



TOGETHER
for a sustainable future

OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.



TOGETHER
for a sustainable future

DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as “developed”, “industrialized” and “developing” are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

15983

Distr.
RESTRICTED

UNIDO/IO/R.193
24 September 1985

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

ENGLISH

ASSISTANCE TO THE SOUK EL KHAMIS CEMENT PLANT

SF/LIB/83/002

LIBYAN ARAB JAMAHIRIYA

Technical report: Assistance to the Zliten Cement Company

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

Based on the work of Boguslaw J. Walczenko,
process instrumentation engineer

V.85-31258
2471T

768

Explanatory notes

The monetary unit in the Libyan Arab Jamahiriya is the dinar (LD).

Reference to tonnes (t) is to metric tonnes.

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

DWC	Daewoo Corporation, Republic of Korea (the operation contractor)
kA	kilo Ampere
KHI	Kawasaki Heavy Industries Ltd., Japan (the contractor)
kV	kilo Volt
NOC	National Oil Company
PTO	Provisional taking-over
RSP	Reinforced suspension preheater
SHI	Secretariat of Heavy Industries
TAC	Technical assistance contract
VDE	Verband Deutscher Elektriker
ZCP	Zliten Cement Plant

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

ABSTRACT

Under the project "Assistance to the Souk el Khamis Cement Plant" (SF/LIB/83/002), for which the United Nations Industrial Development Organization (UNIDO) is the executing agency, a process instrumentation engineer was assigned to assist the Zliten Cement Company for a total period of six months. The present report covers the second period of three months of the consultant's split mission from 6 January to 5 April 1985.

The original purpose of the consultant's mission was to design and implement a maintenance system for the electrical, process control and instrumentation equipment. On the request of the Execution Committee for the Zliten Cement Project his prime duty became the follow-up of the project and technical advising.

The expert continued to check the completion of outstanding items, including the provision by the contractor of maintenance and operation manuals; assisted in the preparations for a meeting to review the two-year consumption of spare parts; advised the management of the Zliten Cement Plant on aspects arising from the operation contract; designed a set of basic forms required for the introduction of a maintenance system; and evaluated offers for the conversion of the existing oil-burning system to one using natural gas.

CONTENTS

	<u>Page</u>
INTRODUCTION	6
RECOMMENDATIONS	8
 <u>Chapter</u>	
I. OUTSTANDING ITEMS	9
II. FINAL DRAWINGS AND MANUALS	11
III. REVIEW OF SPARE PARTS	12
IV. PURCHASING OF SPARE PARTS	13
V. TECHNICAL ASSISTANCE	14
VI. MAINTENANCE PLAN	15
VII. CONVERSION TO GAS-FIRING SYSTEM	17
 <u>Annexes</u>	
I. Job request	19
II. Job report	20
III. Motor record card	21
IV. Instrument record card	22

INTRODUCTION

This report covers the second period of three months (6 January to 5 April 1985) of the consultant's split mission under the project "Assistance to the Souk ei Khamis Cement Plant" (SF/LIB/83/002) for which the United Nations Industrial Development Organization (UNIDO) is the executing agency. As explained in a previous report (UNIDO/IO/R.154), the consultant was originally assigned to establish a system of maintenance for electrical and instrumentation equipment in the newly-commissioned Zliten Cement Plant. However, since the situation existing in the plant called for an expert to deal with the follow-up of the project during the period after the provisional taking over, he was requested by the Project Execution Committee to change the priorities of his assignment and to take care of the technical problems existing or arising in the plant during the guarantee period. His primary duty has therefore changed to technical advising and co-ordination. In particular the consultant was requested to:

- (a) Check the completion of outstanding items;
- (b) Identify new deficiencies;
- (c) Review the consumption of spares for two years;
- (d) Follow up contractual obligations of the contractor;
- (e) Prepare technical documentation for a gas-burning system;
- (f) Establish a basic maintenance system;
- (g) Co-ordinate the technical assistance provided by KHI;
- (h) Clarify all technical matters on a daily basis.

