OCCASION

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

DISCLAIMER

FAIR USE POLICY

CONTACT

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

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

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

DP/ID/SER.A/617
6 May 1985
ENGLISH

RESTRICTED

14815

REGIONAL DEVELOPMENT OF SMALL-SCALE CEMENT INDUSTRY

DP/RAS/83/014

ESCAP.

Technical report: Proceedings of the Mini Cement Workshop for the Asia and Pacific region organized by the United Nations Industrial Development Organization in co-operation with the China Cement Development Centre Beijing and Tianjin, China, 29 October to 5 November 1984

Prepared for the Governments of participating countries
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

United Nations Industrial Development Organization
Vienna

85-25708
2159T

Explanatory notes

The following abbreviations have been used:

CRI	Cement Research Institute of India
IDBI	Industrial Development Bank of India
KHD	Klöckner, Humbolt and Deutsch
t/day	tonnes per day
t/hour	tonnes per hour
t/year	tonnes per year

ABSTRACT

The Mini Cement Workshop for the Asia and Pacific region, held at Beijing and Tianjin, China, from 29 October to 5 November 1984, was organized by UNIDO in co-operation with the China Cement Development Centre within the framework of the UNDP project "Regional Development of Small-Scale Cement Industry" (DP/RAS/83/014).

The workshop was attended by participants from the following 10 countries: Burma, China, India, Nepal, Pakistan, Papua New Guinea, Philippines, Sri Lanka, Thailand and Vanuatu.

The experts discussed their experiences in the mini cement industry covering various aspects, such as the establishment and operation of small-scale plants, training personnel and regional co-operation.

CONTENTS

Chapter | Page

Annexes

PART ONE. REPORT OF THE WORKSHOP

I. ORGANIZATION OF THE WORKSHOP

The Mini Cement Workshop for the Asia and Pacific region, held at Beijing and Tianjin, China, from 20 October to 5 November 1984, was organized by UNIDO in co-operation with the China Cement Development Centre within the framework of the UNDP project "Regional Development of Small-Scale Cement Industry" (DP/RAS/83/014).

The workshop was attended by 40 experts, from the following 10 countries: Burma, China, India, Nepal, Pakistan, Papua New Guinea, Philippines, Sri Lanka, Thailand and Vanuatu. Twenty-one experts were supported by UNDP/UNIDO, 19 by their own authorities.

The purpose of the workshop was to discuss and exchange experience in the development of the mini cement industry in developing countries in the Asia and Pacific region.

Experts compared their experiences in building small plants with a capacity of up to 200,000 t/year of cement.

Visits were organized for the participants to a mini cement plant near Tianjin and to the China Cement Development Centre.

II. OPENING OF THE WORKSHOP

A. Opening ceremony

The workshop was opened by Mr. Xu Yongqing, Manager of the Economic and Technical Co-operation with Foreign Countries of the State Administration of Building Materials Industry.

Mr. Du Enxun, Minister Advisor and Mr. Wang Yanmo, Vice-Minister from the State Administration of Building Materials Industry, Mr. Chen Xingnong, Bureau Head from the Ministry of Economy and Trade attended the opening ceremony.

In a welcoming statement, Mr. Wang Yanmo said that, through the technical interchange among the delegates, the ties of friendship and co-operation, especially between the peoples of the developing countries in the Asia and Pacific region, would be further expanded and consolidated, and the development of the mini cement industry would also be further promoted.

He also assessed the development of the mini cement industry in China and said that the Chinese experts would like to work together and exchange their experience with experts from other participating countries, to learn from them, to accelerate and improve the mini cement industry in China with a view to further strengthening the mutual friendship and understanding between the peoples of China and other countries, and bring forth a common development.

Mr. Li Taoping said on behalf of the China Cement Development Center the workshop would provide a good opportunity for peoples from different countries in the Asia and Pacific region to discuss and exchange experience gained in the field of development of the mini cement industry.

A representative of UNDP thanked his excellency, the Chairman, minister advisor Du and Vice-minister Wang for attending the workshop.

