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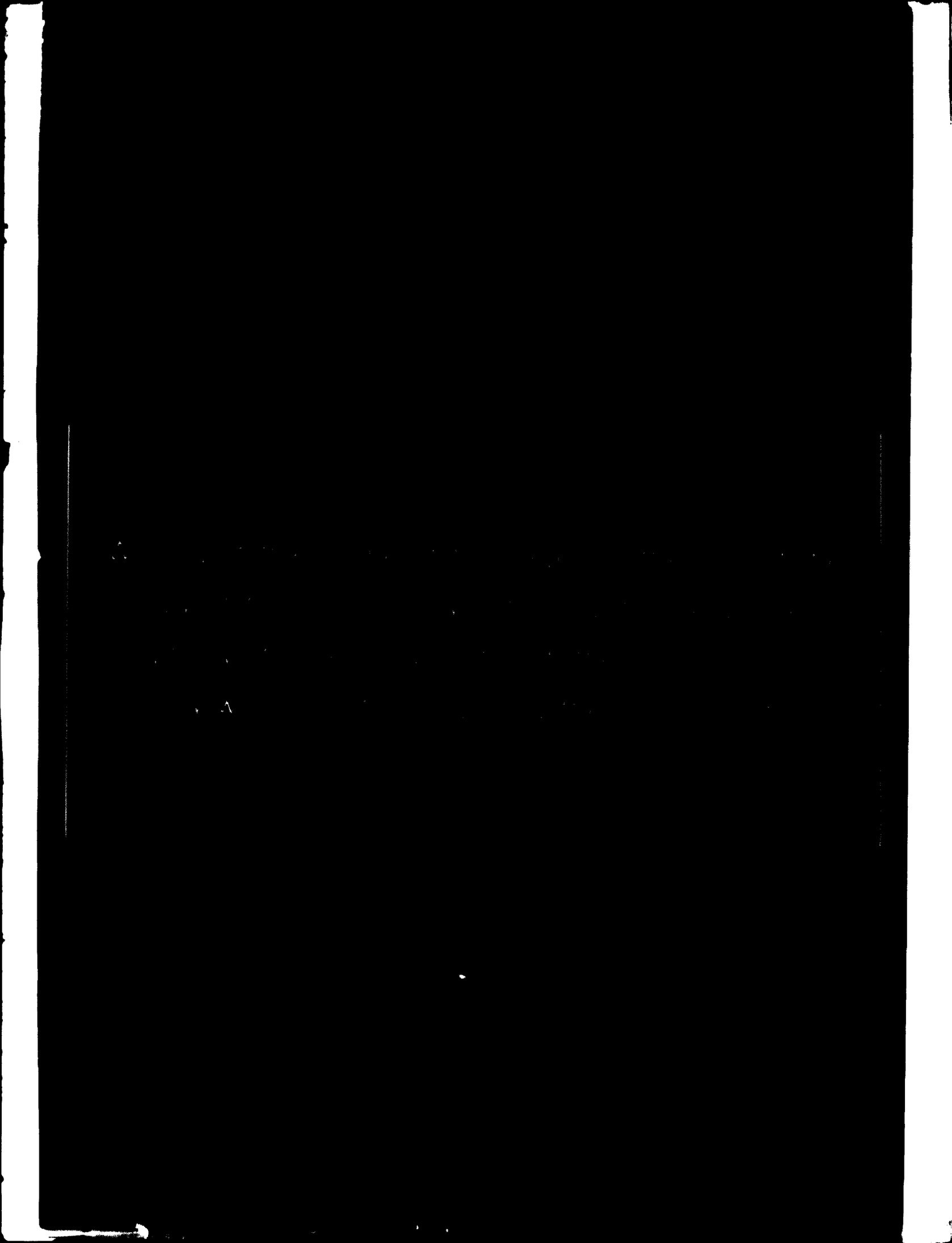
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org



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UNITED NATIONS INDUSTRIAL
DEVELOPMENT ORGANIZATION

(R) PRE-FEASIBILITY STUDY -
WHITE CEMENT PLANT*.

TF/INT/79/001.

14 MAY 1979

Mission report**.

