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SECOND EXPERT GROUP MEETING ON COMPUTERISED

MAINTENANCE SYSTEM IN METALLURGY

Organised by

The United Nations Industrial Development Organization (UNIDO) in co-operation with the Egyptian Iron and Steel Corporation (EISCO), Cairo/Helwan (under the auspices of the Ministry of Industry) and to be held in Cairo, Egypt from 6 - 12 March, 1988

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INTRODUCTION :

Few decades ago industrial machinery were simple in design, manually operated or not the most semi-automatic. They were also cheap to buy and comparatively easy to maintain. But modern machinery are partially or fully automated, and they are very expensive. So, maintenance is becoming one of the most important industrial activities, both in developing countries as well as in developed countries.

In developing countries, economic development has started the industrialization programs associated with the necessary transfer of advanced technology developed in industrial countries, while the developed countries have to cope with the continuous progress in the technology and advance sciences.

In both cases, more machines with complicated designs and electronic control systems are added each year to the equipment stock. As a natural result, the ratio of maintenance costs to production cost is continuously increasing. Also the ratio of maintenance personnel to production personnel is increasing. However, if the machines are not kept properly and handled in a good way to give designed capacities, the final result can be a catastrophe.

It is much more important for a developing country than for a developed one to look after capital equipment and to get the maximum output of any investment.

Capital is one of the most important and decisive resources in developing countries, since most of them are already in debt as a result of heavy procurement of capital equipment.

They can hardly renew or replace worn equipment to cope with technological changes. It is noted that in many developing countries, maintenance is a neglected subject. This shows that the invested capital will be wasted in poor countries, while it is much cared for in rich countries.

MAINTENANCE PROBLEMS IN DEVELOPING COUNTRIES

Main items are :

- lack of maintenance organisations.
- lack of spare parts
- Insufficient workshops for spares manufacturing & reconditioning.
- Lack of hard currencies
- Lack of informations about equipment
- Lack of skilled labours
- Lack of maintenance material
- High power of production staff
- Maintenance plans are not respected
- Lack of training capabilities for production & maintenance powers.

According to the above problems naturally it was expected that suppliers of equipment always try their best to improve maintenance situation to their customers through technical assistance and bilateral cooperation, this of course in addition to continuous flow help from UNDP/UNIDO projects which is usually implemented in developing countries to solve such problems. One of these projects which was implemented in some countries in the last few years

by technical assistance from UNIDO is managed maintenance system. Mainly this system includes different activities such as preventive maintenance system, spare planning and control, planned and information system.

POLICY OF COMPUTERISED MANAGED MAINTENANCE SYSTEM

(CMMS) IN EGYPT.

Egypt also received such assistance in early 1975 & introduce preventive maintenance (P.M.) programmes in ELSCO which recently developed to CMMS covering the the whole area of the plant. The successful implementation results is considerable reserve for increasing the efficiency of production in ELSCO & also, the success of project has lead to an increase of production of about 12% with substantial saving occuring from improved stock control and organization of spare parts & machine utilisation . Such positive results of implementation of CMMS in ELSCO encourage us to continue these efforts in the different industrial sectors by transferring our experience to some selected areas in each sectors so as to be a nucleus in such sectors for spreading the same activity.

STEPS TAKEN

Ministry of Industry is divided to six activities:

- Mining and refractories
- Metallurgical
- Engineering

- Chemical
- Textile
- Food industries

The early plan was built on selecting one company from each sector and have the following:

- Good management
- Back experience in maintenance
- High capability of system production
- High technical staff

El SCO team spread the system in these companies and assist to initiate a pilot center & offered consultancy services in order to be able to transfer the same to other companies within the same activity.

Beside this our team cooperate with UNIDO in some projects in African region. Our previous diagnostic studies showed that plants which have not managed maintenance system suffer from the following:

- 1- Many of these companies applied maintenance systems many years ago and has been going on now. The efficiency of start without any progress through the last years.

- 2- In fact there is no great difference between the present applied system and the break down maintenance.
- 3- The performance of equipment maintenance is inefficient due to bad quality of the used spare parts.
- 4- Big and complicated organization system of maintenance but having no qualified personnel.
- 5- Lack of management

THE NATURAL RESULTS ARE :

- 1- Too much stoppage of production caused by failure of equipment, thus the operation available time is limited due to lack of technical control of operation.
- 2- Production level may not only decrease with high percentage of the rated capacity but also the equipment functions are straightly deteriorated down due to incomplete maintenance planning.
- 3- High investment will be required to restore equipment to its original condition.