He said that in 1979 when a UNDP office had been established in China the exchange of experience in the field of mini cement industry between China and countries in the Asia and Pacific region had really started. There were in China a number of centres specifically catering to the need of other countries. On the other hand, China was co-operating with countries in the Asia and Pacific region to benefit from their experience. He further stated that in 1983 technical co-operation among developing countries in the field of cement industry had started. The first seminar on the cement industry had been held at Beijing in 1980. 1/

A representative of UNIDO thanked those who had helped to make the workshop possible, the State Administration of Building Materials Industry, the China Cement Development Centre, Tianjin, the Ministry for Foreign Relations and last but not least UNDP, which was sponsoring and supporting the workshop.

He continued that the subject of mini cement factories had been under development in Asia for several years and that the workshop through discussions and factory visits would give incentives for further development. It should be possible to promote and develop the technical co-operation among the developing countries in the Asia and Pacific region. The need for technical

---

1/ Report on the Interregional Seminar on Cement Technology, Beijing, China, 9-24 October 1980 (ID/WG.326/20).

co-operation among the developing countries was greater than ever before because the traditional financial resources for United Nations development work did not follow the pace of requirements.

In this relation, he said, it was important that developing countries that had resources and know-how find ways to share them with other developing countries.

These observations seemed particularly valid for the small-scale cement and lime industry.

It was therefore important for this regional workshop to find ways to share the available experience in the region so that the less fortunate areas could benefit from the know-how and experience available in other areas.

He stated that the development of self-reliance and appropriate technology had long traditions in China, but that other countries in the region had developed their own experiences. The objective of the workshop was to share the experiences.

B. News release

On the opening day an announcement about the workshop was broadcast in 36 languages by Radio Beijing.

III. CONCLUSIONS AND RECOMMENDATIONS

The development of the mini cement industry in China and India was examined and it appeared that the available technology could be of immediate interest to Nepal, Pakistan and Papua New Guinea. Some of the subjects considered, such as raw material evaluation, quarry management, plant operation, maintenance and production of spare parts, bore a relationship not only to the small-scale cement industry but to the cement industry in general. Strong interest was expressed by nearly all participating countries in widening their experience with the help of mini-consultations with colleagues in other developing countries. Experts from some countries, such as China, India, the Philippines, Sri Lanka and Thailand, invited experts from other countries to consider making use of their experience in subjects ranging from training of personnel to technical assistance.

It was further concluded that in the near future the Asia and Pacific region would experience a steady development of the cement industry including the mini cement industry and that it was therefore necessary to support and upgrade skills at the country level for the development and evaluation of prefeasibility studies for the cement industry.

There was also a call for more information about special developments and results in the region so that experience could be shared and regional co-operation promoted.

The increasing role of the developing countries in the extension of existing and the creation of new cement industries made it essential for contacts to financial institutes to be strengthened and for regional investment promotion activities to be followed up with direct UNIDO support.

The regional workshop was in itself a very important platform for discussion of experience and plans and it was proposed to organize another regional meeting in three or four years to review the regional activities promoted in the above period and make plans for further development.

It was concluded that a real activation of the regional co-operation would depend on as to how the countries of the region would make available the resources that they possessed. It was decided to examine alternatives and possibilities for the verification of raw material reserves and for the elaboration or updating of techno-economic prefeasibility studies. The expected rapid development of the cement industry would depend on how soon operators and maintenance experts could be trained to handle the new technology in the different countries of the region.

It might therefore be necessary to assess the training requirements for the coming years and evaluate the existing training facilities so that a systematic implementation of training could be initiated with a maximum use of regional resources and to the extent possible. A joint evaluation mission to study requirements and physical resources would seem an appropriate starting point.

PART TWO. SUMMARIES OF COUNTRY PAPERS

Burma

CEMENT INDUSTRY IN BURMA

by U Shwe Kyi and U Nyunt Lwin

The cement industry started in Burma in 1937 with a 200-t/day rotary kiln. In 1962 and 1969 two 400-t/day rotary kilns were added. But since 1983 the first 200-t/day kiln has been out of commission.

The second cement plant in Burma was commissioned in 1976 with two 400-t/day kilns.

New production lines at the second cement plant with two 400-t/day kilns were established in 1981 and are expected to start operating the beginning of 1986.

The third cement mill in Burma with a 800 t/day rotary kiln with 4-stage suspension preheaters (using dry process technology) is under construction and expected to be completed by the end of 1986.

With production of the above three cement mills operating 300 days/year with 80 per cent efficiency, the total annual production of cement in Burma will be 768,000 t.

The projected domestic demand is expected to be 950,000 t by 1989/90, which means a deficit of 182,000 t/year.

