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PRODUCTIVITY IMPROVEMENT
THROUGH
MAINTENANCE OF ELECTRICAL EQUIPMENT
DP/IND/84/020/11-12

Technical Report: Issues Relating to Maintenance of the Electrical Equipment in the Indian Cement Plants and Remedial Measures

Prepared for the Government of India
by the United Nations Development Organization
acting as executing agency for the United Nations Development Programme

Based on the work of Arihiro Takeda
expert in maintenance of electrical equipment

United Nations Industrial Development Organization

Vienna

Report of discussion with N.C.B.

1. Date : Dec. 30th 1986

2. Place : NCB office in New Delhi

3. Participant
(1) Dr. H. C. Visvesvarya
(2) Mr. D. B. Ironi
(3) Mr. Kamal Kumar
(4) Mr. H. C. Hans
(5) Mr. A. Takeda

4. Content

I reported my duty implemented and discussed the following with NCB member.

(1) Too much frequent power failures and cut due to shortage

(2) Power supply system of the BOARD should be reviewed.

(3) Power of BOARD and consumers' generator is required to enable parallel operation.

(4) Installation of AVR will be helpfull to voltage flnctuation.

(5) To keep motors and electric equipmens in good condition, dust collection is needed.

(6) There are so many shut-down of Mill motors, more than ten times a day in some plants, that mechanical and electrical strain will affect them earlier than usual.

(7) Most kilns in Japan keep continuous operation more than one hundred days, having shut-down from two to three weeks for previous maintenance.

(8) With referance to employee training, difference of conditions between India and Japan was discussed.

REPORT ON

ISSUES RELATING TO MAINTENANCE OF THE ELECTRICAL EQUIPMENT IN THE INDIAN CEMENT PLANTS AND REMEDIAL MEASURES

PRESENTATION : MR ARIHIRO TAKEDA 29, DEC. 1986

1.0 INTRODUCTION

I participated in the UNIDO Project IND/84/020 as a specialist for two months November and December of 1986 and visited the following four factories :

1. Udaipur Cement Works (UCW) - Udaipur (Rajasthan)
2. J K Cement Works (JKC) - Nimbahera (Rajasthan)
3. Mangalam Cement Ltd (MCL) - Morak (Rajasthan)
4. Jammu & Kashmir Cement Ltd - Khrew (J&K)

The topic assigned to me was "Application of advanced techniques of maintenance of electrical equipment in the areas of electrical power distribution system, protective devices and various electric drive systems in cement plants".

2.0 PROGRAMME SCHEDULE

Activity	Date
UNDP Mission Formalities	04 Nov 1986
Briefing by the Project Director and Chairman & Director General - NCB	05 Nov 1986
Discussion with Director - NCB	05 Nov 1986

Activity	Date
Discussion with NCB officials on advanced techniques of maintenance of electrical equipment	06 to 20 Nov 1986
Visit to Udaipur Cement, Udaipur (Rajasthan)	21 Nov 1986
Interaction with plant personnel on the plant's problems in the areas of maintenance of electrical equipment	22 to 23 Nov 1986
Visit to J K Cements, Nimbahera, (Rajasthan)	24 Nov 1986
Interaction with plant personnel	25 to 26 Nov 1986
Back to Delhi	27 Nov 1986
Visit to Mangalam Cements, Morak (Rajasthan)	08 Dec 1986
Interaction with plant personnel	09 to 10 Dec 1986
Back to Delhi	11 Dec 1986
A talk on "Maintenance of electrical systems in cement plants"	18 Dec 1986
Visit to J&K Cements, Khrew (J&K)	21 Dec 1986
Interaction with plant personnel	22 to 23 Dec 1986
Back to Delhi	24 Dec 1986
Interaction with NCB counterparts on the outcome of the mission and finalization of mission report by the expert	26 to 30 Dec 1986
Finalization of mission	30 Dec 1986
Debriefing with the Project Director	30 Dec 1986

3.0 PROBLEMS AND REMEDIAL MEASURES

The four factories I visited, have one to three kilns with SP. The Kiln No. 2 at UCW and Kiln No. 3 at JKC are in the process of being changed to precalciner type. UCW has also done a study for the remodelling.