Prepared for the Arab Fund for Economic and Social Development
by the United Nations Industrial Development Organization

Based on the work of Harold C. Beeck, cement technologist

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**The mission forms part of the project DP/RAB/74/011.

id. 79-2432

Explanatory notes

The following abbreviations have been used in this report:

AFSD	Arab Fund for Economic and Social Development
JIC	Joint Syrian/Jordan Industrial Company
MTPY	Metric tons per year
NRA	Natural Resources Authority

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

T A B L E O F C O N T E N T S

I N T R O D U C T I O N

The Arab Fund for Economic and Social Development (AFESD) in Kuwait has requested the United Nations Industrial Development Organization (UNIDO) on a technical assistance by means of a short-term Cement Consultant with the aim to provide the Syrian-Jordanian Committee with assistance in connection with their White Cement Plant Project.

The Syrian-Jordanian Committee established a Joint Syrian -Jordanian Industrial Company (JIC) to undertake studies related to, and implement feasible industrial projects designed to, satisfy the "united market" of both countries.

The Committee decided that the White Cement Plant be allocated to Jordan and charged JIC in May 1977 to undertake a feasibility study to that effect.

When no action was initiated by JIC, the Jordanian Government requested the Pension Fund in May 1978 to undertake the study. Terms of Reference were drawn, consultants invited, proposals analysed and ultimately a contract was entered into between the Pension Fund and the Belgian Cement Consultants, CDR (October 19, 1978).

The writer arrived Kuwait on 09 January 1979 from Ankara, where he is assigned to the Cement Research and Development

/02

Centre as UNIDO Cement Technologist, and is on detail to AFESD in Kuwait for the said mission. After end mission the writer will return to his duty station in Ankara via Vienna for debriefing.

From 13-25 January a mission comprising of Messrs. Khogali ABUBAKR, Head of Mission, Faisal Al KHATIB both from AFESD and the writer went first to Jordan and after Syria, where meetings with authorities and visits to limestone deposits took place.

II FINDINGS AND RECOMMENDATIONS

The preliminary reserve calculations and quality assesment of the raw materials in the Salt area, about 28 km NW of Amman in Jordan, have been carried out by the Natural Resources Authority (NRA), probably, by means of normal blasthole drillings.

The Belgian Consultants, CBR, recommend further investigations on the kaolin and sandstone deposits, which is correct.

Concerning the limestone deposit the Consultants based their assesment on 8 boreholes attaining a total depth of 243 m and where the "cuttings" have been analyzed only.

It is strongly recommended to make further investigations in the limestone deposits by means of regular core drilling, which is indispensable for such a high capital-intensive project in order to make sure the proven reserves, determine the raw mix for clinker production and estimate the cost of quarrying.

The raw mix contains about 80% limestone, thus, it is extremely important to be sure of both quantity and quality.

III VISIT TO JORDAN, 13-18 JANUARY 1979

3.1 Feasibility Study Contract

On 19th October 1978 a contract on a feasibility study for a White Cement Plant in Jordan has been signed between

PENSION FUND
P.O. Box 3294
Amman
(Hashemite Kingdom of Jordan)
Telex: 1716 FUND JO

and

S.A. CIMENTERIES C.B.R.
Chaussée de lan Hulpe 185
B-1170 Brussels
(Kingdom of Belgium)
Telex: 21 464 CIMCBR B

During meetings in the office of PENSION FUND the Terms of Reverence (TOR) have been discussed and copies of the contract made available to the mission.

3.2 Preliminary Time Schedule for the Feasibility Study

1. MARKETING

a. Survey in Middle East	01 JAN - 24 JAN
b. Report	08 FEB

2. RAW MATERIAL INVESTIGATION
   a. Data collection and analysis (Report 1) 01 JAN - 24 JAN
   b. Geological survey (if any) (Report 1a) 24 JAN - 24 APR
   c. Industrial pilot test 24 JAN - 01 MAR
   d. Report and approval (market) (Report 2) 24 FEB - 16 MAR

3. PRODUCTION FACILITIES
   a. Plant location 16 MAR - 08 APR
   b. Process and design 16 MAR - 16 MAY

4. CAPITAL AND OPERATING COSTS 16 APR - 01 JUN

5. FINANCIAL ANALYSIS 24 MAY - 16 JUN

6. FINAL REPORT (draft) (Report 3) 08 JUN - 01 JUL

3.3 Marketing

The marketing study is very important not only in terms of quantities but also in terms of qualities.

If for instance the demand for colored cement is high, the degree of whiteness can be kept lower, which is quite interesting in case of difficulties with the raw materials. However, it will not be so easy to make good profit on such white cement.

In other words the idea would be to produce two kinds of White cement e.g. super and normal.

3.4 Raw materials investigation

The attention should be drawn to the item 2b in the time schedule - geological survey (if any) - which for sure will have to be done and that means at least three months of additional work.