To fill up the gap between demand and supply in 1989/90, the development of mini cement technology is planned as a means of overcoming the deficit in cement supply.

China

KEY POINTS IN SOLVING THE QUALITY PROBLEM FOR A MINI CEMENT PLANT

by Zhu Zupei

The quality of clinker produced in a mini cement plant is somewhat inferior to that of a big cement plant. The reason is that burning in a shaft kiln is not as efficient as it is in a rotary kiln. This shortcoming of the shaft kiln can be compensated by careful design both for the process and for the kiln itself.

Uniformity is the goal to be pursued at all times in order to obtain the best quality of cement. The term refers to the uniformity of the chemical composition of raw materials and semi-finished products; and to the uniformity of the operating conditions of various links of cement-making process.

For the former, the paper stresses selective mining to ensure the grade of quarry raw limestone, and the strict control of proportioning ahead of the mill to stabilize the composition of raw mix. A new type of homogenizing silo developed by this institute will lower the power consumption and both initial and operating costs. For the latter, the supply of fuel, air and water must be kept constant in order to keep the uniformity of operating condition of the shaft kiln.

The paper also emphasizes that uniformity of the cement itself is considered to be the most important requirement for good quality of cement.

China

THE DEVELOPMENT OF THE MINI CEMENT INDUSTRY IN CHINA

by Li Taoping

In the last 20 years, the mini cement industry in China has been developing rapidly. In 1983 the industry's output was 81.07 million t.

By the end of 1982, there were 750 mechanized shaft kiln plants, with a total of 870 mechanized shaft kilns.

China is rich in cement resources, which are distributed throughout the vast territory of the country.

It will be possible for the mini cement plants to sell their cement in the vicinity.

Mini cement plants require less capital investment. As the annual output from a quarry is low, the mines of mini cement plants are usually excavated manually by local peasants.

It is also unnecessary to set up a special railway line. Transportation by highway saves much investment. Also the capital investment for burning and coal supplying system of the mechanized shaft kilns is lower, i.e. it is approximately one third of that for a rotary kiln and a coal grinding system.

The operation of a mini cement plant is easy to learn, the quality of the products can easily be raised and the facilities needed can be manufactured and maintained locally.

On average, the quality of the clinker has attained No. 542 grade; the heat consumption is 1,035 Kcal/kg.

To improve the technique, the quality of the products should be further raised or steadied: the heat consumption of the clinker should be lowered; the environmental conditions and the operating conditions should be further improved and the level of automation should be raised.

Two things have to be given special attention in setting up mini cement plants. Firstly, the scale of the plant should be determined only after a good feasibility study has been made based on the analysis of the market demands and necessary conditions for plant operation. In view of the circumstances in China, one or two mechanized shaft kilns are usually built in the plant, which means a capacity of 80,000 to 160,000 t. Secondly, the mini cement plant must not be far from the raw materials, the mine and the fuel supply. And there has to be a local market for the cement produced in the plant. As for the fuel, it is necessary for the mechanized shaft kilns to use anthracite. But if it is not available in the region, a small rotary preheater kiln should be considered.

China

CEMENT INDUSTRY IN CHINA

by Li Mingyu, Yuan Guangpu and Ding Weidong

Small and medium-size cement plants in China constitute the main part of its cement industry, accounting for 75 per cent of the country's total output. The products are mainly used for important State projects. Wet-process production accounts for 60 per cent of the production of these plants. Because of the old installations and the high power consumption, an attempt is being made to convert the wet process into a dry-process production line adjusted to the specific conditions. The main purpose of the modification of the semi-dry process is to increase the pelletizing quality and the thermal efficiency of the heat generator. The tests for the new dry process started in the 1950s, and now the production line can be designed to manufacture 700 to 1,200 t/day. These plants produce Portland cement and slag cement.

There are 4,800 small cement enterprises in China. Their total output is 81,060,000 t. It is 75 per cent of the overall output of the country and 50 per cent of it is used in agriculture and the construction in towns.

The mini cement industry in China has the advantage of a big market and less investment. It can make full use of small quarries in its region and sell the cement locally. So the industry has developed remarkably. But there are still problems, such as the unstable process flow, poor management and unstable quality of cement. At present, the main task is to improve the quality of the product, strengthen the administrative management and develop a policy for the technical modifications, we shall do more work on the scientific research and adopt the new technology to speed up our mini cement development.