My findings about the problems being faced by the plants and suggested remedies are given as under :

3.1 The problem of inadequate electricity :

Presently, the electrical power situation in India is very bad. None of the factories get more than 40 - 50% of their rated needs. In a bad month, they get even less than 30% of their needs. It is not only that the quantity of electricity received is less but the quality of electricity is also bad. There are large fluctuations in voltage and frequency. Due to these, low voltage trips and frequency trips occur. This has led to situation where continuous operation of the kiln is not possible. The poor power is supplemented by D/G Sets, (Annexure - I) to make up for the insufficient electricity but with increased use of D/G Sets, their maintenance cost also increases. This also increases the cost of producing cement. At MCL one of the two D/G Sets is under repair. Only Kiln Section can run on one D/G Set and therefore it is not possible to keep continuous plant operation unless power from grid is sufficiently available (60 to 70%) but the plant is finding it difficult to get stable power of that level.

At J K Cement Works in accordance with the increased need for electricity due to the expansion programme, they are in the process of setting up two 5 MW D/G Sets and two 7.5 MW thermal power plants. The D/G Sets would be commissioned soon.

At J&K Cements, Khrew, studies have already been done about introducing D/G Sets. At MCL in the plan for remodelling the kiln into pre-calciner type the increased use of D/G Set is taken into account. Thus, with no other way out, every plant is going in for D/G Sets and thermal power for solving the problem of insufficient electricity supply.

3.2 <u>On the problem of voltage and frequency fluctuations</u> :

As stated earlier, it is not just that the power supply is less, but there are wide and frequent fluctuations in the voltage and frequency.

If we were to include the instantaneous trips to these, it works out to 30 - 80 interruptions in a month. At J&K Cements, as the Automatic Voltage Regulator (AVR) was out of order, there were 126 interruptions in the first half of December alone or there was a total of over 100 hours lost. This is four times as much as what was lost earlier when the AVR was functioning normally. With such repeated problems like power failure etc. naturally the frequency of starting and stopping the machines

increases. The machines are subjected to mechanical, electrical and thermal stresses and their lives get reduced rapidly.

Hence, there is need to pay full attention to large sized motors like the mill motors, the kiln motor and others, the frequency of inspection has to be increased. There is the need for checking the coil insulations and the condition of bearings every month. As a counter measure for the electrical fluctuations, it is necessary to use a transformer with automatic ON-Load Tap-changer.

3.3 The parallel operation of received electricity and self-generated electricity

Presently in India, the State Electricity Boards are generally not allowing the parallel operation of received electricity and self-generated electricity. Thus, when the power source is changed from received power to self generated power or vice versa, the power supply hasto be stopped once. As the present power situation is bad, the switchover from one power source to the other takes place any number of times in a month.

Because of this,kiln and mill have to be stopped and this prevents the continuous operation of the plant. Consequently, the possibility of the parallel operation of the two power sources has to be taken note of. Planning has to be done on the utilization of electricity so that there is no need to stop the machinery.

Now, for the parallel application of power, synchronising equipment and load selective trip device are needed. In some cases protective device for reverse power relay also would be needed. Since self-generated power is also used in the running of the plant, parallel operation becomes necessary and efforts should be taken to get approval of parallel operation as early as possible.

3.4 Inspection and maintenance of motors :

The cement plant would usually be dusty and except large sized, high voltage motors like the mill motor, the others should be completely enclosed types. This is infact how we found it in various plants. In the factories I visited, except only in UCW, closed type motors were used. At UCW, motors have to be cleaned very frequently as dust ingress is high. Further there is the extreme case of J K Cement Works where the mill motor were started and stopped over ten times a day. This is extreme in the sense that the frequency of starting and stopping is 4 - 5 times that for the usual motors.

These plants were doing their inspection and maintenance every month to the extent needed. They do not face any problem as maintenance is being done. But they should try to change over to as much long, continuous operation as is possible at the earliest.

What is common to all the factories is that if a little more continuous operation were possible, inspection of the motor while it is in operation is done properly, it will be easy to plan the preventive maintenance and do it, during stoppage hours to ensure trouble free operation.

At present there are lots of sudden break-downs due to unstable power supply and maintenance problems due to the dusty surroundings. I hope efforts are made as early as possible to solve these problems so that stable operation is possible.

3.5 Maintenance of Panels and Control Rooms :

All the plants are keeping their high voltage feeder cubicles in the electrical room and are properly maintaining them. Maintenance was good in particular at MCL. It is also converting its main sub-station into a pressurised chamber. But in all the plants in a number of places, dust was being generated. The various places like the raw mill area, burning area, cement mill area and the electrical room near the machinery are covered with simple construction and dust enters easily. Though much maintenance is done, the switch boards remain dusty due to the dusty surroundings. Because of this, most of the plants were cleaning the place every week to prevent ingress of dust and to prevent insulation deterioration. To prevent the breakdown of switching devices, the frequency with which maintenance is done should be proportionate to the

extent to which they are used and also the surroundings in which they are installed. To reduce maintenance work, all electric rooms should be dust sealed.