The Zliten Cement Plant, which has a capacity of 1,000,000 t/y, was supplied by Kawasaki Heavy Industries Ltd. (KHI), Japan, and since 27 June 1984, the date of provisional taking over, the plant is under guarantee for a period of one year.

As mentioned in the expert's preliminary report, the plant is operated by a technical team of 206 nationals of the Republic of Korea under a technical co-operation contract concluded between the Secretariat of Heavy Industries (SHI) and the Daewoo Corporation (DWC), Republic of Korea.

The operation contractor ought to run the plant in an economical, efficient and skilled manner, ensuring high productivity and a long life of the plant.

The designed production rate of the different departments of the plant and the capacity of the storage facilities for various materials for the process lines were detailed in report UNIDO/IO/R.154.

During the consultant's present mission the Project Execution Committee was elected and the Secretary of the managing body nominated. In that way the project has been transferred to the Zliten Cement Plant and the basis for a proper operational and administrative structure has been laid.

The consul'ant continued to give technical advice, to prepare comments on various technical and contractual matters and to co-ordinate the technical

assistance service. Recently he prepared the necessary documents for the evaluation of the two-year requirement of spare parts, which was due after nine months of operation of the plant. Since the inventory of stores was not ready at the end of March 1985, the meeting on spare parts was postponed until the beginning of May 1985. For that reason and also because the meetings on the final taking over were scheduled for July 1985, at which the presence of the consultant was considered necessary, the management of the Zliten Cement Plant and SHI requested that the consultant should undertake a third mission.

RECOMMENDATIONS

1. The cards and forms for the establishment of a maintenance system should be printed as soon as possible so that the technical assistants can fill in all basic data.
2. The inventory of spare parts should be completed before the meeting on the evaluation of the two-years spares consumption will start.
3. The completion of all outstanding items should be checked jointly by ZCP/DWC and KHI engineers before the final take-over meeting.
4. The weekly technical meetings should continue as a suitable forum for the discussion of all problems.
5. The number of KHI technical assistants should be reduced from 14 to 5, the money thus saved channelled to the trust-fund project, and UNIDO requested to provide the required technical advisers.
6. For the conversion of the oil-fired system to one using natural gas, a subcontractor should be sought for the erection of the works, and the know-how and equipment contracted from a renowned manufacturer of burning equipment for cement kilns.

I. OUTSTANDING ITEMS

As mentioned in report UNIDO/IO/R.154, a list of outstanding items was prepared by the consultant at the end of the performance tests. According to criteria described in that report, those items were divided into two categories: major and minor. The contractor was obliged to report on the progress in completing the outstanding items during the guarantee year and the aim was to clear all items before the final taking-over in June 1985. One of the duties of the consultant was to check, test and advise on the completion of the outstanding items.

Since progress was very slow, it was necessary to call a meeting of the two parties involved, SHI and KHI. During that meeting which was held at the beginning of December 1984, the possibility of withholding payment for outstanding items - as recommended by the consultant in his progress report - was discussed, and as a consequence a total amount of about LD 800,000 has been retained by SHI. This action substantially accelerated the completion of the major as well as minor outstanding items, but a great quantity remained under observation.

From the list of the major outstanding items the following were completed or an attempt made to complete them.

A. Mechanical

Vibration, bearing temperature and support of the RSP fan

The bearing of that fan (capacity 215,000 N m³/h, 1,000 r.p.m. max.) was replaced by a new type in January 1985. The vibrations were less, however not eliminated, and the drive as well as the bearing of the motor showed a higher value of vibrations. It took KHI a long time to prepare a report in which they explained this phenomenon and proposed to change a coupling in order to eliminate the vibrations.

To make a proper judgement, this item has to be further monitored.