China

MODULAR DESIGN OF A 220 T/DAY CLINKER MINI CEMENT PLANT

by Zhu Keqiang

To meet the increasing need for cement in China, while developing the advanced precalcining technology in the cement industry special attention has been paid to the technique of mechanized shaft kilns. For this purpose, a modular design has been made of a small-scale cement plant with a capacity of 220 t/day clinker. A brief description of this model design is given below.

Limestone crushing and storage. The limestone quarry is 7 km away from the cement plant. The limestone crushing department with one stage of crushing is located inside the plant.

Raw mix grinding. The raw mix is proportioned by three components, i.e. limestone, clay and iron ore. As the "full-black" meal burning process is used for this design, fluorite and gypsum are added as a complex mineralizer.

Pre-drying system is used before clay is fed into the mill.

The closed circuit grinding system consists of a mill (2.4 x 7m) for drying and grinding and a separator of 1.8 m.

This mill is newly designed by the Cement Development Institute. The design has an "angular spiral" lining, a two-stage dedusting system is used for the mill.

Raw meal homogenizing and storage. In order to improve the $CaCO_3$ qualification rate of kiln feed, two homogenizing silos (8 x 10 m) are used for this design. These mix-chambers are divided into four aeration sections, which are aerated in turn. The annular part around the mix-chambers is divided into eight aeration sections, which are also aerated in turn.

The silo discharges continuously and has a high homogenizing efficiency.

Clinker burning and crushing. A newly designed 2.75 x 10 m diameter conical grate mechanized shaft kiln is selected for clinker burning. As a major clinker burning method, the so-called "full-black" meal process has been selected. It is possible to change to differential thermal calcination.

Admixture drying. A 2 x 14 m diameter rotary dryer with a capacity of 9 t/h, yearly availability 50 per cent, has been selected for drying clay and slag alternately. The fluidization furnace is designed to supply heat energy to the dryer. The fuel is broken coal.

Clinker silos. There are three 8 x 16 m diameter clinker silos in a row with a dried slag silo. The dried clay silo and crushed stone silos are in another row. Together with the above row they form the lump material silos.

Cement grinding. A 2.4 x 7 m diameter cement mill and a 1.8 m diameter cyclone separator make up a closed-circuit grinding system.

Cement storage and cement shipment in bulk. For cement storage, there are 4 8 x 20 m diameter silos equipped with discharging cones.

Cement packing and finished-product store. A 6-spout packer has been selected with a capacity of 55 t/h.

India

CEMENT INDUSTRY IN INDIA

by Brijendra Sahay

The cement industry in India is expected to expand and be modernized to a great extent during the next few years according to an already formulated investment plan. The present installed capacity of the cement industry is 39 million t/year with 85 cement plants and it is expected to increase to over 44 million t/year by 1984/85 and further to over 62 million t/year by 1989/90. The demand for cement in India in the current financial year has been estimated at about 37 million t and is expected to go up to 87 million t by the turn of the century. These expansion and modernization programmes have emanated mainly because of the recent and present policies of the Government of India.

Though limestone occurs in India in abundance, the cement produced is mostly from marginal or sub-grade limestone. The coal available for the cement industry is also of poor quality with very high ash content and low calorific value. Several industrial wastes, such as paper sludge, thermal power station fly ash, blast furnace slag, are also being utilized.

The cement industry uses three types of processes, dry, semi-dry and wet. There is also a large number of mini cement plants. However, all ordinary Portland cement produced in the country has to conform to only one standard specification.

Mini, medium and large cement plants have a role to play in the development of the national economy. Mini cement plants have been given special incentives since 1979. They are free from price and distribution control, excise was imposed only for five years in 1979 and the Industrial Development Bank of India (IDBI) specially finances the mini cement plants. All plants are being set up with a fairly sophisticated instrumentation, irrespective of the size. Large plants incorporate precalcinators, vertical roller mills etc.

The Cement Research Institute of India (CRI), a national research and development centre for cement and allied industries, has also developed an indigenous precalcinator for Indian conditions. A few precalcinators are already in operation. CRI has also been operating a productivity enhancement and modernization programme for mini as well as large plants for eight years. CRI has also developed several other technologies, such as vertical shaft precalcinator (for conversion of wet to semi-wet process), coloured clinker, special cements, improved packaging, stepped swirl burner, etc. Keeping in view the demands that the planned expansion in cement capacity is going to make on the requirement of trained manpower, CRI has also expanded its activities in training and is organizing various programmes for different categories of personnel.