The basis for assessment of the main raw material component - limestone - is only "cuttings" from eight boreholes attaining a total depth of 243 m. The spacing between the boreholes ranged from 120 to 500 m and furthermore the boreholes were irregularly sited because of accessibility reasons.

The above-mentioned drillings have been carried out in June - November 1977 by Natural Resources Authority (NRA) and a report made by Messrs. M HADDADIN and D. SALMAN.

Also geological mapping on scale 1:2000 was made and 88 chemical analyses were made for LOI (loss on ignition), IAR (insoluble acidic residues), CaO, Al_2O_3, Fe_2O_3, MgO, Na_2O and K_2O.

Unfortunately the 243 m of drillings, already carried out, can only be considered to provide indicative figures. A normal drill for blast-hole drilling has probably been used and the chips or cuttings, brought up by the flushing air, analysed.

In appendix A and B is shown the difference between blast-hole drilling and core drilling. From the former only a small part of the raw material will be recovered. Most of the impurities will disappear together with the flushing air.

3.5 Core Drilling

Core drilling gives the best answer to all questions concerning determination of the right raw mis and the most appropriate quarry layout.

For such a white cement plant project, where the total investment cost most probably will be in the region of US$ 70 million, it would be hard to convince any investor on its viability without a comprehensive market and raw materials investigation.

There are no fixed roles about how many metres of core drilling which will have to be done, but in general it can be said that for each million tons of raw material quarried about 90-100 metres of core drilling are required provided the recovery of the cores can be kept at least 90%.

It is not an easy task to keep such a degree of recovery and specially not with old drilling equipment.

For the White Cement Plant Project in Jordan the required quantities of raw materials can for a lifetime of 40 years roughly be estimated as follows:

		Metric Tons
Limestone, 80%:	40 x 100,000 x 1.6 x 0.8 =	5,120,000
Kaolin, 10-15%:	40 x 100,000 x 1.6 x 0.125 =	800,000
Sand, 5-10% :	40 x 100,000 x 1.6 x 0.075 =	480,000

The above-mentioned estimates are based on a yearly production of 100,000 metric tons of clinker and for each ton of clinker 1.6 tons of raw mix, whith a maximum moisture content of 1%, are required.

Clinker is the product coming out of the kiln and will have to be ground together with a retarder (about 5% gipsum depend on SO_3 content) to reach the final product of cement.

It should be mentioned here that the terms "clinker" and "cement" many times are making confusion. However, it is advisable always to express the production capacity of a cement plant in tons of clinker particularly when guarantee figures are discussed.

3.6 Proposed Drilling Programme

Limestone deposit:	500 m with 450 m recovered
Kaolin deposit :	80 m with 72 m recovered
Sandstone deposit:	50 m with 45 m recovered

For the Kaolin and Sandstone deposits it might be difficult to make core drilling because of accessibility problems. In that case the alternative would be to dig shafts.

According to informations given on page 6 in the report on White Cement Raw Materials Salt Area by Messrs. M. HADDADIN and D. SALMAN, dated January 1978, geological mapping on scale 1:2000 is made. Further, contoured maps will have to be carried out, which will have to be discussed between the parts concerned.

Considering an open quarry with only one bench being developed, a depth of about 20 m for each borehole will be required. Say, the usable high of the quarry face will be 16 m and the specific weight of limestone is 2.2 (low figure), the required area will be about 150,000 m^2 (150,000 x 16 x 2.2 = 5,280,000 metric tons of limestone inclusive moisture content).

Appendix C shows a proposed drilling pattern, where the

quarry face is 300 metres. The spacing is made more dense, where the quarry will have to be opened. However, this drilling pattern is indicative and wishful thinking and will have to be done according to available geological maps and accessibility of the drilling machine.

The time estimated for 500 m core drilling in the limestone deposit is 50-60 days (one drilling machine only) and for Kaolin and Sandstone 15-20 days. All depend on mobility of the drilling equipment.

It is expected that the core drillings and loggings of the cores can be done by the Natural Resources Authority (NRA).

3.7 Items for the Core Drilling Programme

Time schedule to be determined by NRA.