DIFFICULTIES DURING APPLICATION OF MAINTENANCE POLICY

When we started maintenance systems in the different companies we were faced by some problems in some areas as follows :

1- MAINTENANCE ORGANIZATION :

- a) All maintenance items are not executed according to the plan due to inaccurate planning, bad control of inspection for repair and spare parts, lack of spare parts required for planned maintenance and capital repair and lack of qualified number of maintenance workers.
- b) Organization of maintenance technology (i.e. Maintenance standards, equipment improvements, correction of maintenance works, education and training are hardly practised) are weak. For this reason no technical level growth and no accumulated technical know-how.
- c) Local maintenance shops are under the control of superintendants of production shops. Their main target is to increase the production regardless the equipment condition. Maintenance plan are not respected.

In addition, there are no sufficient maintenance staff and most of them are not capable to judge the mechanical of electrical maintenance problems.

The first step of maintenance activity is to begin with efforts that lead to minimize production down time. In order to define the responsibilities, it is necessary to improve the organization of maintenance to an effective and systematic one which has the functions of equipment control and maintenance technology. Also we have to separate between production department and maintenance department so that technical speciality can be fully utilized.

2- REPAIR

QUALITY OF REPAIR

- a) With the poor level of repair skill we can not say that maintenance works are executed to restore worn equipment to original functions, as the basic maintenance works are incomplete, the problem will continue regardless its start up.
- b) Moreover the required tools available with the repair crews are not enough, measuring devices used for machinery assembly jobs are not periodically controlled.
- c) Intensive labour forces working in repair increase the cost.

PLANNING OF REPAIR

Concerning the planning of repair the following facts has to be considered:

- a) No clear maintenance policy
- b) Details of repair plan made by local maintenance shops are not clear.
- c) Insufficient central functions to adjust repair works

In order to level up the planning and implementation job it is essential to improve the maintenance organization planning and control system.

MAINTENANCE MATERIAL :

a) QUALITY OF MECHINICAL PARTS

Some spare parts are manufactured locally. Some of these spare parts are quite out of specification due to improper manufacturing material quality and manufacturing defects.

b) MAINTENANCE MATERIAL

there is a big lack in maintenance material like sealing, packing, bolts ..etc.. The short life of many parts to improper storage represents money losses.

c) STOCKING OF SPARE PARTS

The stocked spare parts are not quite enough due to incomplete planning and also the order and policy system, accordingly there is time delay due to that.