India

STATUS OF THE MINI CEMENT INDUSTRY IN INDIA

by Brijendra Sanay

Mini cement plants play a complementary role in the development of the cement industry in the country, alongside the medium size and large plants. Whereas large cement plants go a long way in bridging the gap between the demand and the availability of cement, mini plants have also to be established because of the advantages they offer in the techno-socio-economic context of the country.

CRI has developed an appropriate technology incorporating vertical shaft kiln, based on which seven plants are already in operation including one in Bhutan and a very large number is at different stages of implementation throughout the country. The plants in operation have been making good financial returns and producing cement conforming to Indian Standard Specification, which is the same as for modern large plants with sophisticated instrumentation and automation. The Government of India has also been promoting this sector of cement plants through its policies. CRI has done a lot of developmental work to keep the technology up to date. At present CRI is assisting a number of mini cement plants to manufacture different types of blended and special cements and also implementing incorporation of an inexpensive microprocessor for automatic control of desired parameters with a view to producing quality clinker on a consistent basis.

Nepal

CEMENT INDUSTRY IN NEPAL

by D.B. Chatri and A.M.S. Bania

The first cement plant in Nepal went into operation in 1974 with a vertical shaft kiln of 2.4 m diameter and 8 m high, with a capacity of 160 t/day. Another plant with a capacity of 750 t/day with rotary kiln is scheduled to go into operation by the end of the year. The first cement plant is being expanded by addition of one more shaft kiln to be supplied from machinery supplies of the Government of China.

The Department of Mines and Geology, the main agency for the exploration and investigation has so far proposed one more cement plant with a capacity of 1,200 t/day in the eastern part of the country and is investigating two more plants of 1,000-1,200 t/day in eastern and mid-eastern parts of the country.

Considering the scattered limestone deposit all over the country and the transportation difficulties in hilly regions, the Government of Nepal has been emphasizing small-scale cement plants in the areas to which cement that will be produced from larger cement plants cannot be economically transported.

Pakistan

CEMENT INDUSTRY IN PAKISTAN

by N. Siddiqui and Zakir Mohammed

The cement industry in Pakistan is a blend of wet-process and dry-process kilns. To save fuel, which is available in limited quantities, all new plants are based on dry process. At the same time the wet-process plants are being converted into dry-process plants.

Most of cement plant components can be manufactured in the heavy mechanical complex, which was established with the help of China.

Against an installed capacity of 5.1 million t, Pakistan produced 4.4 million t in 1983/84. One and a half million t of cement had to be imported to meet the demand of the country, which was estimated at 6.3 million t.

Seven more units of a total capacity of 2.8 million t are under construction. Out of these, three units with a total capacity of 1.9 million t will come into production in 1985, thereby making Pakistan self-sufficient in cement in 1985/86.

It was generally believed in Pakistan that mini cement plants are uneconomical and that the quality of clinker produced was not good and uniform. However, the discussions that took place in the workshop have shown that the mini cement plants are viable and that Pakistan can look in this direction for meeting its future requirement of cement and that large areas can benefit from industrial development.

Papua New Guinea

CEMENT INDUSTRY IN PAPUAL NEW GUINEA

by Taunao Vai

Cement is gaining impetus in Papua New Guinea and, with the early interest revealed by potential investors, it is likely to gain further impetus.

With the relatively moderate government industrial policies, and the state of the country's economy, the cement industry is very much in a position to play a leading role, especially in the building and construction sector.

With such an outlook, demand is almost certain to increase and call for an increased supply, which for some years to come will still be based on imports.

In view of past trends and the present economic conditions, it can be assumed that demand and supply will increase to about 100,000 t/year or even more by the end of the 1980s.

The Government has already taken measures to cope with the situation. Taking into account the cost factor, it may opt for a vertical shaft kiln technology for a mini cement plant. With this in mind, data are being compiled for the formulation of an integrated package deal, which will eventually form the basis for assessment of future proposals.