1. Drilling/Shaft Digging

   a. Limestone deposit, 500 m

   b. Kaolin deposit 80 m

   c. Sandstone deposit 50 m

2. Core Logs

   a. Limestone

   b. Kaolin

   c. Sandstone

3. Double-check Chemical Analyses

a. Limestone, approx. 2 x 250

b. Kaolin, approx. 2 x 40

c. Sandstone, approx. 2 x 25

4. Mapping

a. Topografical maps, 1:1000

b. Geological maps, 1:1000

3.8 Cost Estimate

Provided drilling, core logs, part analyses, mapping can be carried out by NRA the cost of double-check analyses will have to be paid extra.

The Belgian Consultants, CBR, charge 154.- US$/complete analysis, thus the cost will be about 315 x 154.- = 48,510.- or say US$ 50,000.-.

3.9 Chemical Analyses

The chemical analyses of the cores should comprise following elements:

SiO_2	%	K_2O	%
Al_2O_3	%	Na_2O	%
Fe_2O_3	%	Cl	%
CaO	%	TiO_2	%
MgO	%	P_2O_5	%
MnO	%	Cr_2O_3	% or ppm
L.O.I.	%	Silicium Modul	
Total	%	Alumina Modul	

3.10 Time-saving Procedure

Today, in most developing countries, cement plants are Government owned and the implementation takes therefore normally place in the form of turnkey supply.

It is normal practice to employ a consultant company for carrying out investigations, procurements, management etc. etc. However, it should be noted that the consultants have no responsibility for the guaranteed output of the cement plant. Thus, it is important to use the consultants efficiently and not let them do double-work.

Process engineering and design should for instance be carried out by the international invited tender and not by the consultants as far as turnkey supply is concerned.

The very few suppliers in the world, who cna supply a White

Cement Plant will implement their own design concept. The supplier is ultimately responsible for the quality and quantity of production.

Prospective suppliers could immedeately be asked for a Budget Proposal subject to the raw materials investigation and plant site location. After receiving the Budget Proposal consultants can be extremely useful for evaluation and selection of process design.

Following such a procedure considerable time can be saved to the advantage for all parts concerned.

7.11 Potential Suppliers of a White Cement Plant

Following well-known manufacturers of complete cement plants could be asked for further informations (in alphabetic order):

FIVES-CAIL BABCOCK
7, Rue Montalivet
F-75383 Paris Cedex 8
France
Phone: (1) 742 21 19
Cable: fivcail-paris
Telex: fivcail 650 328

FULLER COMPANY
P.O. Box 29
Catasauqua, Pennsylvania 18032
United States of America

IHI Ishikawajima-Harima
Heavy Industries Co., Ltd.
Shin Ohtemachi Bldg., 2-chome,
2-1 Ohtemachi, Chiyoda-ku
Tokyo 100 JAPAN
Phone:
Cable: ihico tokyo
Telex: J22232 (ihico j22232)

KAWASAKI
Heavy Industries Ltd.
4-1 Hamamatsy-cho 2-chome
(World Trade Center Bldg.)
Minato-ku, Tokyo JAPAN
Phone:
Cable: kawasakiheavy tokyo
Telex: j22672

KHD Industrieanlagen AG
HUMBOLDT WEDAG
P.O. Box 91 04 04
D-5000 Köln 91 GERMANY, Fed. Rep.
Phone: Köln (02 21) 8 23-1
Cable: humboldtwedag köln
Telex: 8 873 221

POLYSIUS AG
Graf-Galen-Strasse 17
D-4720 Beckum GERMANY, Fed. Rep.
Phone: (0 25 25) 711
Cable:
Telex: 89 481 polbk

F.L. SMIDTH & Co. A/S
77 Vigerslev Alle
DK-2500 Valby Copenhagen DENMARK
Phone: +45 1 30 11 66
Cable: folasmidth copenhagen
Telex: 270 40 flsco dk

17 VISIT TO THE SYRIAN ARAB REPUBLIC, 19-24 JANUARY 1979.

The mission has also paid a visit to the limestone deposit at Saydanaya, about 40 km from Damascus, where adequate raw materials for production of white cement is found.

17.1 Preliminary Raw Materials Investigation

During a meeting held on 21 January at the General Organization for Cement a report dated July 1976 on a preliminary raw materials investigation was made available to the mission. The report was conducted by:

COUTINHO, CARO & Co
Technical Group
Steindamm 80
P.O. Box 10 11 40
D-2000 Hamburg 1
Federal Republic of Germany

On 22 January the mission paid a visit to the Saydanaya limestone deposit. Visually the deposit looks promising, but also here core drilling will have to be carried out before any statement can be done. However, it seems that the Saydanaya quarry would be much easier to run than the Ajlun quarry in Jordan as the limestone is soft and can be quarried by ripping or digging.