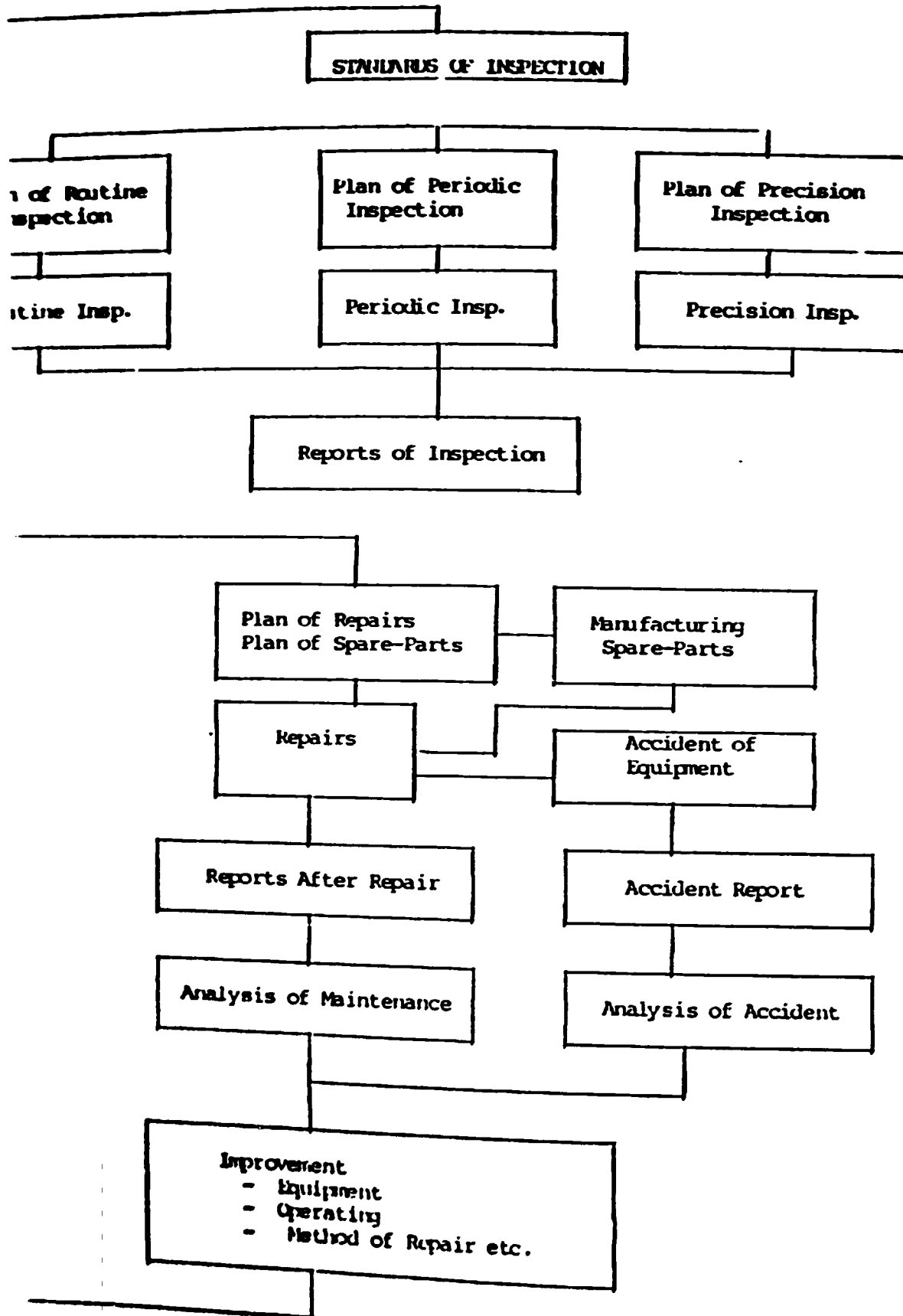
4- HIGH WEARING RATE OF EQUIPMENT

The main reason for the high wearing rates are summarized as follows:-

- a) Daily maintenance is bad and ineffective, in addition to bad operation.
- b) Repairs are not accomplished at the due time because of bad maintenance system.

c) Low level of skill for the repair works and the use of improper spare parts. In all cases it is very difficult to get the good results of preventive maintenance at the existing conditions of hard wearings. It is necessary to restore equipment to their original functions before the application of the preventive maintenance system. The daily control should be definitely done and the operation procedures must be corrected taking into consideration that the degree of equipment wearing is depending on the level of the daily control of maintenance lubrication, cleaning, unit adjustment and operating procedure..etc.. One of the main preventive maintenance principles is that the daily maintenance is a first degree item, it is impossible to neglect such fact. You can extend the equipment life against wearing with the right performance of daily maintenance.

FIG. 1 GENERAL FLOW OF C M M S



COMPUTERIZED MANAGED MAINTENANCE SYSTEM (CMMS)
DEVELOPEMENT AND IMPLEMENTATION
EXPERIENCE IN EGYPT

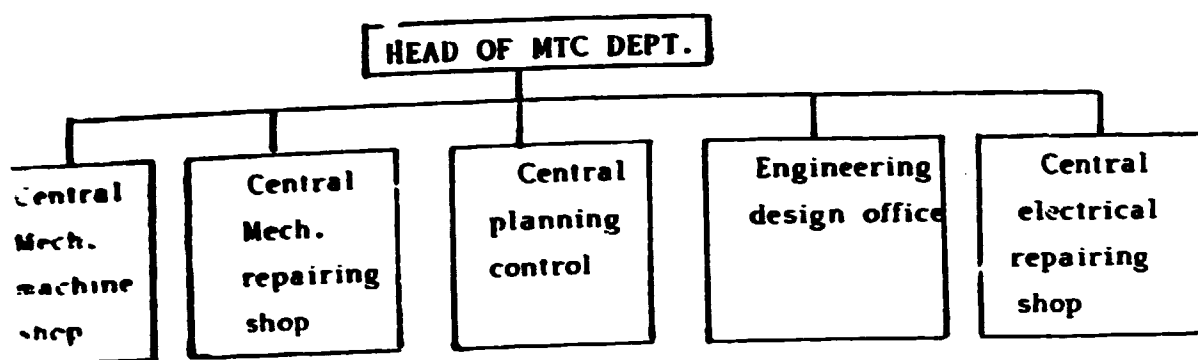
1- Production activities must be separated from maintenance activities because in many companies production dept. is in charge of both maintenance and production.