Philippines

PHILIPPINE CEMENT INDUSTRY: OVERVIEW, REHABILITATION/MODERNIZATION AND PCIA POLICY 1985/86

by Lydia San Juan

The total installed capacity of cement plants in the Philippines is in excess of domestic demand to such an extent that the decline of the cement export market, in volume and in price, resulted in negative effects on cement plants operating at low capacity utilization levels. The operating conditions of the 18 cement plants were reviewed in 1978 and it was decided that the maximum productive capacity of the industry could reach only 82 per cent of the original rated capacities of these facilities.

In anticipation of an economic recovery by 1987-1990, an increased productivity program for the Philippine cement industry is being initiated by the Government in close collaboration with the cement sector. This program envisages an incremental production of 450,000 t through a short-term rehabilitation programme and of 1 million t/year through a modernization and conversion programme of selected plants by the end of 1990.

Sri Lanka

CEMENT INDUSTRY IN SRI LANKA AND ITS FUTURE

by K.V.H. Premachandra

The cement industry in Sri Lanka commenced with the establishment of a long kiln of 2.9 m diameter with a capacity of 25 t/day in 1950 at Kankesanthurai in the northern part of the island. The plant operated as a government department until 1957, when it was converted into a semi-governmental public corporation. In 1960 the kiln was converted to a 400 t/day kiln with a four-stage suspension preheater and at the same time another kiln with a capacity of 500 t/day with a four-stage suspension preheater was installed. The quarry was conveniently situated adjacent to the plant. In 1968 another plant was established at Puttalam, a town on the north-west coast of the island. It consists of two kilns, each with a capacity of 660 t/day and with a diameter of 3.6 m. The quarry feeding this plant is located 28 miles away, from where limestone is transported by rail.

All four kilns were equipped with suspension preheaters of K.H.D. design without conditioning towers and hence not efficient. All kilns were oil fired.

A clinker grinding plant of a capacity 24 t/h was established at Galle, a town on the south coast of the island. Clinker for this mill is supplied from the northern plant by sea and rail.

With these production facilities, the demand for cement could be met until 1978 and therefore no cement was allowed to be imported. However, with the liberalization of the economy after 1978 and the commencement of massive development programmes, the demand for cement increased rapidly, and in 1981, the demand was around 1.2 million t as opposed to 360,000 t in 1977. Free import of cement without duty was allowed during this period.

In 1983 the cement corporation planned a cement plant with a capacity of 3,200 t/day. This is a single kiln with a diameter of 4.5 m with double steam preheaters. The first stage of this plant was commissioned in 1983.

The plant was put up by several firms from the Federal Republic of Germany on a semi-turnkey basis, i.e. kiln, crusher housing, fans, conveyers, ductings, preheaters, were fabricated locally under the supervision of the main contractor. The second stage of this plant will go into operation in 1985/86. Sri Lanka is now self-sufficient in cement.

A private sector joint venture in co-operation with a Japanese company has put up a clinker grinding plant with a capacity of 200 t/year at Trincomalee on the east coast of Sri Lanka.

On the basis of research and development of the cement corporation the oil fired kilns were converted into coal fired kilns at the Krankesanturai plant and the conversion work is going on at the Puttalam plant.

Conditioning tower systems have also been installed at the Krankesanturai plant and work is proceeding at the Puttalam plant.

Haphazard mining of coral along the coastal belt for lime production at cottage-industry level is creating sea erosion problems. The possibility of establishing a vertical shaft kiln for lime production from dolomite deposits in the southern part of the country should be examined.

Thailand

CEMENT INDUSTRY IN THAILAND

by Piyavute Naphatthalung

There are at present three companies in Thailand, the oldest of which was founded in 1913 and by 1915 it was operating with an annual capacity of 20,000 t. It now produces 5.7 million t/year, plans to have a 3.3-million-t/year expansion project, which will be commissioned in 1988. The second company, which was founded in 1956, has an annual capacity of 0.36 million t.

The third company founded in 1969 has an annual capacity of 2.25 million t and will commission a 1.76 million t/year expansion project in 1987.

In 1984 the cement industry had a total capacity of 9.4 million t. By 1988, Thailand will have a cement production of 15 million t/year.

Energy saving

At present all the wet-process kilns are closed down or converted to dry-process kilns to save heat consumption. Coal, lignite and natural gas are used as alternative fuels. Coal is imported for cement making at the main burner. The consumption is estimated to be 0.5 million t/year in 1988.

