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English

Strengthening the National Council for Cement and Building Materials of India capability in Productivity Enhance of the Cement Industry

DP/IND/84/20

Terminal Report

Prepared for the Government of India by the United Nations Industrial Development Organisation, the Executive Agency of the United Nations Development Programme.

Based on work of Palle Barnkob, Technical Consultant UNIDO
Post 11 - 10/B

United Nations Industrial Development Organisation,
UNIDO, Vienna

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I N D E X

Abstract

Name of Project	:	Strengthening the NCB's capability in production by enhancement of the cement industry.
Number	:	DP/IND/84/20
Post title	:	11-10/B. Expert in Productivity Improvement through Preventive Maintenance.
Arrangement	:	Direct assistance.
Branch	:	Cement Industry
Purpose of Project	:	To improve the total productivity factor in the industry and the technological levels of the various units of the cement industry in India through strengthening of the national centre - The National Council for Cement and Building Materials (NCBM).
Purpose of the activity	:	Planning of prevsntive maintenance schedules and implementation of preventive maintenance schedules and techniques in selected Indian cement plants.
Method of activity	:	Through team work with NCB staff effectively diagnosing maintenance problems and productivity constraints, formulate programmes and methodologies for solving the problems and improve productivity and recommend solutions during visits to selected cement works.
Duration	:	13th March to 9th August 1988
Executive Office of the Government	:	Ministry of Industry, India
Executive Office of the UN	:	United Nations Industrial Development Organisation UNIDO.

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CONCLUSIONS

Among the parameters for productivity enhancement in the cement industry proper maintenance of the plants plays a very vital role. From a financial point of view approximately 10% of a plants turn-over is spent on maintenance and the best utilization of these, often large sums, has become essential.

From a technical point of view efficient maintenance of a cement plant today will not only depend on ordinary mechanical, electrical and processing techniques, but also on the use of modern management systems both for production and maintenance, where preventive maintenance is an integrated part of these systems.

An optimized, fully implemented and utilized PM-system can reduce repair costs by 10 to 15% and improve the run-factor by a further 10-12%.

From the plant visits it was learned that the concept of modern maintenance management had been recognised at many plants although it is not yet fully implemented.

The maintenance standard of the plants was generally of an acceptable standard although it could vary. The housekeeping is very good in some plants, but in general there is room for improvement.

The plant production targets were in a number of cases not met, being hampered by a low availability of the production units. To some extent this is caused by factors outside the control of the plants e.g. power and fuel shortage. Amongst the other reasons which can be mentioned are design and process problems and lack of maintenance. With the exception of a few plants which are already performing very well the run-factor should be improved and stabilised in the range of 85% of the time available.

The preventive maintenance concept is advancing at all the plants. The degree of implementation varies from the bare minimum to a few plants working on computerised systems. In general it can be said that the interest exists and that further advice in the future will be sought by the plants.

RECOMMENDATIONS

In order to assist the cement industry on matters related the maintenance, including preventive maintenance, expertise should be available at NCB in the following fields :

- Plant Data Base where detailed technical information on production units installed is compiled.

- Preventive Maintenance Data Base which contains all preventive maintenance data for units installed.

- Computer based maintenance management systems including PM-system and Inventory Control system.

- Computer specialists able to advice cement plants on hard and software questions both in relation to first-time users where EDP strategies should be made, as well as to plants where compability to existing systems is topical.

- Consultancy and implementation assistance at plants, especially of PM-systems.

- Execution of non-destructive testing based on advanced equipment.

- Mechanical monitoring and maintenance of kilns and coolers covering kiln ovality and alignment, kiln supports, thrust device and drive.

- Refractory lining of kilns and coolers.

- Trouble shooting connected with specific maintenance problems and repairs.

INTRODUCTION

The advisory assignment in India was organised by UNIDO under project No: DP/IND/84/20 the aim of which is to strengthen the National Council for Cement and Building Materials (NCB) capability in productivity enhancement of the cement industry.

Based on a letter of appointment Mr Palle Barnkob was assigned to work for three months, later extended to five months as an expert in productivity improvement through preventive maintenance and in accordance with job description 11-10/B under above-mentioned project number.

BACKGROUND INFORMATION

The cement industry in India comprises today of some 94 cement plants with an installed annual capacity of app. 40 million tonnes. The production potential consist of plants utilising wet, semi-wet as well as dry process techniques and has been commissioned over the last 50 years. However, the majority of the production is from modern, large dry process units installed over the last 10 years. As all areas of society depend directly or indirctly on the availability of cement at any time it is essential that the cement plant operates

efficiently and as economical as possible in order to meet the demand and competition from the world market.

It has been published that the average capacity utilisation at present is 75 percent, and that an increase of 10 percent above this level will result in a considerable national saving.

