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ASSISTANCE TO ESTABLISHMENT OF CEMENT INDUSTRY
IN THE STATE OF KUWAIT

(TF/KUW/75/002)

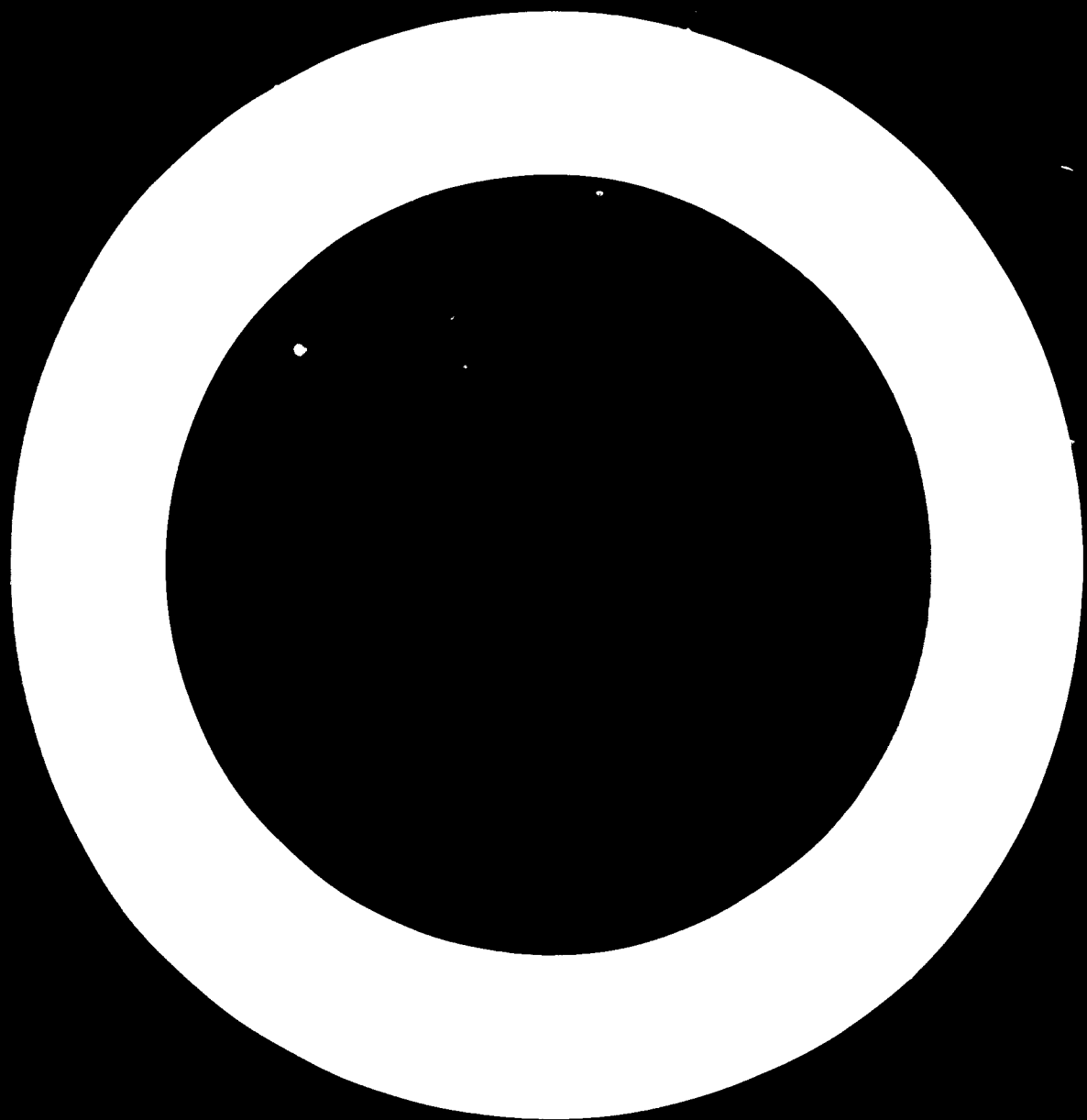
Terminal report

Prepared for the Government of Kuwait by the
United Nations Industrial Development Organization,
executing agency for the
United Nations Development Programme

Based on the work of Mehmet A. Basman, cement industry adviser

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We regret that some of the pages in the microfiche copy of this report may not be up to the proper legibility standards even though the best possible copy was used for preparing the master fiche



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Explanatory notes

References to "tons" are to metric tons.

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

Commas are used to distinguish thousands and millions.

Numbered superscripts in the text refer to the keyed reference list.