3.6 Maintenance of static electrical machines like transformer, controlling devices etc.:

Usually static electrical machines can be used for very long periods with little or no-maintenance if they are used in clean surroundings and if they are used within the maker's specifications. One should take care to see that insulations are not dirty and overload is avoided in the transformers. Generally checking of the insulation oil, once in 2 - 3 years in enough. For maintaining the static electrical machines there has to be proper maintenance of the surroundings and the temperature and dust have to be controlled. I hope all the plants pay proper attention to this.

3.7 Power consumption :

Table shows the power consumption in the three main sections - Raw Mill Section, Kiln Section and Cement Mill Section. As can be seen, the total for these three sections is highest for J&K Cements, at 146 kwh/t-c, followed by MCL and UCW at 128 and 127 kwh/t-c respectively. At JKC it was told that the figure is 120 kwh/t-c, but since the break up is not known, not much can be understood. As J&K Cements does not have self-generation, and as the received power is insufficient and there are a number of interruptions the power consumption is high. The figure for the kiln section is high for all the plants because of the idling time and because the fan consumes power even when the kiln is not producing during normal-

isation. This power loss is very large.

TABLE - 1

POWER CONSUMPTION OF THE PLANTS

	UCW	JKC	MCL	J&KC	JAPAN
			NOV'86	Jan-Dec '86 Ave.	Apr-June '86 Ave
Raw Mill Section	34	-	33	43	30
Kiln Section	58	-	46	56	29
Cement Mill Section	35	-	49	47	44
Sub-Total	127	120	128	146	103
Others	4	-	20	4	-
GRAND TOTAL	131	-	148	150	-

NOTE : Figures for Japan are the average for the three months April - June 1986 for 22 companies 42 plants

At MCL and J&K Cement, in the raw mill section and cement mill section the actual output per unit time was lesser than the rated capacities. The efficiency of the mill and the separator have to be investigated and attempts made to reach the rate capacities. If we presume there is steady supply of electricity and that this leads to a saving of 5 kwh/t-c, as the total cement production in India is 3.3 crore tonne, keeping the price of electricity at 0.8 Rs/kwh this amounts to a saving of Rs 13.2 crores in a year. In other words, a

lot of energy is wasted and it is a big national loss.

The immediate need is to ask for a set up in which steady power is available. Further, I think large manufacturers who also use self-generated power should immediately get approval from the State Electricity Boards for parallel operation.

3.8 Dust prevention in the factory :

So far, I have been mentioning about the plants being dusty. Now I want to point out the reasons for the dust.

Firstly, there are a number of places where dust emission takes place, like the conveyors and open stock yards. In a number of places the dust collecting equipment is not being used. Even in places where it is being used, it is not powerful enough. Taken as a whole, this means that the dust collecting capacity is not sufficient.

Secondly, in certain specific places dust keeps on accumulating despite cleaning. This only means that the problem that leads to dust formation has not been investigated and solved.

Thirdly, dust is only a part of the raw material. It is a semi-processed material which cost some money. One should view dust in this manner.

Dust is detrimental not only to electrical machinery, but to other machinery as well. The first step to easy maintenance, lesser breakdowns and lower cost is dust prevention. Realizing this is very important. Please try to create clean environment in cement factories and try to have continuous operations in the plant.

4.0 SPECIFICATION AND CAPACITY OF THE MAIN MACHINERY IN THE FOUR PLANTS

Given at Annexure I

5.0 ACKNOWLEDGEMENT

I am grateful for the help I received from various quarters during my two months stay in India.

I would be very happy, if because of this report there is a little improvement in the Indian Cement Industry.

I would like to thank the following :

Dr M Kamal Hussein (Senior Industrial Development Field Adviser)
and
Mr Sat Pal (Asst. Programme Officer) of UNDP.

Dr H C Visvesvaraya - Chairman and Director General NCB

Mr D B Irani - Director

Mr Kamal Kumar - Programme Leader

Mr V K Arora, Mr H C Hans, Mr P K Bhatnagar and Mr A Ghosh of NCB.

I would also like to express my heart felt thanks to the staff of Udaipur Cement Works, J K Cement Works, Mangalam Cement and J&K Cement.