B. Electrical

Jointing on 6 kV ring main cables

KHI monitored the temperature at the joints over a period of six months and the result was satisfactory. According to the PTO agreement, KHI was obliged to carry out that test to verify that the joints, made by an inline splice to repair 21 joints on the 6 kV ring main cables, can withstand 10 kV AC and fault current (short-circuit current). The testing procedure, which conforms to the relevant international standards, had been prepared jointly by KHI and the consultant. The test was carried out in the works of Sumitomo Electric Co. at Osaka, Japan, using special equipment which allows to apply for a short period of time a current of 10 kV. The consultant was nominated by SHI to supervise the test and confirm the results obtained. His pertaining report was submitted to SHI. Furthermore, KHI was obliged to submit a separate certificate for a test carried out, according to VDE standards, by Sumitomo 3 M on the insulation tape used for splice joints. As soon as that report will have been submitted, this outstanding item will be considered completed.

C. Instrumentation

Drift of accuracy of weigh belts and weigh feeders

This problem was monitored and reported on at regular intervals, and the results were satisfactory.

Reliability of the gas analysers

Some improvement in the stability of the gas analyser protecting the electro-precipitators of the raw mill was observed after modification of a sampling probe. The reliability and stability of the gas analyser at the kiln inlet could not be improved, although ZCP constantly reminded KHI to take the necessary steps.

Blending computer, pneumatic sampling and X-ray analyser

The blending computer and other elements of this automatic closed control loop, i.e. pneumatic sending of samples, sampling stations, X-ray analyser etc. have not been operating since November 1984 due to a fault in the X-ray system. Therefore monitoring was not possible. KHI was urged to repair the system, as it is very inconvenient to perform all analyses manually. Since there are only three months left before the date of the final taking-over, it will not be possible to evaluate the performance of the system, as adequate time after its repair is needed to observe it under normal operating conditions.

D. Additional outstanding items

During the initial period of operation some new problems have arisen. Most serious is the malfunctioning of the reverse osmosis units in the water treatment plant and an extensive rusting of all water pipes throughout that plant. During the weekly technical meetings KHI was requested many times to submit proposals on how to resolve the problem.

Another serious problem is that pitting occurred in large reducers i.e. in the reducer of cement mill No. 1, of the kiln main drive and of the crusher.

Both issues will be closely monitored and a decision will have to be made at the final take-over meeting.

II. FINAL DRAWINGS AND MANUALS

With some delay, in January 1985, the electrical drawings and manuals were provided with a consistent index system and an appropriate master list. The consultant, together with a KHI engineer, checked that they were distributed to all locations described in the previous report.

The mechanical documentation, i.e. the so-called maintenance and operation manuals were still not ready to begin general check-ups because the index system was missing. Random checks showed that the documentation was not in a shape to use it as a reliable source to carry out maintenance and repair work. Although the contractor was often reminded of that shortcoming, no action has been taken so far.

Since it is important to be able to comment on the documentation before the final take-over meeting in July 1985, the expert suggested to the management to assign one electrical and one mechanical engineer who would start with the checking immediately, as there are only three months left to finalize this matter. It was recommended, that one engineer of SHI Tripoli, who was involved in the execution of the Zliten Cement Plant project, will be assigned on a full-time basis to that job.

It has to be pointed out once again that proper technical manuals and drawings help to reduce downtime and maintenance costs, and are a major factor in eliminating frustration of maintenance workers. In a country like the Libyan Arab Jamahiriya, which is far from service centres, good documentation is vital to carry out proper maintenance.

III. REVIEW OF SPARE PARTS

At the provisional taking-over (PTO) meeting held in August 1984, it was agreed that spare parts for a two-year operation will be reviewed nine months after PTO, i.e. at the end of March 1985.

According to the contract, KHI shall ensure that any shortfall in the two-year requirement of spare parts, due to normal plant operation during those nine months, shall be supplied free of charge. The consumed spare parts can be divided into two groups:

(a) Spare parts which were provided by KHI according to the spare-parts lists and were stored in the ZCP store house;

(b) Spare parts which were not included in the lists of spares, but have been consumed and procured again by KHI during the nine-month review period. Those additional spare parts were imported and stored by KHI. At the weekly technical meeting No. 5 on 13 November 1984, SHI requested that the additional spare parts provided by KHI be checked and recorded by SHI to permit an evaluation of the consumption of spares. This procedure has not always been observed.