2- CMMS

From the experience of IRON & STEEL CO. in the implementation of CMMS in the last few years it was clear that the important thing to promote CMMS is to execute exactly the following by inspection of equipment.

- a) To grasp condition of equipment
- b) To plan minute maintenance schedule
- c) To record result of maintenance
- d) To modify positively the equipment with many troubles (accident repeating repair) and to improve maintenance and operating way. This linked general view of CMMS is shown in Fig (1).

3- CURRENT MAINTENANCE ORGANIZATION IN EISCO



In the trend of recent industry, maintenance activities become more important. Specialization of maintenance technique and control. Example Typical Organization for maintenance is shown above in addition to that local small maintenance shops belong to Production Dept.

4- PLAN OF IMPROVEMENT

We recommended the following improvement in future to solve existing problems of maintenance organization and establish CMMS in industry.

a) INDEPENDENCE OF MAINTENANCE DEPARTMENT

Keep maintenance department independent and not belonging to production department because it will be the promoter of CMMS. keep local maintenance group as assigned maintenance, belongs to production preventive maintenance system.

b) TOTAL CONTROL OF MAINTENANCE SCHEDULE ADJUSTMENT AND EXECUTION

To improve effectiveness of CMMS, running P.M. and annual repairing schedules of capital repair, the plans be done and to be respected for better implementation.

c) SPECIALIZATION OF MAINTENANCE TECHNIQUE

Engineering control to check result of maintenance, to analyse reason of failure, to improve and level up maintenance effect is necessary to promote CMMS for this engineering control, special engineering staff group should be established.

RESPONSIBILITIES OF THE GROUP

Establishment, correction of each kind of standards, measures of maintenance effect, technical study of modification of equipment introducing of new technique and in addition precision inspection which is not done in local maintenance shops.

d) DEVELOPMENT AND IMPLEMENTATION EXPERIENCE

In the first stage of implementation of UNDP/UNIDO project EGY/75/025, EGY/78/006 for managed maintenance, we consider the plan of improvement of maintenance management according to the direction of improvement mentioned before, was progressed into 3 steps.

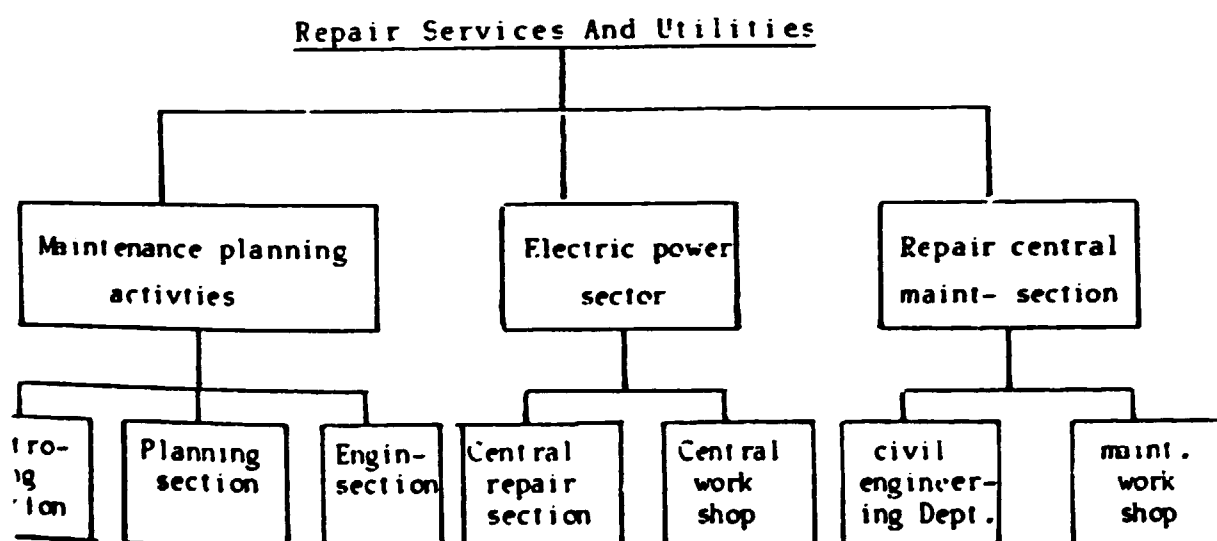
Step 1 : Establishing the committee for improvement of maintenance organization, study the quality of this recommendation, decide the measures and prepare for improvement.