ARIHIRO TAKEDA

ANNEXURE I

		Udaipur Cement Works (UCW)	J K Cement Works (JKC)	Mangalam Cement Limited (MCL)	Jammu and Kashmir Cement Ltd., (J&KC)
Kiln	No.1	600 TPD	900 TPD	1200 TPD	300 TPD
	No.2	600 "	1200 "	-	300 "
	No.3	-	1350 "	-	-
Raw Mill	No.1	60 T/H : 2000 HP	75 T/H : 2500 HP	115 T/H : 2x1650 HP	55 T/H : 2000 HP
	No.2	100 " : 2500 HP	110 " :2x1010 KW	-	-
	No.3	-	110 " :2x1010 KW	-	-
Cement Mill	No.1	40 T/H : 2000 HP	55 T/H : 2500 HP	70 T/H : 2x1000 HP	35 T/H : 2000 HP
	No.2	80 " :2x2000 HP	67 " :2x1350 KW	-	-
	No.3	-	75/79 " :2x1350 KW	-	-
Main Transformer		2x10/12.5 MVA 132 KV/3.3 KV 50 Hz.3ϕ (On-Load Tap Changers)	1x31.5 MVA,1x15 MVA, 132 KV/11 KV 50Hz, 3ϕ (On-Load Tap-changers)	2x7.5 MVA 132 KV/6.6 KV,50 Hz, 3ϕ (On-Load Tap-changer)	2 x 5 MVA 33 KV/6.6 KV 50Hz, 3ϕ (On-Load Tap-changers and One AVR)
Demand		Contract 15 MW / Actual 14.5 MW	Contract 31.5 MW / Actual 25 MW	Contract 10.6 MW / Actual 7.0 MW	Actual 5.5 MW
Diesel Generator	Existing Plant	2x4.500 KW 3ϕx3.3 KV Fuji Diesel	3x3,500 KW USSR (Three units are out of order) 2x3,500 KW Fuji 3 x 11 KV Diesel	2x3,150 KW 3ϕx6.6 KV Fuji Diesel (One unit is under repair)	-
	New or Additional Plant	-	2x5,000 KW : Fuji Deigel 2x7,500 KW : Thermal Power Plant (In the Installation stage)	2x5,000 KW (In the planning stage)	4x1,500 KW (In the planning stage)

Report on Visit to Udaipur Cement Works,
Bajaj Nagar (22-23 Nov 1986)

Team Members : Mr Arihiro Takeda - UNDP Expert
Mr H C Hans
Mr P K Bhatnagar - NCB Experts

1.0 INTRODUCTION

This report is based on visit to Udaipur Cement Works, Bajaj Nagar for two days. Time was insufficient to generate data in detail. The data presented here was collected by making inquiries from the plant staff. Identification of technical problems is based on discussion with the plant officials. The plant is facing the problem of unstable power supply with wide variation in supply voltage and frequency and severe power cuts. Due to the generally dusty conditions inside the plant, maintenance of equipment is adversely affected.

2.0 LOCATION

This plant is located at Bajaj Nagar, about 20 Kms from Udaipur in the State of Rajasthan at a distance of about 550 kms from Delhi. The mining of UCW is done about 8 kms from the plant and raw material is sent by overhead ropeway.

3.0 PRODUCTION CAPACITY OF THE PLANT

This plant has two SP kilns of 600 tonnes per day capacity each. After incorporation of MFC precalciners capacities are expected to be 1200 and 1600 tonnes per day in December 1986 and March 1988 respectively. The maximum power demand of the plant is 15 MVA. It has two main transformers of 10/12.5 MVA capacity each at 132 KV/ 3.3 KV voltage and 50 Hz frequency. The transformers have on load tap changers. The motors upto 325 H P are low tension drives (415V) and above 325 HP; these are

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high tension drives at 3.3 KV. Motors are generally SPDP type. The plant has two diesel generators of 5 MVA each.

4.0 NATURE OF ELECTRICAL PROBLEMS

The plant is facing the following major problems.

4.1 Unstable Power Supply : Whenever the supplies from Kota Atomic Power Plant are affected, the plant experiences

(i) Severe power cuts ranging upto 70%

(ii) Voltage variations ranging from 90 KV to 145 KV against standard value of 132 KV.

(iii) Frequency variations ranging from 42 to 52 Hz against standard value of 50 Hz.

In one year, problems of unstable power supply for appromately six months are experienced. During this period, the plant mainly depends on D G power. The state electricity board does not allow synchronisation of D G power with that of grid power even during normal conditions of voltage and frequency. The kiln and other equipment has to be stopped during changeover of supplies.