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SUMMARY

In August 1975, upon the request of the Government of Kuwait, an industrial engineer assigned by UNIDO went to Kuwait to advise and assist the Kuwait Cement Company in their evaluation of proposals for the establishment of cement production, using local raw materials. Specifically, the adviser was to evaluate and report on the local raw materials situation and advise on offers already received by the company.

The findings of the UNIDO adviser confirmed earlier studies that had shown that a cement plant, using locally available raw materials, with relatively small supplementation by imported materials, and using a wet-system technology, would be feasible both economically and technically. Economic feasibility derives primarily from the ready availability, at low cost, of the needed utilities (water, electrical power and fuel) and of industrial loans but also from the high shipping cost of imported clinker and cement.

The technical feasibility of the project derives from the existence in the country of substantial and reasonably accessible deposits of raw materials (limestone, clay and gypsum). These materials would, however, have to be upgraded by the addition of up to 6% of imported raw materials.

International bidding for the project, organized by the Kuwait Cement Company, with the assistance of a consultant firm, has revealed new alternatives. Consequently, the company, of which the Kuwaiti Government is the dominant shareholder, should review the original feasibility study and the investigations of the availability of raw materials.

Recommendations for the establishment of a suitable cement plant are presented. Technical assistance to the Kuwait Cement Company in the implementation of this project should be arranged.

INTRODUCTION

The first preliminary study for the establishment of a cement industry in Kuwait was undertaken in May 1963 by a team from the Helwan Cement Factory in Egypt. Owing to the difficulty of obtaining suitable raw materials and the limited demand for cement at that time, this study was not followed up. In 1968, the Kuwait Cement Company was established, and by 1975 Government participation represented 28% of its capital. As its first step, the company undertook the construction of a clinker-grinding and -packing plant with a capacity of 300,000 tons/year at the Shuaiba Industrial Area. This plant was constructed by the Association Cement Cos.Ltd of India, and it has been in operation since March 1972. Its requirements of clinker and gypsum are all imported.

In 1972, as a second step, the company began a search for local raw materials and investigated the feasibility of a cement plant of 500,000 tons/year capacity. To realize these plans, the company retained the Swiss consultant firm, "Holderbank" Gestion et Conseils A.G. This consultant has conducted the four studies described below.

The preliminary study of the raw materials situation was submitted to the company in August 1970.⁽¹⁾ It drew up an inventory of the known and probable deposits of limestone and clay that would be suitable for the production of cement, identified the most promising of them and concluded that these locally available raw materials might have to be supplemented with imported materials in a proportion of as great as 6%.

In a follow-up study submitted to the company in February 1972,⁽²⁾ the consultant firm reported the findings of its investigations of local deposits of limestone and clay. It drew attention to possible deposits of limestone in the south of the country, near Mena Saud, and to a deposit of clay at Wafra, near the oilfield. This limestone would be costly to quarry and grind, and the material would have to be supplemented with imported high-quality limestone, bauxite and ferric oxide to make it suitable for the

production of cement. It was also found that the reserves of these minerals were limited; they could meet the demand of cement plant of 500,000 tons/year for no more than 40 years.

A more detailed study submitted to the company by the consultant firm in October 1972⁽³⁾ reported its findings in the Mena Saud, Khor Al-Amah and Al-Khiron limestone regions; the Wafra Road, Al-Mutla and Rhowatain clay regions; and the Um Al-Aish gypsum region. It was again noted that these raw materials would be suitable for cement production only if supplemented by corrective raw materials that would have to be imported. On the other hand, the estimates of the reserves of limestone were increased; it was concluded that they would suffice for a plant of 500,000 tons/year for perhaps as long as 50 years. It was also noted that the investment and operating costs of such a plant might be too high to permit its product to compete with imported clinker.

In its most recent study, which was submitted to the company in April 1973,⁽⁴⁾ the consultant firm revised its earlier conclusions and reported that a cement plant of 500,000 tons/year capacity, erected near the existing clinker-grinding and -packing plant of the company in the Shuaiba Industrial Area, would be economically feasible owing to the low costs of utilities (water, electrical power and fuel) and industrial loans.

Based on these studies and at the request of the company, the consultant firm prepared tender documents for a cement plant of 700,000 tons/year capacity, to be situated in the Shuaiba Industrial Area, using a wet-process technology. These documents were submitted to the company in November 1973⁽⁵⁾. Eight cement-equipment contracting firms of international reputation were invited to bid on them. Bidding has proceeded in several stages and on several contract bases: turn-key, equipment-supply, and wet and dry processes. At the present writing, three of the bids are still under consideration.