The members of the committee were UNIDO/EISCO experts prepare and improve some details of the current system.

Step II : Preparing training program for crew of local maintenance shop to implement the program.

Step III: Evaluation and measurements of results, implementation and introduction of the necessary improvements according to local conditions and then prepare the final package which can be implemented by local experts of the engineers of central maintenance.

This was accompanied by establishment of control maintenance planning activities, the groups of this department are responsible to extend M.M.S. to cover the whole production areas of Egyptian Iron & Steel Co. also beside this some minor change in the organization of the maintenance sectors were approved as shown in the following fig:



MAIN RESPONSIBILITIES OF MAINTENANCE PLANNING

1- CONTROL SECTION FOR MAINTENANCE

- a) maintenance plan and adjustment
- b) Plan, control of supply and demand of maintenance spare parts.
- c) Plan, control of supply and demand of maintenance materials.
- d) Control of maintenance estimation.

2- MECHANICAL MAINTENANCE ENGINEERING SECTION

- a) Engineering control of mechanical maintenance.
- b) Improvement of mechanical maintenance efficiency.
- c) Mechanical precision inspection
- d) Maintenance training
- e) Research and study of mechanical maintenance system.

3- ELECTRICAL MAINTENANCE ENGINEERING SECTION

- a) Engineering control of electrical maintenance
- b) Improvement, electrical maintenance efficiency.
- c) Electrical precision inspection
- d) Control of spare motors.
- e) Maintenance training
- f) Research and study of electrical maintenance system.

BESIDE THIS AND ACCORDING TO OUR EXPERIENCE OF
IMPLEMENTATION OF CMMS.

We can decide that total responsibilities of local maintenance section as follows ;

- a- Preventive maintenance of mechanical and electrical equipment.
- a- Completion of maintenance schedule of mechanical and electrical equipment.
- c- Daily maintenance.
- d- Planning of maintenance parts and material.
- e Advice on maintenance for operation section and repairing section.

E- BENEFITS OF CMMS

Preventive maintenance is executed to grasp the condition of the equipment , and then plan for maintenance is to be prepared and maintenance works is practised by the result of inspection will be wrong. This is the case of all plants which have not introduced P.M.

Therefore P.M. is one of the most important activity for MMS and inspection is one of activity of preventive maintenance which is done by sensitive method through eyes, ears, nose and hands, and measuring tools and vibration analysis equipment in order to define the condition of wearing and find out the abnormal condition of equipment. It is the activity of preventive maintenance to find out the abnormal condition and repair wear to achieve minimum production loss.

EVALUATION & BENEFITS OF CMMS

From our experience since 1975 our company has received UNDP/UNIDO assistance through the project entitled "Managed Maintenance in Metallurgical Industries". Since 1981 the project was developed to CMMS, the success of transfer of experience to the steel Co. has led to an increase in production of 12% with substantial saving occurring from improved stock control and organization of spare parts and machine utilization.

STEPS OF TRANSFERRING THE KNOW-HOW OF THE CMMS

A team of 45 engineers and programmers are well trained and working now in this CMMS, they can cover the following fields.

- 1- Preventive maintenance system
- 2- Spare parts planning & control.
- 3- Man power planning & control.
- 4- Inventory control.
- 5- Industrial engineering.
- 6- System analysis.
- 7- Industrial engineering
- 8- Computer application in industry
- 9- CAD/CAM
- 10- Computer consultancy service.
- 11- Organization Management.

THE FIRST STAGE OF IMPLEMENTATION OF CMMS

- 1- Formulation of steering committee from some selected members of the UNIDO technical assistance group in addition to Egyptian experts. They were responsible for planning the different activities,

for the sub-committee and organizing the relation between them.

- 2- Formulating sub- committee from Egyptian experts in the different activities of CMMS.

OUR PLANNING WAS TO CONCENTRATE ON THE FOLLOWING :

- 1- Introduce the new technique of CMMS.
- 2- Design a suitable organization to carry CMMS.
- 3- Training the staff to be aware of the management activities.

FROM OUR PRACTICAL RECOMMENDATION AND PROPOSAL FOR IMPLEMENTATION OF CMMS IN OTHER AREAS

- 1- To be sure that all what we believe good for the system must be applied or we shall lose time.
- 2- Some of the basis was to train and guide management in the whole maintenance area.