4.2 Maintenance Problems : Due to the very dusty conditions in the plant, maintenance of eletrical equipment is difficult. Control rooms, panels and other electrical equipment is exposed to dust which hampers their performance and leads to equipment failures.

5.0 ANALYSIS OF PROBLEMS AND SOLUTION

5.1 Power Supply : The problem of unstable power supply cannot be solved at the plant level. But as the problem is faced whenever supply from Kota Power plant is not normal, the plant should try to keep information about the power position and should use the D G power to keep

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the plant running with minimum of interruptions and maximum possible utilization. The plant should try to get permission for parallel operation of grid power and D G power. It will help in reducing the stoppages. It will result in better use of available power and reduction of electrical and thermal energy consumption.

5.2 Maintenance Aspects :

i) Motors used in the plant are mainly SPDP type (open type). Dust enters the motors which is likely to reduce its insulation resistance and also reduce heat dissipation resulting in temperature rise of the motor. If possible, important motors may be replaced by totally enclosed type motors. The existing motors should be cleaned as frequently as desired.

ii) The control room should be made fully enclosed and pressurised.

iii) Dust generation should be reduced by dust sealing wherever possible, water sprays and having more dust collection points.

6.0 ELECTRICAL POWER GENERATION UTILISING WASTE HEAT FROM EXHAUST GASES

The feasibility of electric power generation utilising heat of exhaust gases was discussed. It was roughly estimated that power of the order of 4 MW can be generated utilising waste heat of exhaust gases from suspension preheater after completion of expansion project but the main constraint of scarcity of water in the area has to be overcome.

7 DISCUSSION ON MAINTENANCE OF ELECTRICAL EQUIPMENT

Maintenance and protection aspects of various electrical equipment e g H T and L T motors, transormers and switchgear etc., were discussed in detail with the plant officials. It was stressed that for proper running

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of motors, periodic maintenance and recording is very necessary. Checking of insulation value, condition of bearings, carbon brushes and slipprings should be done at regular intervals. In transformers, level of oil, dielectric strength of oil and insulation of windings should be periodically checked and recorded. In the case of circuit breakers, it is important to check condition of main contacts, level of oil and its dielectric strength (in case of oil circuit breakers).

REPORT ON VISIT TO J K CEMENT WORKS - NIMBAHERA (25-26 NOV 1986)

Team members : Mr Arihiro Takeda
(UNDP Expert)

Mr H C Hans
Mr P K Bhatnagar NCB Experts

1.0 INTRODUCTION

This report is based on visit to J K Cement Works Nimbahera for two days. Time was insufficient to generate data in detail. The data presented here was collected by making inquiries from the plant staff. Problems have been identified on the basis of technical discussion with the plant officials. The plant is subjected to severe power restrictions from the State Electricity Board and depends heavily on captive power generation.

2.0 LOCATION

This plant is located at Nimbahera, about 30 Kms from Chittorgarh in the State of Rajasthan at a distance of about 450 kms from Delhi.

3.0 PRODUCTION CAPACITY OF THE PLANT

The plant has three SP Kilns of capacities 900, 1200 and 1350 tonnes per day respectively. The third kiln capacity is expected to be raised to 2600 tonnes per day by incorporating a precalciner.

The modification is likely to be completed by May 1987.

4.0 PROBLEMS RELATING TO THE ELECTRICAL EQUIPMENT

4.1 Power Scarcity :

The maximum power demand of this plant is 25 MW. It has two main transformers of 31.5 MVA and 15 MVA capacity each at 132 KV/11 KV supply at 50 Hz frequency. The transformers have on-load tap changers to take care of voltage variations. The plant is subjected to power restrictions upto 80% and therefore hasto depend on captive power generation. It has five diesel generators of 3.5 MW capacity each. At the time of the visit, two units were working and the other three were under major repairs. Two new diesel sets of 5MW each were under installation and were to be commissioned soon. The plant is also in the process of installing a thermal power station with two sets of 7.5 MW each. One of the units is likely to be commissioned by June 1987. With these units becoming operational, the plant is expected to tide over the problem of power scarcity.

4.2 Starting duty of mill-motors :

It was reported that frequency of starting and stopping of the mill motors is very high even reaching 10 - 12 times a day. It is partially due to power problems and partially due to operational problems.