Thailand has about 2,000 million tons of lignite deposit. Lignite can be used at the precalciner. The consumption is estimated to be 1 million t/year in 1988.

Thailand has plenty of natural gas reserves in the Gulf of Thailand but owing to high investment costs there is not enough margin for making cement, so it is planned to use coal and lignite instead.

Mixed ordinary Portland cement is OPC with a 25-28 admixture such as sand, limestone or raw meal. This type of cement has low early strength but can be used in bricklaying, house building, surface finishing and surface coating.

Mixed Portland cement requires low power consumption when grinding and can save a lot of valuable clinker.

Cement-making technology

The new advanced technology to produce cement in Thailand is a dry-process kiln with suspension preheater and precalciner system. A computerized X-ray spectrometer has also been installed to measure ingredient proportions precisely to ensure the finest quality of cement products and efficient process operation.

Cement production

Present production is at a good level owing to a constant high demand. Most cement manufacturers operate at almost full capacity. Thailand has many huge construction projects, which consume a large quantity of cement. So the existing cement manufacturers as well as the other new investors try to obtain promotional privileges from the Board of Investment to expand their production capacity and to establish the new plants.

Since 1982 the cement production has almost been able to meet local demand and sometimes it produces a surplus. If every plant operated to its full capacity and planned to expand its capacity, Thailand would be self-sufficient in cement.

The problems of the cement industry in Thailand are domestic shortage, the cost of fuel and raw material increase, maintenance and emergency repairs.

Vanuatu

BRIEF REPORT ON THE CEMENT INDUSTRY IN VANUATU

by Kalpao Vatoko

The installation and commissioning of a joint venture enterprise between Vanuatu, a private Australian investor and New Zealand company was begun in June 1984.

Raw materials used were 15 per cent pozzolana, 4.5 per cent of imported gypsum and 80.5 per cent of clinker imported from New Zealand. Paper sacks are also from New Zealand.

The plant capacity is 4 t/hour. Pozzolana/cement is required to stabilize base materials for the planned airport extension and road works. The cement produced is only for local consumption. Other products of the cement industry are concrete blocks and premixed concrete. The project aims at local market and covers only the expected increase of demand created by ongoing projects, such as hotels, industrial estate etc.

The project will relieve pressure on the import of cement. The impact on foreign exchange is substantial, approximately 40 per cent. The project will increase import of materials, create jobs for local people and reduce cost of concrete products. Local cement is cheaper than imported cement. Four foreigners and 37 local people are employed. In-service training has been arranged to enable the foreigners to be replaced by local people.

Annex I

LIST OF PAPERS SUBMITTED TO THE WORKSHOP

Burma: U Shwe Kyi and U Nyunt Lwin, "Cement Industry in Burma"

China: Cao Yongsheng, "Intensification of technical management and production of high-grade clinker"

China: Chen Guowei, "The general layout design for cement plant with shaft kiln"

China: Gu Dagong and Hu Daohe, "The physical model of raw material motion in Krupp preheater"

China: Han Xiujun, "The expansion project with a 2,000 t/day precalcining system in Jiangxi cement plant"

China: Li Mingyu, Yuan Guangpu and Ding Weidong, "Cement industry in China"

China: Li Shutian, K. Xiangzhong and G. Fong, "Application of rod mill in the local cement industry"

China: Li Taoping, "The development of the mini cement industry in China"

China: Peng Jiulin, "Perfection of the preparation system for raw meal, increase of the clinker output for shaft kiln and improvement of its quality"

China: Wang Yiguang, Hang Jinyang and Chen Pinguang, "Design for the process of mini cement plants"

China: Wang Zaixing, "Introduction of coal-fired precalcining kiln with a capacity of 700 t/day clinker in Xinjiang cement plant"

China: Zhang Baishou, "Improving the quality of cement clinker; reducing the consumption of coal in sintering"

China: Zhao Zixiang and Deng Zhongjin, "700 t/day production line with precalcining system in Shanghai Chuansha Cement Plant"

China: Zhu Keqiang, "Modular design of a 220 t/day clinker mini cement plant"

China: Zhu Zupei, "Key points in solving the quality problem for a mini cement plant"

India: Brijendra Sahay, "Status of the mini cement industry in India"

Nepal: D.B. Chatri and A.M.S. Bania, "Cement industry in Nepal"

Pakistan: N. Siddiqui and Zakir Mohammed, "Cement industry in Pakistan"