IN ORDER TO TRAIN THE MAINTENANCE MANAGEMENT TO
ACCOMPLISH THIS, THERE ARE FOUR STEPS.

- 1- Be alert to problems.
- 2- Decide what is needed to eliminate or alleviate the problem.
- 3- Determine all the ways to solve the problem (there may be 3 or 4 ways).
- 4- Decide from all these alternatives the most suitable one for the problem, that means the best alternative to solve it and reach a sound resolution :

" The concept of management is that everything that happens in the plant is the result of management action. Whatever the workers do or do not, is the result of what management did or did not do"

" A total management maintenance system is an attitude of all operating management. This concept must be in the mind of all management people. Maintenance management is a part of operating management".

NOTES ABOUT CHMS

- CHMS is to prevent unnecessary wear and damage to equipment by proper operation.
- Make necessary inspection, adjustments, lubrication ...etc. as scheduled.
- When repairs are needed a plan for execution should be scheduled, this will minimize down time.

DON'T FORGET THAT ULTIMATE GOAL :

High level of production and a minimum down time.

THIS MEANS THAT :

- 1- The organizing of every detail of lubrication, adjustment and inspection is according to a fixed schedule and time cycle.
- 2- Technical assistance, the utilities, the instrument repair, the electric, the field maintenance dept. must go on a fixed time cycle and inspect the department to determine the overhaul conditions of how it is being operated ; and how it is being maintained.

the technical assistance departments can also then recommend change and improvements to the operating manager.

7. Planning maintenance programmes and planned overhauls are basic for planned preventive maintenance, of course the computer programs, the microfilm programs are only tools and the tool will do nothing by itself.

The spares control program is also a computer program help, it helps the central planning to know which spare parts exists and which do not and help the shop planners to know what is needed to be done next.

OUR EXPERIENCE THROUGH TRANSFERRING OF KNOW- HOW
OF THE PROJECT TO OTHER PLANTS

The transfer of experience is the biggest problem because what is communicated is what to be understood.

People are not communicating usually due to difference of back ground, experience, education and the willingness to understand. In addition we try to spend a part of our time to determine how can change of our plans and our system to be more suitable to the running condition and to be more effective during period of implementation ; so one of our extremely important point of our philosophy that we guide and try to train our clients to do the job by themselves.

KEEP YOUR MIND OPEN TO SEE THE PROBLEM IN ORDER TO
TO SOLVE IT :

- 1- for example the spares control committee, when they started to fill the data sheets, immediately it was recognized the need for having an equipment code, they came up with suggestion and we gave them just a little guidance and then they

come up with suggestion and we gave them just a little guidance and then they start to apply the equipment codes and build their experience in this field.

2- In addition to above , I would like to say that no CMS in Egypt is static, it is dynamic process. It can be changed from plant to another. For example system implemented in Mehalla Textile is different from that implemented in Alexandria Shipyard five years ago.

3- Also another problem from our experience is lack of data and information. Most organization in developing countries suffer from the unavailability of proper information needed for a decision maker .

Usually all levels of management are severely handicapped in managing their plants because information is inaccurate, incomplete and late. Plants have pursued technological methods to alleviate this situation by such things as the installation of computer, the use of microfilm, and a system

for keeping engineering drawings in technical archives. These efforts are merely steps taken in proper direction but they are not by themselves the full solution.

Expected results of the adaption of these technological methods have been hampered because of the following:

- 1- Uncertainty as to the proper system needed for this specific company.
- 2- Lack of integration and co-operation between components of the organization.
- 3- Confusion between the services provided compared to the function required.
- 4- Inexperience of involved personnel.

Any given organization should seek the most suitable type of information for its own need listed below the main functions that should be included in the activities of an information center if

these functions are carried out properly and correctly in timely manner, then management of the organization will have a great increased ability to make proper decisions.

THE FUNCTION OF THE INFORMATION CENTER

- a) Documentation
- b) Data collection
- c) Data storage
- d) Feed back
- e) Data processing and analysis
- f) Providing information to management
- g) Reports and publication
- h) Selective dissemination of information
- i) The management should assign the highest priority to the selection of the most suitable information service for its needs.
- j) We pay attention to introduce CMMS to achieve high production level from the mill to improve situation of transfer of experience and information system but this cannot be realised unless we have saved working conditions for the

worker so he feels secure or safe. So he can concentrate on the work he is doing. "Safety is an essential factor to high production."