The above-mentioned Consultants have received a Budget Proposal from a Danish company. According to a pilot test and subject to further raw material investigations by core drilling the company expects the whiteness of the white cement produced by Saydanaya limestone, Jordan kaolin and sand from Tanaya near Damascus to be 83%, which is a satisfactory white cement.

The whitest cement in the world is expected to be produced in the Republic of Korea at a new plant under construction. Whiteness is guaranteed by the supplier to be 87% (100% whiteness is the color of pure Magnesium powder (MgO)).

Concerning the market of white cement it is expected that the [illegible] will absorb about 70,000 metric tons per year and Jordan [illegible] TY in 1982.

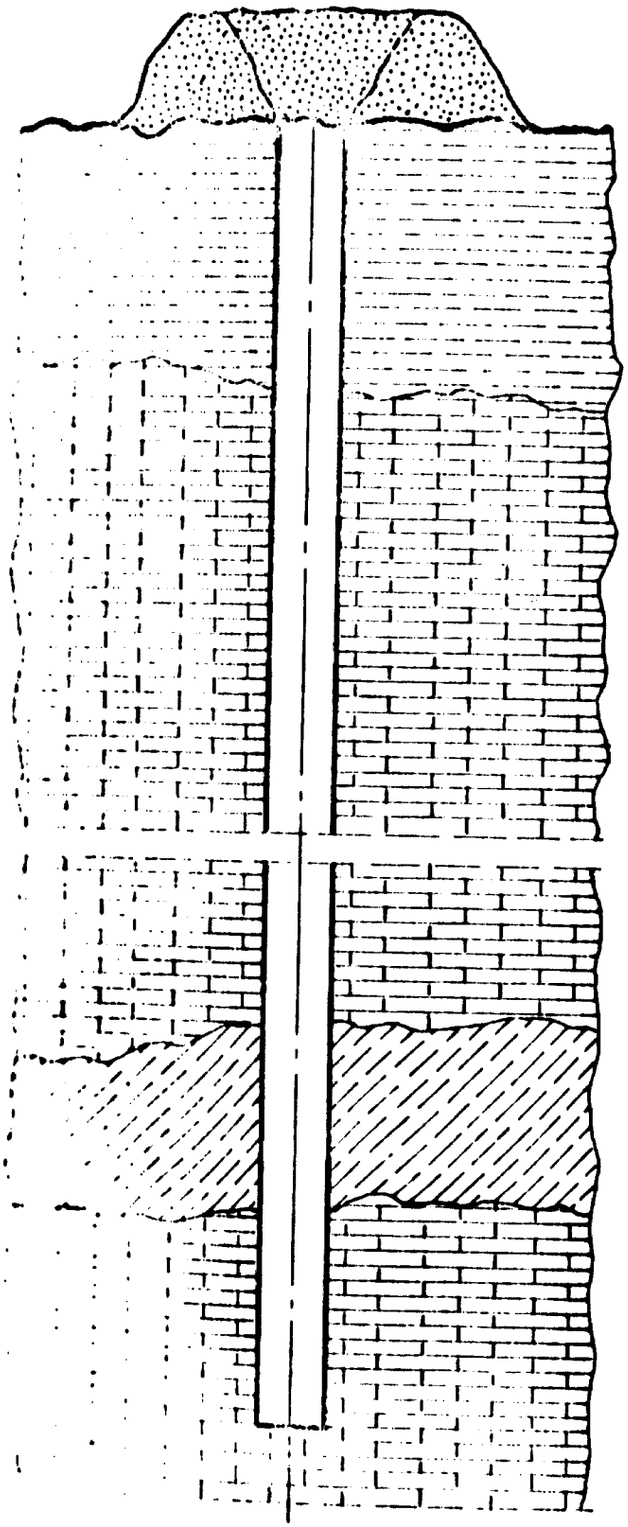
The cost of machinery for the proposed plant with a capa-

city of 100,000 metric tons per year was DM 53,650,000.- (July, 1976). Generally speeking, the total investment cost of a cement plant is about three times the FOB price of machinery.

Production costs were estimated to be 190.50 D.kr./t (10.- KD/t or 37 US$/t). This is an extremely low figure mainly due to very cheap fuel oil supply from Irak (0.16 D.kr./kg equal to 8.5 fils/kg or 31 US$/t)

Based on informations from the above-mentioned report the possibility of producing white cement in Syria seems quite promising and should be taken into consideration if serious raw material problems or high production costs should arise in the Salt area in Jordan.