4.3 Motor Bearing problems :

Due to problem of wear of rubber bushes in the flexible coupling misalignment takes place and the effects are reflected to the motor bearings resulting

in damage to motor bearings and reduction in overall performance of motors.

4.4 Motor Bearing Problem due to Electric Welding :

Whenever welding is done near the motor on the load side, the return path of the welding current is completed through earthing cable as a result of which high welding current passes through the motor bearing and motor/earthing cable and this adversely affects their performance.

4.5 Overheating and Burning of Motors :

Whenever there is a choking in the pneumatic conveyors, screw conveyor (SC) or trough chain conveyor (TCC) and the motor stops due to overload, sometimes the raw material choking is not removed. The motor is started and stopped and the process is repeated to clear the choking. This results in overheating of the motor due to high current inrush and subsequent motor burnouts, burning of contacts etc.

4.6 Maintenance of Motor Control Centres :

The installation of some of the MCC's like kiln feed section, mill section is very close to equipment i.e. F K Pumps, Fluxo's and other material handling equipment which have high dust generation. This results in excessive dust ingress in these MCC's as well as sometimes spark overs in the contactors. Moreover, due to high dust ingress these MCC's requires more frequent maintenance in respect of cleaning and blowing.

5.0 ANALYSIS AND SOLUTION

5.1 Power Shortage and Precaution of Machinery Stoppage :

The plant has already taken steps to reduce its dependence on supplies from the State Electricity Board. With the commissioning of D.G. Sets and thermal generating station mentioned earlier, it is expected that the plant will be in a position to run continuously. If the plant can get permission for paralleling of grid power and self generated power, it will lead to lesser stoppages and better optimization of available power. Further for efficient use of power, it is important to have better co-ordination with the supplier (electricity board).

5.2 Prevention of motor problems :

It is a matter of concern that the larger motors like the mill motors are being frequently started and stopped upto 10 times a day. The mechanical and electrical stresses the motor experiences due to frequent stoppings and startings are quite high. Though the motors may not have immediate problem, these stresses adversely affect the motor life span. Frequent starts/stops also results in deterioration of dielectric strength of oil and burning of contacts of oil circuit breakers.

5.3 Inspection and Maintenance of Motor Bearings :

The inspection and maintenance of motor bearings and couplings is very important for the motor.

By periodic inspections of the motors, most of the troubles can be identified before they actually occur. The more important the machine, the more frequent the inspection should be and this would lead to higher safety for the machine. Usually most of the coupling troubles may be due to the inferior quality of the parts, incorrect installations such as misalignments etc. These points should be taken care of at the appropriate time.

5.4 Earthing system of the electric welding ;

In order to avoid this type of problems, it is recommended that welding wire line should be kept separate from the common earth wire for motors etc. and separate contactor should be used for this. The return path of welding should not be passed through motor.

5.5 Over heating and Burning of motors due to choking problems :

These problems are not really technical problems of the electrical section but are related to the management of operation and maintenance. For this purpose the training of operators and other related personnel is very essential. The motors should not be repeatedly started and stopped in order to clear chokings in the conveyor systems asthis results in high current inrush in the motor which may damage the insulation of windrings and subsequent motor failures/ Burnouts.

5.6 Maintenance of Motor Control Centres :

As far as possible, efforts should be made to install the MCC's (power control centres) in Mill and kiln feed section in closed rooms with proper ventilation in order to keep them away from dusty environment and to avoid dust ingress in the panels which may result in the sparkovers.

6.0 CONSUMPTION OF ELECTRICAL POWER

The consumption of electrical power was reported to be 120 kwh/tonne of cement. Although the power consumption is much better than other plants, it is still possible to reduce it further upto 110 Kwh/tonne. The following measures may result in substantial savings in power consumption :

a. Use of speed control system for controlling the fans in place of damper control systems.

b. Reducing the frequent switching of equipment/ motors.

c. Reducing the idling of machines.

d. Reducing the downtimes / troubles.

7.0 TRAINING OF OPERATING PERSONNEL

Proper training of the operating personnel is very essential to minimise downtimes, proper maintenance, correct operation of the equipment. It was informed that the plant is taking necessary measures for strengthening their training centre in order to train the staff at operative levels. It is expected that this will go a long way in overcoming many maintenance and operational problems and will help increase productivity of the plant.

