4	3	–	–	–	–	–	–	–	–	1	–	–	–	14
Repatriated	1	1	1	1	3	–	1	–	1	–	–	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	13
Total	3	1	1	1	3	–	2	–	1	–	1	5	5	3	–	–	–	–	–	–	–	–	1	–	–	–	27
31-36 months																										
Still assigned	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Repatriated	1	–	3	–	1	1	2	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	9
Total	1	–	3	–	1	1	2	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	10

continued

Annex I (continued)

Length of stay	Group number																										Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	
37-42 months																											
Still assigned	-	-	-	-	1	-	5	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	9
Repatriated	1	1	1	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
Total	1	1	1	1	1	-	5	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	14
43-48 months																											
Still assigned	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Repatriated	2	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Total	2	1	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	5
49-54 months																											
Still assigned	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	2
Repatriated	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	2
55-60 months																											
Still assigned	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Repatriated	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
61-66 months																											
Still assigned	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Repatriated	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
More than 66 months																											
Still assigned	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Repatriated	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Total in group	26	22	9	10	14	8	19	9	7	5	2	7	10	11	4	8	7	8	5	4	6	3	2	10	14	1	231

continued

Annex I (continued)

B. Specialists still at duty station, by length of stay

Length of stay (months)	Group number																										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	Total
Less than 6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	13	1	24
6-12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	5	3	1	-	-	-	12
13-18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	4	-	-	-	-	-	-	-	11
19-24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	6	6	-	-	-	-	-	-	-	-	-	14
25-30	-	-	-	-	-	-	1	-	-	-	1	4	4	3	-	-	-	-	-	-	-	-	1	-	-	-	14
31-36	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
37-42	-	-	-	-	1	-	5	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	8
43-48	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
49-54	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	2
55-60	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
61-66	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
More than 66	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Total	2	3	-	-	2	-	6	1	1	2	1	4	4	3	2	6	6	7	4	3	6	3	2	10	14	1	93

Note: Including repatriated and re-assigned specialists.

C. Repatriated specialists, by length of stay

Length of stay (months)	Group number																										
	1	2	3	4	5	6		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	Total
Less than 6	4	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	1	-	-	-	-	-	-	7
6-12	6	8	1	1	1	1	-	3	2	1	-	-	2	-	-	1	-	-	1	-	-	-	-	-	-	-	28
13-18	5	4	2	6	7	5	5	1	1	1	-	-	2	1	1	1	1	1	-	-	-	-	-	-	-	-	44
19-24	2	4	1	1	-	1	5	3	1	1	1	1	-	7	-	-	-	-	-	-	-	-	-	-	-	-	28
25-30	3	1	1	1	3	-	1	-	1	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	13
31-36	1	-	3	-	1	1	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9
37-42	1	1	1	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
43-48	2	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	4
49-54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
55-60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
61-66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
More than 66																											
Total	24	19	9	10	12	8	13	8	6	3	1	3	6	8	2	2	1	1	1	1	-	-	-	-	-	-	138

Annex II

SUMMARY LIST OF STAND-BY CANDIDATES

A. Candidates remaining from interview in March 1981

Budget line	Post title	Number
11-08	Cement miller	1
11-11	Maintenance mechanic	6
11-16	Maintenance electrician	4
11-19	X-ray specialist	1
11-25	Fitter	3
11-29	Shift electrician	5
11-31	Workshop and light electrician	5
11-34	Petrol engine mechanic	1
	Total	26

B. Candidates remaining from interview in March 1982

11-07	Central panel operator	1
11-08	Cement miller	2
11-09	Burner	1
11-38	Lime burner	5
	Total	9

C. Candidates selected in December 1982

1. Specialists for ceramic brick plant

11-0Z	Ceramic shift leader	3
11-6X	Ceramic technologist	3
	Ceramic maintenance mechanic	1
	Total	7

2. Specialists for cement plant

11-06	Shift leader	1
11-23	Welder	20
11-22	Sheet metal fitter	8
11-14	Milling machine operator	4
11-12	Compressor mechanic	3
11-09	Burner	3
11-20	Mechanical engineer	1
	Total	40

Annex III

REPORTS ISSUED UNDER THE PROJECT TF/LIB/75/002 OR TF/LIB/82/002

UNIDO/IOD.37 24 May 1976	Report on the first part (February to April 1976) of a year's mission by a building-materials adviser to the cement industry in Benghazi A.M. Afify
UNIDO/IOD.174 11 July 1977	Report on the second part (November 1976 to August 1977) of a year's mission by a building-materials adviser to the cement industry in Benghazi A.M. Afify
UNIDO/IOD.264 1 August 1978	Planning a system of mechanical maintenance Alfred Madsen
UNIDO/IOD.345 16 March 1979	Preventive maintenance planning in the mechanical maintenance service Mehmet A. Basman
UNIDO/IOD.354 15 August 1979	Assistance in instrument maintenance Boguslaw J. Walczenko
UNIDO/IOD.361 12 December 1979	Report of the project co-ordinator for the period up to October 1979 A.M. Afify
UNIDO/IOD.383 16 September 1980	Assistance to the electrical engineering staff in organizing and carrying out electrical maintenance Boguslaw J. Walczenko
UNIDO/IO.437 16 January 1981	Report on a one-month mission (from 11 November 1980) to review and evaluate the progress of the project A.M. Afify
UNIDO/IO.475 13 March 1981	Instrument maintenance systems at the Benghazi complex: final summary Boguslaw J. Walczenko
UNIDO/IO.472 6 July 1981	Report of a one-month mission (from 19 May 1981) to review and evaluate the progress of the project A.M. Afify
UNIDO/IO/R.7 30 July 1981	Raw materials deposits at Wadi Ash Shati and Al Jufrah Abd El R. Marei
UNIDO/IO/R.14 17 December 1981	Preliminary study for long-term technical advice A.M. Afify
UNIDO/IO/R.33 28 October 1981	Progress of the project from 10 May 1980 to 31 July 1981 A.R. Marei
UNIDO/IO/R.17 2 November 1981	Feasibility of producing sulphate-resisting cement A.R. Marei
UNIDO/IO/R.29 26 March 1982	Replacing cylpebs by grinding balls in Benghazi I and Hawari cement mills A.R. Marei

UNIDO/IO/R.34 26 March 1982	Progress of the project from 1 August 1981 to 31 December 1981 A.R. Marei
UNIDO/IO/R.42 26 March 1982	Formation of cement lumps and accretion in cement silos A.R. Marei
UNIDO/IO/R.53 26 March 1982	New gypsum deposits A.R. Marei
UNIDO/IO/R.84 24 January 1983	Progress of project from 1 January 1982 to 30 June 1982 A.R. Marei
UNIDO/IO/R.85 24 January 1983	Feasibility study on plant for ready-mixed concrete and prefabricated concrete products A.R. Marei
UNIDO/IO/R.99 27 October 1983	Evaluation of the raw material situation of the Al Khums I Cement Plant A.R. Marei
UNIDO/IO/R.120 27 October 1983	Follow-up study on the introduction of sulphate-resisting cement production A.R. Marei