Blast-hole Drilling



Chips or cuttings from the drilling, 3-4 mm, blown up to the surface by the flushing air.

Overburden

Limestone

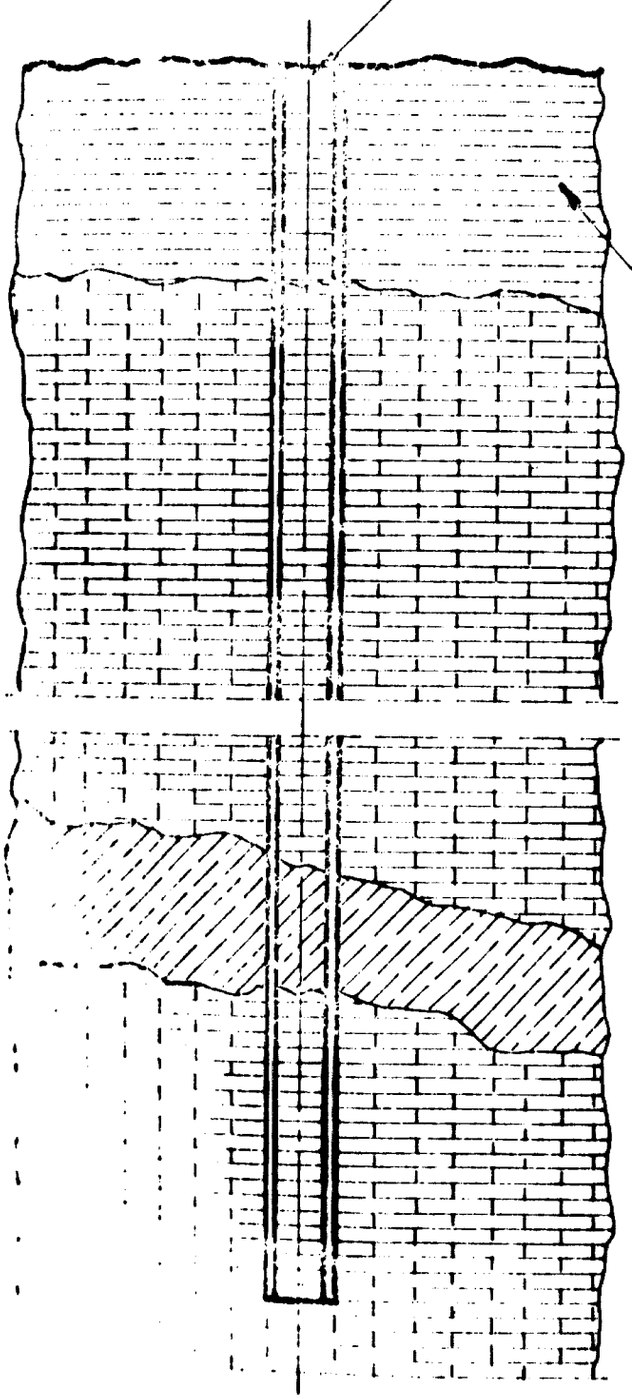
Vein of Impurities

Diameter of borehole is 75-150 mm.

When more than 105 mm the advantageous down-the-hole-drill can be used.

Boreholes for blasting are normally inclined 15-20° in order to avoid a vertical quarry face for security reasons.

Core Drilling



Core

Diameter of the core can vary from 25 to 100 mm starting with large diameter according to the required depth of the hole.

Core recovery should be kept 90% or more.

Overburden

Should not exceed 10% of usable depth of raw material.