Moreover, the storehouse was undergoing modification during the time when the consignment of spare parts arrived, and was not ready until November 1984. Both events contributed to the fact that the storehouse documentation was inaccurate. Therefore, the consultant recommended and initiated an inventory of stocks in March 1985. The fact that the arrangement of the spares in the storage area had not been completed by the contractor created difficulties in identifying spares. At the request of ZCP, KHI agreed to delegate again a store specialist from Japan to the site. KHI proposed to recalculate the actual requirement of spare parts for the remaining period of 15 months by a direct pro-rate calculation of consumed spares due to normal wear and tear during the nine-month period. All pros and cons concerning this formula have been discussed with ZCP engineers, but as long as real consumption figures were not available, it was not possible to determine whether that procedure would be advantageous for ZCP. Therefore, the meeting to evaluate the two-years spare parts consumption was postponed until May 1985.

IV. PURCHASING OF SPARE PARTS

During the second part of his mission, the consultant helped to prepare orders for various spare parts and initiated inquiries addressed to some manufacturers. Some catalogues of manufacturers of tools, machinery, refractory and chemicals were obtained. However, it is essential to establish, without delay, a proper overseas purchasing department within the administration of ZCP, since commercial relationships with foreign manufacturers and suppliers will increase. Once the guarantee period will be over, it will be the responsibility of ZCP to purchase all spare parts and consumables in order to ensure proper operation of the plant. The purchasing department shall co-operate closely with the chief of stores and the stock controller. Furthermore, all correspondence concerning purchases shall be the function of the purchasing department. Production and maintenance personnel must have close and regular contact with the supplies department in order to know the current situation.

Since the time lapse between the first inquiry and delivery to the plant recently became longer due to financial and customs-clearance procedures in the country, it is necessary to begin now with the preparatory work for the delivery of spares due in two years' time. Good communication facilities, like telex, are indispensable to speed-up the communication process on financial and technical matters with foreign suppliers. Therefore, ZCP shall not spare any effort to install a telex equipment.

V. TECHNICAL ASSISTANCE

At the beginning of 1985 the number of trainees in different fields was essentially increased. Besides, an electrical engineer returned from a one-year training at Siemens A.G. and resumed his duty as chief of the electrical department. Nevertheless, some areas of the operation and maintenance could still not be taken over by the local personnel, and the same number of the operation contractor's personnel had to be maintained. It is planned, however, that in the third year of operation the personnel of operation contractor will be reduced to only 86 persons.

As explained in the consultant's previous report, the technical assistance provided by KHI does not meet the needs of the local engineers and technicians, the reasons being a lack of command of English or a lack of interpersonal communication skills. Some of the positions were redundant from the beginning, such as fitter, rigger and plate worker. Those specialists were never in touch with their local counterparts. All technical assistants tend to protect the interests of the contractor or to follow-up the completion of outstanding items instead of being advisers to the ZCP engineers. Considering all above-mentioned facts, it was proposed to the People's Committee of ZCP to reduce the number of technical assistants from 14 to five essential positions. The money thus saved could be channelled to the UNIDO trust-fund project and UNIDO could bring in advisers, who would be selected by the ZCP authorities. The consultant discussed this proposal with the Committee, emphasizing the advantage of UNIDO technical assistance.

Since the plant is still operated by the team of the operation contractor, only few experts need to be provided as advisers to the management.

During a briefing at Vienna, the consultant discussed this project with the substantive backstopping section of UNIDO and prepared an outline for the project document.