Programme

The programme was prepared in advance by NCB and the activities included were :

A. Introduction to the project.

B. Papers on preventive maintenance presented by the expert.

C. Visits to selected cement plants.

Schedule

During the weeks 811, 812 and 813 areas under A and B were covered so the plant visits were undertaken during the weeks 814 to 830 inclusive. For plant reports refers to separate section.

Maintenance

In recent years the attitude to technical maintenance has changed drastically. While formerly repairs and the replacement of faulty parts were normally only undertaken when necessitated by breakdown, the advanced technology applied in rational production plants calls for a modern maintenance concept.

Systematic maintenance is based on the following parameters:

- Maintenance policy
- Adjusted maintenance organisation
- Consistent allocation of responsibility/authority
- Highly qualified personnel
- Continuous training
- Necessary tools
- Proper working facilities
- Good environment
- Continuous follow-up on resources used
- Relevant systems

In the present situation emphasis shall be on relevant systems amongst which the following will be noted:

- Plant register
- Preventive maintenance system
- Spare-parts system
- Job system
- Budget and cost control system

If these systems are interfaced they form a maintenance tool which can assist in the following areas:

- Remembering all the maintenance jobs
- Collecting the jobs into practical groups and assigning responsibility for job groups
- Providing the relevant personnel which planning and budgeting facilities
- Collecting all relevant maintenance information in a systematic way

- Supplying the personnel with sufficient information for performing the job
- Planning and scheduling of the maintenance work, hereunder the preventive maintenace.

Preventive Maintenance

Preventive maintenance means the implementation of systematic routines for inspection, lubrication, cleaning and condition checking of all machinery and installations including electrical equipment and instruments installed at a plant. The purpose is to reduce non-planned stops, breakdowns and abnormal wear and to provide a sound base for planned maintenance.

It is recognised that the full effect of a preventive maintenance programme cannot be obtained until the condition of the plant has been brought up to a high level. The extent to which preventive maintenance procedures should be introduced normally depends on the required production capacity and the desired life of the equipment. However, a certain degree of preventive maintenance is always needed to avoid costly breakdowns and to ensure that the plant complies with environmental and safety regulations.

The preventive maintenance functions such as cleaning and lubrication are by nature very simple and no drastic changes in this work have taken place for many years. The execution of the functions aiming at establishing the mechanical condition of a complete unit and/or components of same e.g. fan, bearings, gear box or drive, have on the other hand changed drastically in recent years. Earlier the inspection of these parts depended on, or was restricted by, the human factor for determining their condition. However, parallel with the technical development of machines, especially with regard to complexity and sophistication instruments for non-destructive testing, have also been developed.

For modern condition monitoring today are used instruments such as

- Field Balancer and Vibration Analyser
- Shock Pulse Meter
- Ultrasonic Unit
- Ultrasonic Flaw Detector
- Corrometer
- Stoboscope
- Thermometer - Pyrometer, infrared based
- Axial measuring equipment
- Inclinometer
- Kiln shell ovality instument
- Livering migration instrument
- Kiln aligment methods
- Oil Testing Unit

Newest in the line is a data logger, which is a small, portable micro-computer based instrument which can record and store a number of varicus signals normally obtained from different specialized instruments. When used in connection with a PC computer the signals can be analysed and evaluated.

A preventive maintenance system (PM-system) is based on the following information being available :

- Basic technical information of units installed
- Preventive Maintenance information

The components/functions of a PM systems are basically :

- Plant register
- PM Data Base
- PM maintenance scheduling and feedback function

- Machine history and fault analyse functions
- Work order function

Plant Register

The operation of a PM-system requires that all machines and other equipment are individually identified along with their physical location in the plant. To obtain this a codification system must be used which specifies the departments in the plant as well as the location of the individual machines. The codification system can be used everywhere where there is a need for precise technical communication e.g. flow-sheets, layout drawings, control panels, motor lists, spare parts system etc. The codification number should be implemented physically throughout the plant.

PM data base

The PM data base must contain all relevant preventive maintenance data for each unit to be covered by the PM-system. The compilation of this data should be based on the suppliers instructions as well as the plant's own data. It must be updated, in accordance with experience gained through the PM-system.

PM maintenance scheduling and feedback function:

Scheduling of the plant's preventive maintenance jobs, i.e. daily/weeky determation of the preventive maintenance jobs that are due for execution, outputting these in efficient worklists and back-reporting their execution and any faults detected.

Scheduling parameters would be :

- Job period stating how often the job should be done
- When the job was last done

- When the job is due next time
- Where the job should be done
- What should be done
- Who should do the job
- How the job should be done.

The job lists elaborated with them should be used by the PM-personnel for execution and feedback.

Machine history and fault analysis function:

The faults detected on the vaious units must be recorded through this function. The same applies for any repair work carried out where specific information on cause of fault, repairwork done, manpower and time as well as spares used should be stated.

The information can be analysed from various angles and the results used for updating the PM-data base and initiating possible remedial steps. Plant availability for production can also be calculated from the records.