Limestone

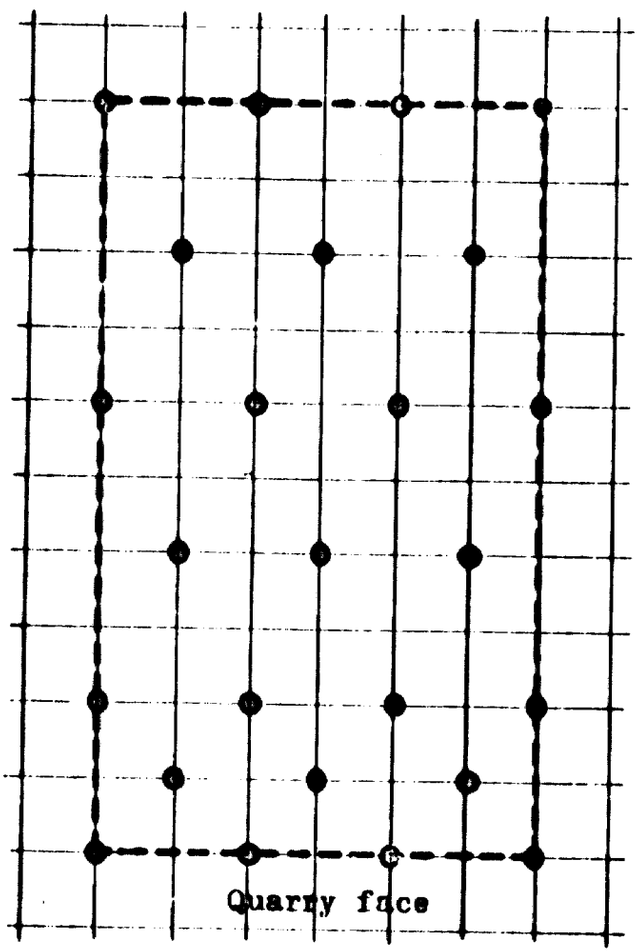
Vein of Impurities

The depth of the borehole depends on the number of benches appropriate for the quarry.

For each bench about 20 m of drilling is required.

Core Drilling Pattern Proposal

Scale 1:5000



Proposed location of crusher and belt conveyor to the plant site.

" a 100,000 MTPY cement plant the required limestone deposit " 40 years production will be 160,000 x 40 x 0.8 = 5,120,000 t.

' deposit of about 150,000 m^2 x 16 m depth x 2.2 t/m^3 = ',000 metric tons.

' quarry layout would be a quarry face of say 300 m ' will move about 500 m after 40 years or 12.5 m per year.

JOB DESCRIPTION

POST TITLE	Consultant White Cement
DURATION	Three weeks
DATE REQUIRED	As soon as possible
DUTY STATION	Kuwait with travel to Jordan and Syria
PURPOSE OF PROJECT	To formulate a project profile for production of white cement as joint venture between Jordan and Syria.
DUTIES	The consultant will be assigned to the Arab Fund for Economic and Social Development in Kuwait for the purpose of a preliminary study for the establishment of a factory to produce white cement as a joint venture between Jordan and Syria. He will visit the relevant authorities in Amman, Jordan and Damascus, Syria to obtain the necessary data. Following further discussions with AFESD in Kuwait he will prepare a report on the situation which he has found as a result of his visits to Jordan and Syria. If agreed by all parties concerned, he will draft terms of reference for a detailed feasibility study of the project.
LANGUAGE	English
QUALIFICATIONS	University degree in mechanical/electrical engineering with atleast 10 years experience in cement industry.
BACKGROUND INFORMATION	Cement production plants already exist in both Jordan and Syria. This project would, if agreed, set up a new plant for the production of white cement and would be financed if agreement was reached mainly by Arab Fund for Economic and Social Development in Kuwait.

TERMS OF REFERENCE

1. A mission comprising Mr. K. Abubakr, Mr. H. Boeck and Mr. F. Al Khateeb will visit Jordan and Syria during the period 13 - 25 Janurary 1979. The purpose of the mission is to establish a full dossier on the proposed White Cement Factory. In the process the mission will review in detail the background and present status of the project, particularly in respect to the steps taken, T.O.R. drawn, Consultants invited, Committments made etc.. in respect to this project.

2. The mission will consider all parameters: technical, economic, financial, organizational and institutional on which information is available and/or opinion has been established in both countries.

3. The mission will concentrate on the analysis of the inter-country aspects related to the project particularly the questions of location, marketing arrangements and institutional requirements.

4. The mission will recommend a position for consideration and subsequent adoption by the Regional Programme. It will submit a back to office report not later than 10 days after return to Kuwait.

Persons met

Jordan (13-19 January, 1979)

National Planning Council

Dr. Hana Odeh	President
Mr. Nabil Sowein	Director of Projects
Dr. Akram Karmoul	Senior Officer

Pension Fund

Mr. Basil Jerdaneh	General Manager
Dr. Maan Shukair	Project Manager

Syrian Jordanian Industrial Company

Mr. Abdellatif Kutait	Chairman
Mr. Khalid Najdawi	General Manager

Ministry of Industry and Trade

Mr. Chazi Diab	Director of Economic Cooperation
Mr. Abdalla El-Bukhari	Deputy Director of Industry

Syria(20-25 January, 1979)