The issue was later discussed with SHI and an official request for UNIDO assistance followed. The initial project document was revised during a meeting with the People's Committee of ZCP and finally the following specialists were requested:

Adviser in electrical engineering

Adviser in electronic engineering

Adviser in process engineering

Adviser in mechanical engineering

Adviser in chemical engineering

If the project could be operational before June 1985, the advisers' duty would be to check all machines, equipment etc. in order to prepare a list of deficiencies for the final take-over meeting in July 1985. If the advisers could be fielded only after that date, they would be concerned with initiating or improving the routine operation of the departments concerned.

In any case the advisers shall work close to their local counterparts to ensure a transfer of experience on a person-to-person basis.

VI. MAINTENANCE PLAN

The consultant prepared a set of basic forms in order to establish a procedure in the Maintenance Department. The efforts concentrated mainly on the Electrical Department; however, some of the forms are common for the Electrical and the Mechanical Department. The following forms were prepared.

Job request

The form reproduced in annex I is a typical maintenance order, which should be completed by the supervisor in the Production or Maintenance Department, before sending it to the maintenance supervisor or to the maintenance worker in the appropriate section of the plant. An important feature of the form is that the maintenance worker is informed of the nature of the fault and the priority assigned to the job. To ensure the safety of workers, it may also be necessary for certain jobs to receive a work permit from the official responsible for safety.

Job report

In the job report (see form in annex II) the work done and the condition of the machinery or equipment are recorded. For any maintenance scheme to be effective, there must be a continuous flow of information to and from the persons executing the work. Such feedback is essential for the control and adjustment of the plan. Occasionally a maintenance worker may be called upon to correct a minor defect such as a blown fuse, a sheared pin etc. In isolation, it may appear not worth the bother of making out a job report; indeed, it may take longer to complete the form than to do the actual job. But if the same defect occurs several times, this could signal some serious trouble. Only when such individual incidents are recorded over a longer period of time and viewed as a whole may their true cause become apparent. Thus, seemingly unimportant faults should be reported so that they can be entered in the history card and thus help to build up a complete picture on the maintenance undertaken.

Record card

The record card is a document on which information about all work done on a particular machinery or piece of equipment is recorded. For the initiation of the electrical maintenance system two basic cards were proposed: a motor record card and an instrumentation record card (see annexes III and IV). In the course of time the system should be extended to cover other equipment such as transformers, control cubicles etc.

Apart from basic information such as the name of the equipment, its identification number, location etc., all maintenance events during the operational life of the equipment are to be recorded on the card.

Initially it may be difficult to decide what information is essential, and the tendency might be to record everything mentioned on the job report; but with experience, it will be possible to summarize the information effectively. For most purposes it is sufficient to log, in chronological order, such details as: inspection, repairs, servicing and adjustments carried out; breakdowns and failures, their result, their causes, corrective action taken; work done on the equipment, components repaired or replaced; conditions of wear, tear, erosion, corrosion etc.; measurements or readings taken, results of tests and inspections; and the time and cost involved to carry out the maintenance or repair.

The forms are bilingual, Arabic and English, and master copies were given to the management in order to arrange the printing of 1,500 pieces of hard cards. An appropriate filing system has to be purchased locally. Initially, the technical assistants will help to record on the cards the basic information taken from documentation, manuals, name plates etc.

VII. CONVERSION TO GAS-FIRING SYSTEM

A coastal gas pipeline which will deliver natural gas from the Marsa Brega petrochemical complex to Homs is now in its final stage of construction under the auspices of the National Oil Company. Each industrial complex along the coast will be connected.

The Zliten Cement Plant has a gas receiving station, located just at the fence of the plant which will reduce the gas pressure from 50 to 11 bars. According to information received from the National Oil Company, gas will be available in December 1985. Therefore, the Secretariat of Heavy Industries has requested ZCP to select a contractor for the conversion of the existing oil-fired system to a system using natural gas.