FINDINGS

Raw materials

Limestone

The deposit to be exploited for the production of cement is at Mena Saud, in the Khiran region, 80 km from Kuwait city and 50 km from the Shuaiba Industrial Area. It is near the sea and is 10 km long and from 600 to 1,200 m wide. It consists of relatively thin (8-10 m) layers of oolitic lime sand, contaminated with quartz and fragmented shell-bearing layers. The reserves of this deposit are estimated at 60 million tons, excluding 30 million tons of low-quality material. The exploitable reserves are estimated to be 48 million tons, two thirds of which are below the water table. This stone is porous and friable but difficult to grind; the energy requirement for this purpose is estimated at 40 kWh/ton. Its calcium carbonate titration varies between 72% and 85%.

Chemical analysis of this limestone reveals a high silica content (15% to 20%) and a low alumina content (0.7% to 0.9%). Compounds that could have adverse effects on the clinker or on the smooth operation of the plant are within tolerable limits, as follows:

Magnesia	0.3% to 0.5%	(less than 1.7%)
Sulphur trioxide	0.2% to 0.3%	(less than 0.5%)
Alkalie (potassium hydroxide and sodium hydroxide)	0.5% to 0.7%	(less than 1.0%)

On the other hand, the chlorine content (Cl 0.5% to 3.0%), while within tolerable limits (less than 0.25%) for the wet process, it is above those (less than 0.05%) for the dry process. The phosphate content has not yet been investigated.

Clay

The most suitable clay deposits are situated in the Mutla region, 40 km north-east of the city of Kuwait and 90 km from the Shuaiba Industrial Area, on both sides of the Um Al-Aish road. These deposits are scattered over

areas with a total surface of 20 km². Their thickness varies from 0.5 to 1.9 m, and the total reserves are estimated at 725,000 tons.

These clays consist of silty-sand material. Their chemical analysis has revealed a relatively high content of calcium oxide (6.6% to 8.4%), alumina (6.2% to 9.9%) and magnesia (1.7% to 2.6%) and low content of ferric oxide (2.1% to 3.3%) and chlorine 0.0%. They contain no deleterious materials at significant levels. Their silica ratio ranges from 5 to 10. They would be very difficult to quarry mechanically; a permanent crew of labourers would be required for this work.

Raw mixes

The third study submitted by the consultant firm⁽³⁾ also foresaw the use of some imported raw materials - bauxite, alumina and ferric oxide - and even high-quality limestone - in a proportion perhaps as high as 6%, to produce clinker of good quality. However, these chemical additives would not improve the physical qualities of the local raw materials. Not only would the grinding costs be high, the composition of the limestone with its high chlorine content, plus the lack of plastic minerals in the clay, would result in the generation of large amounts - perhaps as high as 30% - of high-chlorine dust. However, smooth operation of the kiln could alleviate this problem and at least some of the dust could be recycled.

Plant location

Because of the infrastructural advantages available there, the consultant firm selected a plant site in the Shuaiba Industrial Area. However, this location has the serious disadvantage that anti-pollution and environmental-protection measures are very strict there. Furthermore, the site is about 50 km from the principal deposits of raw materials. This site was not selected on the basis of estimates of investment and operational costs. It would seem that the site formerly recommended by the consultant firm was a better one, even though it would involve a higher investment cost.

The process

The consultant firm selected the wet process for the proposed plant as being better suited to the available raw materials, which are insufficiently homogeneous and whose chlorine content is high. While it is true that this process makes for easier operation of the plant and for reduced investment cost, its principal disadvantage, namely that it is less economical in fuel consumption than the dry process, would be largely offset by its lower investment cost and the low cost of fuel in Kuwait.

However, in alternative proposals bidders have suggested the use of the dry process so as to reduce the waste through dust.⁽⁶⁾ These proposals foresee different methods for reduction of the quantities of alkali-contaminated dust.

1. A washing plant for the raw materials before they go to the cement plant so as to reduce the chloride content of the limestone to a level suitable for the dry process;

2. A dry-process kiln with a precalcinator from which a reduced quantity of waste, high-alkali dust would be produced; and

3. A semi-dry-process kiln with a granulator to reduce dust formation by means of a specially assigned electrostatic dust precipitator.

While it appears that these new proposals would partially resolve the dust problem, they would complicate plant operation and increase investment costs. Furthermore, such plants do not appear to be suitable for a country without an established cement industry.

RECOMMENDATIONS

The recommendations of the UNIDO adviser concerning the establishment of a cement plant in Kuwait fall under the four general headings presented below.

1. Availability of raw materials and optimal plant capacity

Owing to the limited confirmed quantities of raw materials for the production of cement, the capacity of the proposed plant should be reduced from 700,000 tons/year to a more realistic level. Detailed topographic and geological studies of the limestone deposits should be undertaken on which to base the quarrying programme. These investigations should include detailed physical and chemical tests and calculations of reserves. They should cover the demand for raw materials at the planned capacity for at least 20 years, and additional geological investigations should be undertaken to locate new reserves of high-grade limestone and clay so as to end the need to import corrective raw materials and to assure the availability of reserves for more than 50 years.