Papua New Guinea: Taunao Vai, "Cement industry in Papua New Guinea"

Philippines: L. San Juan, "Philippine cement industry: overview, rehabilitation/modernization and PCIA policy 1985/86"

Sri Lanka: K.V.H. Premachandra, "The cement industry in Sri Lanka and its future"

Thailand: Piyavute Naphatthalung, "Cement industry in Thailand"

Thailand: Santi Lorlowhakarn, "The cement industry in Thailand"

Thailand: Surapol Pongsatat, "Cement industry and mini cement plant (Thailand)"

Vanuatu: Kalpao Vatoko, "Brief report on the cement industry in Vanuatu"

Annex II

LIST OF PARTICIPANTS

Burma

A.U. Shwe Kyi, General Manager, Cement Mill No. 2 (Kyangin), Ceramic Industries Corporation, Rangoon

B.U. Nyunt Lwin, Assistant General Manager, Cement Mill No. 2 (Kyangin), Ceramic Industries Corporation, Rangoon

China

Gong Tingrong, Second Department of International Liaison Office, Ministry of Foreign Trade Economy

Nie Yong, International Economic and Technological Cooperation Company, National Bureau of Building Materials

Yuan Guangpu, Cement Department, National Bureau of Building Materials

He Xiongxian, Basic Construction Department, National Bureau of Building Materials

Chen Guo, Foreign Affairs Department, National Bureau of Building Materials

Cheng Fuyuan, Science and Education Department, National Bureau of Building Materials

Jia Huailin, Mechanical Department, National Bureau of Building Materials

Huang Jinyang, Research Institute of Building Materials

Li Shutian, Hefei Cement Research Institute

Qian Yuansheng, Nanjing Cement Industry Design Institute

Peng Jiulin, Southwest China Cement Industry Design Institute

Tong Damao, Wuhan Institute of Building Materials Industry

Wang Tiandi, South China Institute of Technology

Hu Daohe, Nanjing Institute of Chemical Technology

Yang Boshou, Shandong Institute of Building Materials

Cao Yongsheng, Jixian Cement Plant, Tianjin

Wang Zaixing, Xinjiang Cement Plant

Li Taoping, Tianjin Cement Industry Design Institute

Zhu Zupei, Tianjin Cement Industry Design Institute

Wang Mingluo, Bureau of Building Materials, Guangxi Zhuang Nationality Autonomous Region

India

B. Sahay, Joint Secretary, Ministry of Industry, Government of India, Udyog Bhavan, New Delhi

D.B.N. Rao, General Manager, Cement Research Institute of India, M-10 NDSE II, New Delhi 110 049

V.K. Jain, Group Manager, Cement Research Institute of India, M-10 NDSE II, New Delhi 110 049

S.C. Rastogi, Senior Scientist, Cement Research Institute of India, M-10 NDSE II, New Delhi 110 049

H.C. Visves-Varaya (joined only for the last day in Beijing), Chairman and Director General, Cement Research Institute of India, M-10 NDSE II, New Delhi 110 049

Nepal

D.B. Chatri, Senior Mining Engineer, Mines and Geology Department, Kathmandu

A.M.S. Bania, Senior Laboratory Chief, Himal Cement Company Ltd

Pakistan

Z. Mohammed, Managing Director, Mustahkam Cement Factory, Wah

N. Siddiqui, Managing Director, Kohat Cement Factory, Kohat

Papua New Guinea

T. Tai, Senior Project Officer, Department for Industrial Development, National Planning Office, Port Moresby

Philippines

L. San Juan, Executive Director, Government Agency, Board of Investments, Industry
and Investments Building, 385 Sen. Gil J. Puyat (Buendia) Ave., Ext. Makati, Metro Manila

Sri Lanka

F.V.H. Premachandra, General Manager, Sri Lanka Cement Corporation, Colombo

S.D.H.N. Lawrence, Assistant General Manager (address same as above)

Thailand

P. Phatthalung, Senior Engineer of Industrial Projects, Ministry of Industry, 75/6 Rama VI Rd., Bangkok

S. Lorlowhakarn, Production Engineer, The Siam Cement Co., Ltd, 814 Techavanich Rd., Bangkok

Vanuatu

K. Vatoko, Trainee Head, Extension Service Office, Industry Department, Ministry of Finance, Port Vila