REPORT ON VISIT TO
MANGALAM CEMENT LIMITED - MORAK (RAJASTHAN)
(9 - 10 DEC 1986)

TEAM MEMBERS

Mr Arihiro Takeda - UNDP Expert
Mr H C Hans - NCB Expert

1.0 INTRODUCTION

This report is based on studies of Mangalam Cement Limited for two days. The data presented in this report was collected by making inquiring from the plant staff. Identification of technical problems is based on discussion with the plant officials. The major problems being faced by the plant in the electrical field are power scarcity, frequent interruptions and higher power consumption.

2.0 LOCATION

The plant is located at Morak about 70 Km from Kota, a district headquarter in the State of Rajasthan. It is about 470 Kms from Delhi.

3.0 PLANT

The Mangalam Cement Plant has only one SP Kiln of 1200 tonnes per day. It was commissioned in 1980. The plant is planning to incorporate a pre-calciner in the near future which is expected to enhance its capacity to 2000 tonnes per day. The plant is also studying the possibility of adding roll presses before the raw mill and cement mill grinding

to enhance the grinding capacity. It is also likely to affect substantial saving in power consumption.

Specification of Major Equipment

Name	Capacity	Motor Capacity
Raw Mill	115 TPH	2 x 1650 H.P.
Kiln	1200 TPD	225 KW
Cement Mill	70 TPH	2 x 1000 H.P.

The maximum power demand of the plant is 10.6 MVA. It has two main transformers of 7.5 / 10 MVA capacity each at 132 KV / 6.6 KV voltage with on load manually operated tap changers. The plant also has two D.G. Sets of 3.15 MW capacity each.

4.0 PROBLEMS BEING FACED BY THE PLANT

The plant is facing the following major problems :

4.1 Power Scarcity :

The plant is being subjected to power cuts ranging upto about 80%. For the last three years the extent of power cuts is given below :

Year	Power Cut		
	Min.	Max.	Avr.
1984	4.0%	76.5%	35.7%
1985	3.7%	77.5%	40.4%
1986(Jan to Nov)	9.2%	79.2%	35.8%

The power is being supplemented by operation of D.G. Sets.

4.2 Power Interruptions :

The plant has been facing the problem of sudden power interruptions. In 1984 the total interruptions caused were 933 whereas the number for 1985 and 1986 has been 615 and 338 respectively.

4.3 Power Consumption :

Power consumption per tonne of cement is about 150 kwh/tonne of cement. It was intimated by the plant officials that as per the plant designer/ supplier the power consumption per tonne of cement is 135 kwh/tonne of cement.

5.0 ANALYSIS AND SOLUTION

At the time of the visit, one of the two D.G. Sets was under major breakdown. With no power from the grid and only one D.G. Set working, it was not possible to run either the raw mill section on the cement mill section, kiln section was also stopped for want of raw meal. Working of raw mill section or the cement mill section was possible only when grid power was available. With the level of power cuts going as high as 80% plant operations were suffering badly. In such a condition the plant has no option but to go for immediate repair of the second D.G. Set to keep the plant running at a reasonable level of production.

The plant is presently experiencing on an average one interruption per day. The average was earlier two interruption per day in 1985 and three interruptions per day in 1984. The interruptions lead to higher power consumption and lower life of equipment

due to the mechanical, electrical and thermal shocks experienced by it as a result of frequent starts/stops.

The power consumption of the plant is on the higher side. The raw mill production has been 95 tonnes per hour against its rated capacity of 115 tonnes per hour. Similarly cement mill production is about 65 tonnes against its rated capacity of 70 tonnes per hour. The lower rates of production are one of the reasons of higher consumption. Due to frequent interruptions and changeovers electrical equipment take higher current during starting which add to the power consumption. After every interruption, the equipment takes some time before its operation is stabilized again. It is necessary to investigate the reasons of lower production rate of raw mill. The plant should also try to get permission for synchronisation of the D.G. power and grid power. It will give flexibility for managing the available power and also reduce interruptions every time the grid power supplies are affected.

6.0 MAINTENANCE ASPECTS

Dusty conditions in the plant affect proper maintenance of electrical equipment. The plant is converting its main substation into a closed pressurised chamber to avoid ingress of dust. The low tension motors are generally closed type and therefore the environmental effect is lesser.

Maintenance planning for various equipment is generally good. The plant may try to reduce generation of dust by dust sealing wherever possible, water sprays and having more dust collection points.

SUGGESTIONS FOR REDUCING POWER CONSUMPTION

1. Fan drives in the kiln section consume much power. Fans damper position may be checked and if these are more closed, the plant may consider reducing the fan capacity by cutting the fan blades. This method of power reduction is generally applied for cooling fans in Japan.