Ministry of Planning

Mr. George Houranieh	Minister of State
Mr. Hameed Marie	Deputy Minister
Mr. Abdel Gadir El Nayall	Director, Economic Cooperation
Mr. Diab Sahyoun	Senior Officer

Ministry of Industry

Mr. Abdelatif Kutait	Deputy Minister

Ministry of Agriculture

Mr. Saleh El-Kurdi	Deputy Minister
Mr. Abdella El-Masri	Director of Pastures

Ministry of Economy and Foreign Trade

Mr. Fathi El-Jabban — Director, Arab Economic Cooperation

General Cement Organization

Mr. Tayssir Dabbous — Technical Director

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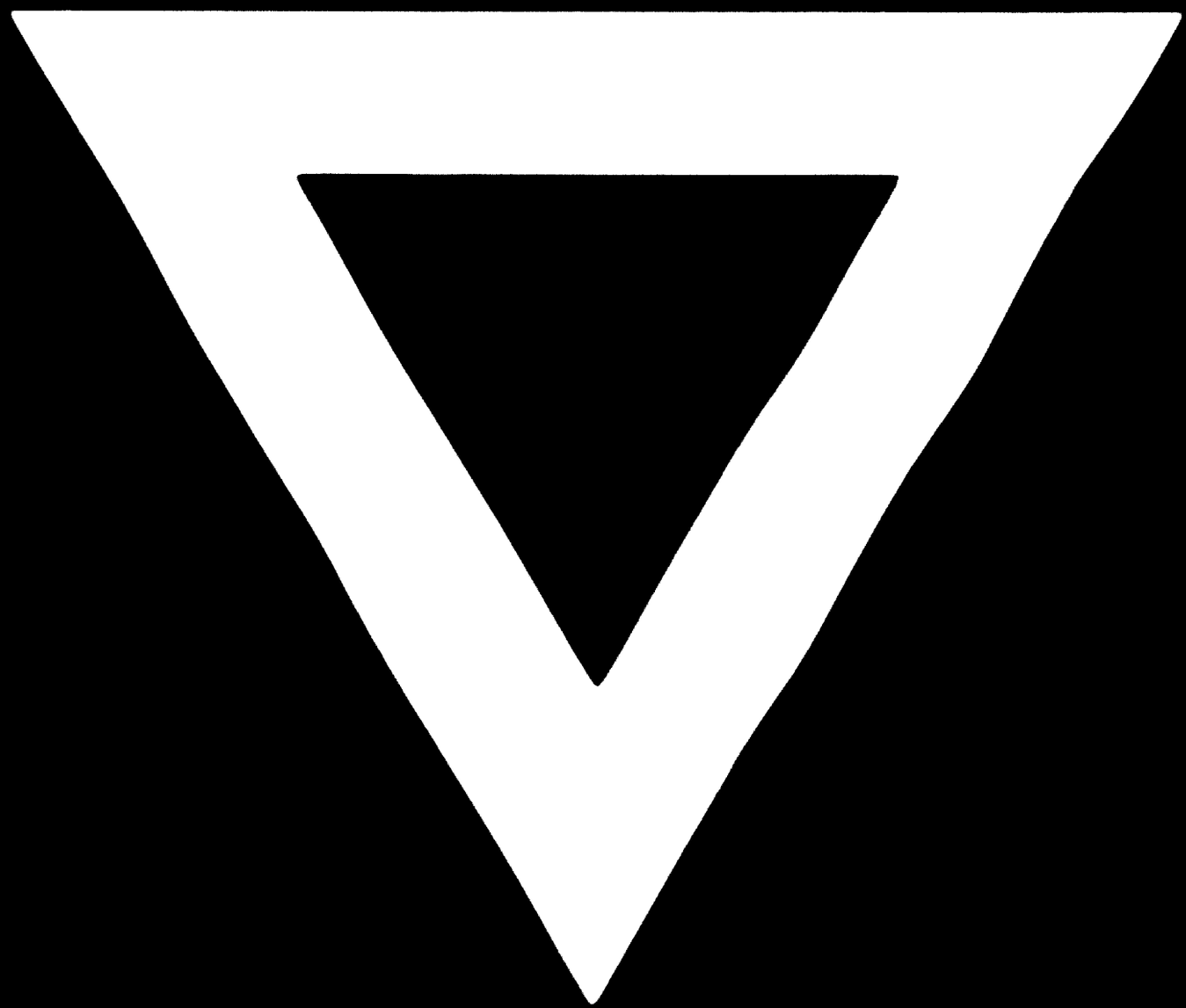

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