Manually or Computerised PM-system

A PM-system will only prove effective if the technical contents, execution of the work, feedback and updating is done to a high standard. The system must be well documented and the flow of papers and information must be simple, easy and fast.

Even at a small cement plant the scheduling, preparation of lists, feedback and updating is a very time consuming work because of the large amount of data to be handled. In larger plants where coordination to other administrative systems is a necessity a manual PM-system not is feasible.

At present time it can only be recommended that top priority is given to computer based PM-systems, which later can be interfaced with other systems and be part of a modern management system.

General

Preventive maintenance work is characterized as various forms of inspections and controls of the units condition. Any repairs resulting from the feed back from the PM-system can be regarded as planned maintenance work and handled by another section under the maintenance department. Only by means of previously mentioned system such as

- Work order system
- Spare part system
- Budget and cost control system

can an overall coordination, planning, spareparts requirement, cost control etc of the maintenance work be achieved by the maintenance department.

In case these systems are not implemented some of the functions from the work order system should be incorporated in the PM-system so also planned repair work can be followed.

Papers on Preventive Maintenance

Based on the ideas for preventive maintenance the papers presented emphasized :

- Maintenance objectives
- Maintenance aspects
- Preventive maintenance functions
- Preventive maintenance data base
- Preventive maintenance work lists

Preventive Maintenance implementation at a plant :

- Motivation
- Decision
- Consequences

Additional areas :

- Workshop office
- Planning
- Instruments

Computerized Management Maintenance :

- Plant register module
- Preventive maintenance module
- Spare part module
- Job system

The structure of the papers presented on the preventive maintenance can be seen in the appendix No 2. Each subject was illustrated by means of overhead projection slides, slides, brochures and in certain cases, instructions from different suppliers. Wherever possible the training documentation was reproduced and handed over after each session.

The scope of this part of the programme had a dual purpose. Firstly to establish and ensure that all team members were fully aware of the most commonly used terminology within the area of preventive maintenance prior to the plant visits, where this would be the main topic to be discussed. Secondly to form a sound and uniform base for discussions on computerised maintenance systems to be developed by NCB.

The subjects discussed were later followed up during visits to the plants, where the practical aspects of acquiring and implementing of administrative systems for registration of plant data, preventive maintenance and spare parts were discussed at management level. In this way both the theoretical and the practical aspects have been dealt with by all team members.

As for the computerized management maintenance discussions, these have concentrated on the abovementioned 4 modules, these being the basic ones for modern management of heavy industry.

The areas of system survey, main menues, sub menues and functions have all been discussed with the team in order to initiate work along the lines at the NCB. The clear object is to offer a computerised maintenance system as a service package to the cement industry.

Plant Visits

The schedule for the plant visits is listed below :

			Appendix
Week 814	:	Ramakrishna Plant, Andhra Pradesh	3
		Priyadharsini Plant, Andhra Pradesh	4
Week 815	:	Shree Cement Ltd., Rajasthan	5
Week 817	:	Narmada Cement Works, Gujarat	6
		Magdalla Cement Works, Gujarat	
Week 818	:	Awarpur Cement Works, Maharashtra	7
		Manikgarh Cement Co., Maharashtra	8
Week 819	:	Sankarnagar Cement Works, Tamilnadu	9
		Sankari Cement Works, Tamilnadu	10

Week 820	:	Modi Cement Ltd., Madhya Pradesh	11
Week 825	:	Gujarat Ambuja Cement Ltd., Gujarat	12
		Cement Corpn. of Gujarat Ltd, Gujarat	13
Week 826	:	ACC, Wadi Cement Works, Karnataka	14
		ACC, Shahabad Cement Works, Karnataka	15
Week 827	:	The Uttar Pradesh State Cement Corpn.	
		Chunar Cement Works	16
		Churk Cement Works	16
		Dalla Cement Works	16
Week 828	:	Diamond Cement Ltd., Madhya Pradesh	17
		Lakshmi Cement Ltd., Rajasthan	18

The plants were visited by the writer accompanied by different officials from NCB, thus normally forming a team of 3. The procedures followed at each plant visit were :

- Introduction to Plant Management
- Joint inspection of plant with maintenance management officials
- Discussion of observations
- Specific areas/problems at the plant
- Recommendation from team
- Paper on preventive maintenance.

Plant Reports

After each plant visit the visiting team prepared a report, which was sent to the plant, a copy of each is enclosed here.

The reports have been made in accordance with the following pattern

1 — Summary of main conclusions
2 — Introduction
3 — Background information
4 — Findings and Observations
5 — Conclusion and recommendations

The type of plants visited ranged from old to new ones, small to large capacity, and some working with wet process and the remainder dry process. This range of plant types revealed many different types of problems existing within the cement industry.

Acknowledgement

I take this opportunity to express my sincere thanks to Dr H. C. Visvesvaraya, Chairman and Director General and Project Director, and all the staff at the National Council for Cement and Building Materials with whom I have worked for the good cooperation, hospitality and friendly spirit extended to me during the mission here.