2. Bigger fans like I D Fan and cooler exhaust fan may have speed control drives e.g. slip recovery system to reduce power losses.

3. Generally in the kiln section there are many air leakages. Due to this, there is additional power consumption in I D Fan. Air leakages should be checked and proper sealing may be provided.

REPORT ON VISIT TO
J & K CEMENT LIMITED - KHREW (J&K)
(22 - 23 DEC 1986)

TEAM MEMBERS

Mr Arihiro Takeda - UNDP Expert

Mr H C Hans) - NCB Experts
Mr A Ghosh)

1.0 INTRODUCTION

This report is based on studies carried out at J&K Cements Limited, Khrew for two days. The data presented in this report was collected by making enquiries from the plant staff. Identification of technical problems is based on discussion with the plant officials. The major problems being faced by the plant in the electrical field are very poor quality of power with frequent power shut downs, low voltage and frequency and maintenance of equipment as a result of high emission of dust.

2.0 LOCATION

This plant is located at Khrew, about 22 Kms from Srinagar in the State of Jammu & Kashmir.

3.0 PRODUCTION CAPACITY OF THE PLANT

The J & K Cement Plant was commissioned in 1982. It has two small SP Kilns, each of 300 tonnes per day capacity. The capacities of raw mill and cement mill are 55 TPH and 35 TPH respectively.

The maximum power demand of the plant is 5.5 MVA. There are two transformers of 5 MVA each at 33/6.6 KV with on load manually operated tap changers. Operations of these transformers are controlled by state electricity board. The plant has installed an automatic voltage regular which has an operating range of 5.4 KV to 7.0 KV. The plant intends to install one more automatic voltage regulator after the second transformer in early 1987.

4.0 NATURE OF ELECTRICAL PROBLEMS

The plant is facing the following major problems.

4.1 Power supply :

The plant is facing very poor power position with frequent shutdowns., very low voltage and frequent voltage and frequency fluctuations. The voltage level goes down to as low as 5 KV at the maximum tap position of transformers which is even beyond the operating range of the automatic voltage regulator which has been installed after one of the two transformers to boost up the voltage level. Alongwith the voltage, frequency also goes down to as low as 45 - 46 HZ.

At the time of the visit, the AVR was also not working. It was informed by the plant officials that it got damaged in November 1986, probabely as a result of a high voltage surge at the time of restoration of supply when the load on the system was negligible. The system did not have high voltage protection. The supplier's circuit breaker at the plant site did not trip at the time of damage.

4.2 Maintenance Problem :

Due to very dusty conditions in the plant, frequency of maintenance is high. It was informed that maintenance schedules for various equipment have been prepared but due to very irratic power conditions, it is generally not possible to do the maintenance as per schedule. It was also informed that burning rate of motors below 10 H.P. is high. These are generally air slide motors which take high starting current for a longer duration.

The plant has four bulk oil H.T. breakers which are giving a lot of maintenance problems.

4.3 Power consumption :

The power consumption is about 150 kwh per tonne of cement which is on the higher side.

5.0 ANALYSIS AND SOLUTION

5.1 Power supply problem :

The plant is getting repaired the damaged AVR. To provide adequate protection to it, a new circuit breaker is being installed before the AVR and high voltage protection is also being incorporated. The plant is also planning to install another AVR on the second transformer. With these new installations, the problem is expected to be partially solved. With the existing power system, it is difficult to solve the problem fully, it is suggested that the plant should install D.G. Sets to tide over the problem of power scarcity.

Maintenance of Equipment :

i/ With the installation of a new AVR and repair of the existing one, power supply position is expected to improve. It is suggested that equipment maintenance schedules be adhered to as far as possible.

ii/ Burning rate of air slide motors which take high starting current for a longer duration is likely to come down with lesser starting operations when the supply becomes comparatively stable.

iii/ The bulk oil circuit breakers have become almost obsolete. The plant may plan their replacement with other modern types of circuit breakers.

iv/ Vacuum cleaners may be used in place of blowers for cleaning motors etc to affect better cleaning.

Power Consumption :

I/ One of the main reasons of higher power consumption is frequent trippings of plant equipment. A lot of power is lost during starting/normalisation of equipment.

ii/ Motor sizes of raw mill/cement mill appear to be higher. Actual load conditions may be checked.

iii/ Production rates of raw mill and cement mill are low. The reasons of lesser TPH require to be investigated.

iv/ Idle running of equipment mainly during normalisation of kiln section after stoppages contributes to higher power consumption.