Inquiries have been prepared by the consultant and were sent to six companies, but only three have so far submitted their technical offer. Because of inaccurate information concerning the technical data of the natural gas supply and the related reducing station, the offers were in many instances based on assumptions. Therefore an evaluation of the offers was very difficult as their scopes were different, and the consultant had to gather more accurate and up-to-date information. The consultant studied the offers, held technical meetings with the engineers of bidding companies, and, for comparison, prepared a comprehensive table containing summaries of the offers. Up-to-date data were forwarded to the bidders and new quotations are expected soon.

Considering the circumstances in the Zliten Cement Plant, it would be advisable to find a contractor for a turnkey project. From the engineering point of view the best solution would be to sign the contract with KHI who delivered the plant. However, KHI submitted an offer only for the supply of the equipment, the engineering and supervision, but declined erection. Besides, KHI's prices are rather high. It is therefore recommended to find a subcontractor for the erection of the works and to contract the know-how and equipment from a renowned manufacturer of burning equipment for cement kilns. Such an arrangement would reduce the costs substantially; on the other hand it will necessitate the assignment of at least one full-time co-ordinator to this project.

Annex I

JOB REQUEST

Job request		العمل المطلوب Mechanical department	قسم الكهرباء Electrical department
التاريخ Date	اسبقية العمل Priority	من ربح عمله صادر عن Work permit by	
الموقع Location		وصف العمل Description	
محرك رقم / بند واسم Item No./Motor No.			
Time	زمن الايام Reported		
البدائية Started			
الانتهاء Cleared			
الكلي Total			
Signed production	توقيع الايطال Approved	Requested by	طلب بواسطة
Production	Mechanical	الميكانيكا Electrical	الكهرباء Electrical

Annex VI

JOB REPORT

Job report		قسم الميكانيكا Mechanical department	قسم الكهرباء Electrical department
اسم الذي قام بالعمل Name of tradesman	التاريخ Date	الزمن المأخوذ Time required	
بند رقم Item No.	الشرح التفصيلي للتقرير Details of report		
الموقع Location			
العطل Defect			
طريقة التصحيح Corrective action			
المواد المستعملة / الاحتياط Spares/material used			
ملاحظات / القياسات Measurement/observation			

MOTOR RECORD CARD

Motor record card محرك تسجيل بطاقة		Zliten cement plant - electrical department زليتن اسمنت مصنع الكهرباء قسم	
رقم المحرك Motor No.	بند رقم Item No.	القسم Department	الاسم Name
مرجع اوكت. رقم Manual No.	خريطة رقم Drawing No.	المعدات الاضافية Ancillary equipment	
مرجع ا.ك.ت. رقم Spare part manual No.	قطع غيار رقم Spare parts No.		
النوع Type	الجهد Voltage		
ك/وات/حصان hp/kw	الامبيرس Amperes		
لقة كل دقيقة r.p.m.	رقم التصنيع Manufacturer's No.	العدد Bearings	تاريخ الشراء Date of purchase
النوع Type	التردد بالحصان hp	العدد Bearings	
النسبة Ratio	رقم التصنيع Manufacturer's No.	الاسم Price	الوزن Weight
Clutch			

Annex IV

INSTRUMENT RECORD CARD

Instrument record card بطاقة تسجيل جهاز		Zliten cement plant - Electrical department مصنع اسمنت زليتن		الكهرباء	قسم
جهاز رقم Instrument No.		بنذ رقم Item No.	القسم Department	الاسم Name	
مدى معدل القياس Measuring range		التشغيل Operation	الإشارات Alarming signs	رقم الكتيب أو المرجع Manual No.	خريطة رقم Draw. No.
عناصر Primary element	النوع Type		ملاحظات Remarks		
	المصنع Manufacturer				
	الموقع Location				
مرجع أو كتيب قطع غيار رقم Spare parts manual No.					
قطع غيار رقم Spare parts No.					
النوع Type					
ناقل الإشارة Transducer	المصنع Manufacturer				
	الموقع Location				
	مرجع أو كتيب قطع غيار رقم Spare parts manual No.				
قطع غيار رقم Spare parts No.					
معدات إضافية Ancillary equipment					