2. Site and form of the plant

The plant should be located near the limestone quarry. Its infra-structural needs (electrical power, water and fuel) and optimal building sites should be investigated in detail. The wet process should be selected, and a single production line, with one kiln, should be erected. The cement-grinding department of the operation should be foreseen as an extension of the existing clinker-grinding plant at the Shuaiba Industrial Area.

3. Feasibility study and the tender documents

The feasibility study⁽⁴⁾ should be revised, full consideration being given to the changes that have occurred since it was completed (April 1973) and should be grounded on detailed market forecasts and estimates of investment and operational costs. When this re-evaluation has been completed, the tender documents⁽⁵⁾ should be revised accordingly and new bidding organised.

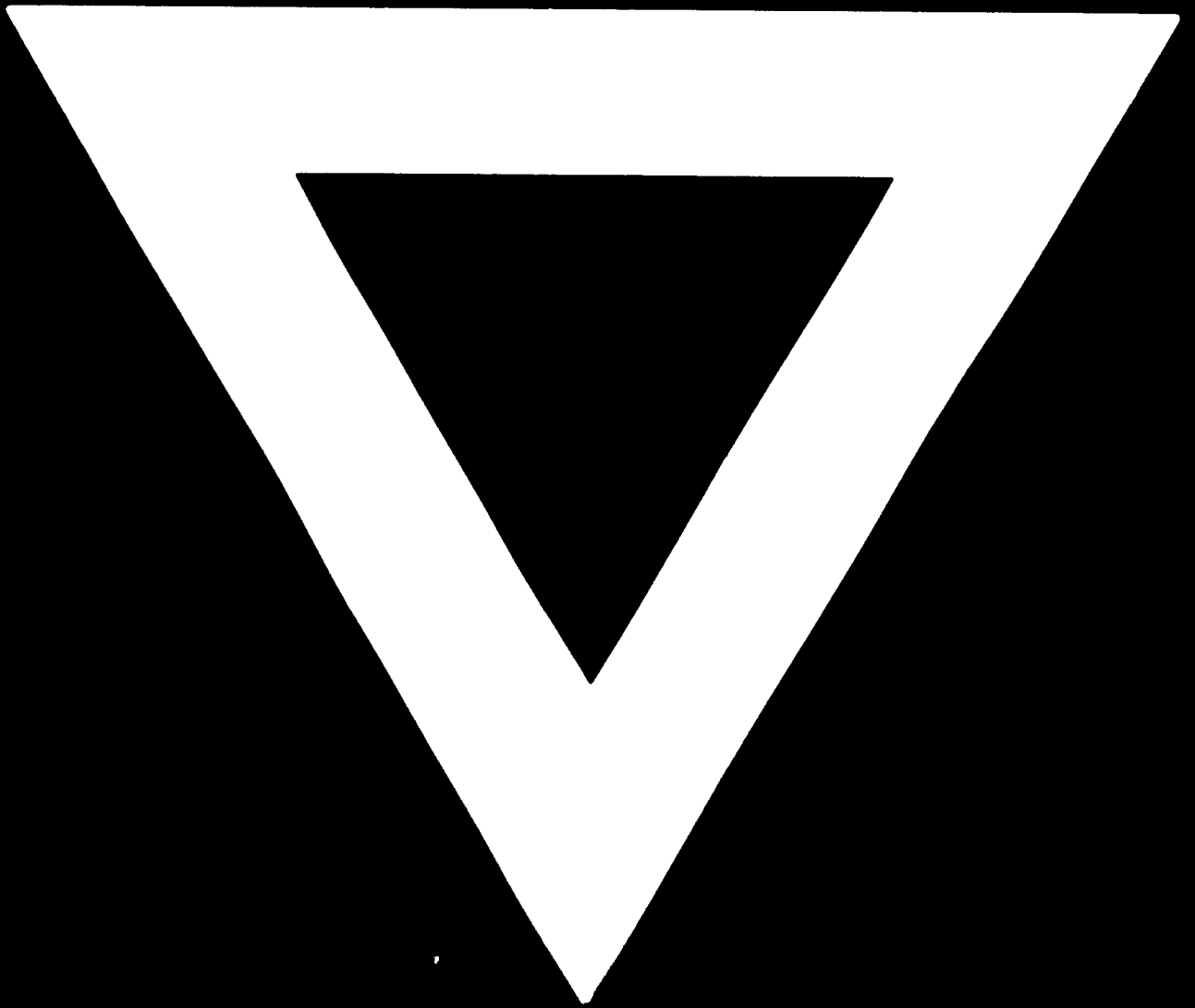
4. Technical assistance

If the company will require further assistance from UNIDO in the implementation of the project, this should be arranged through the Government.

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