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

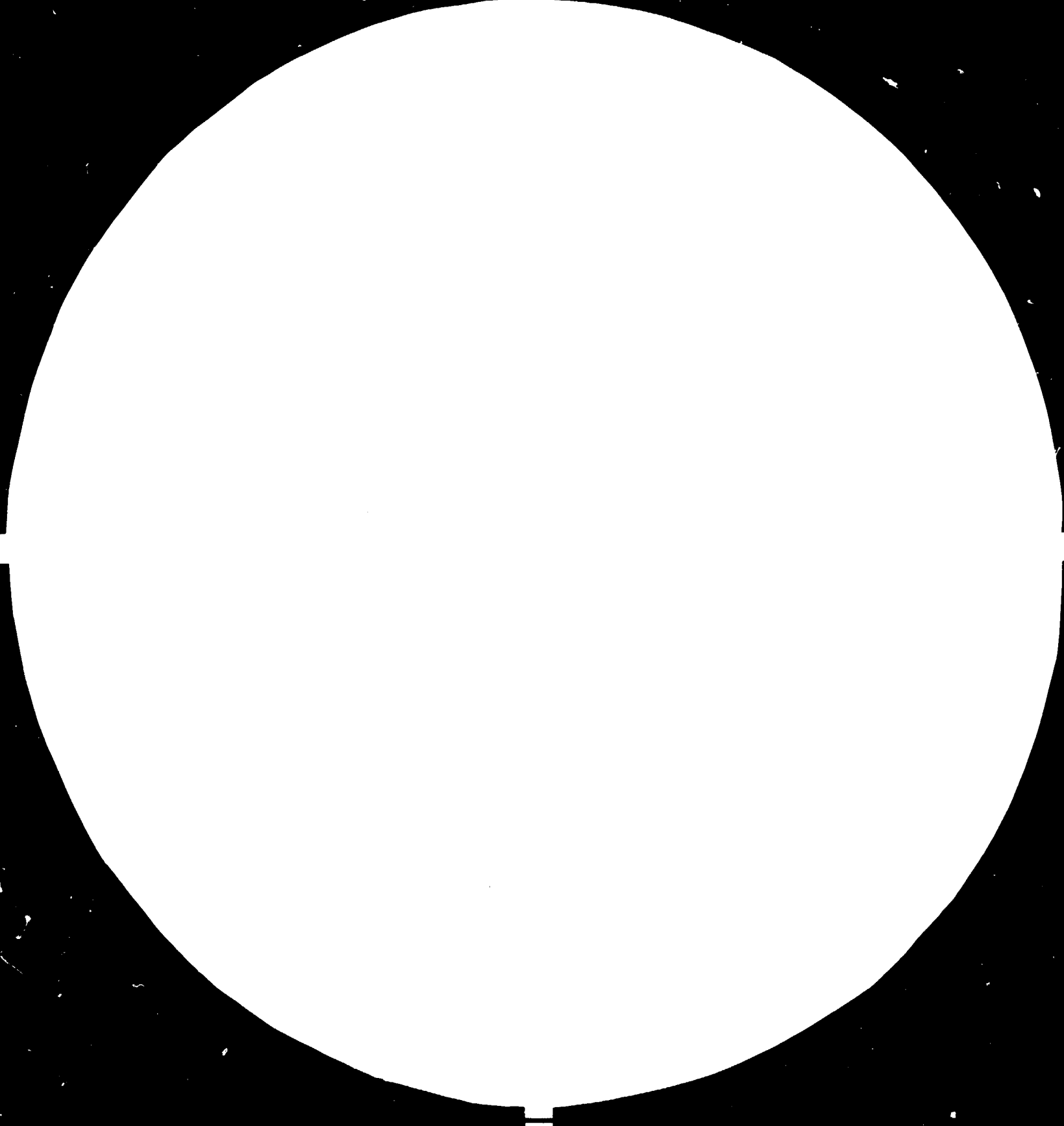
FAIR USE POLICY

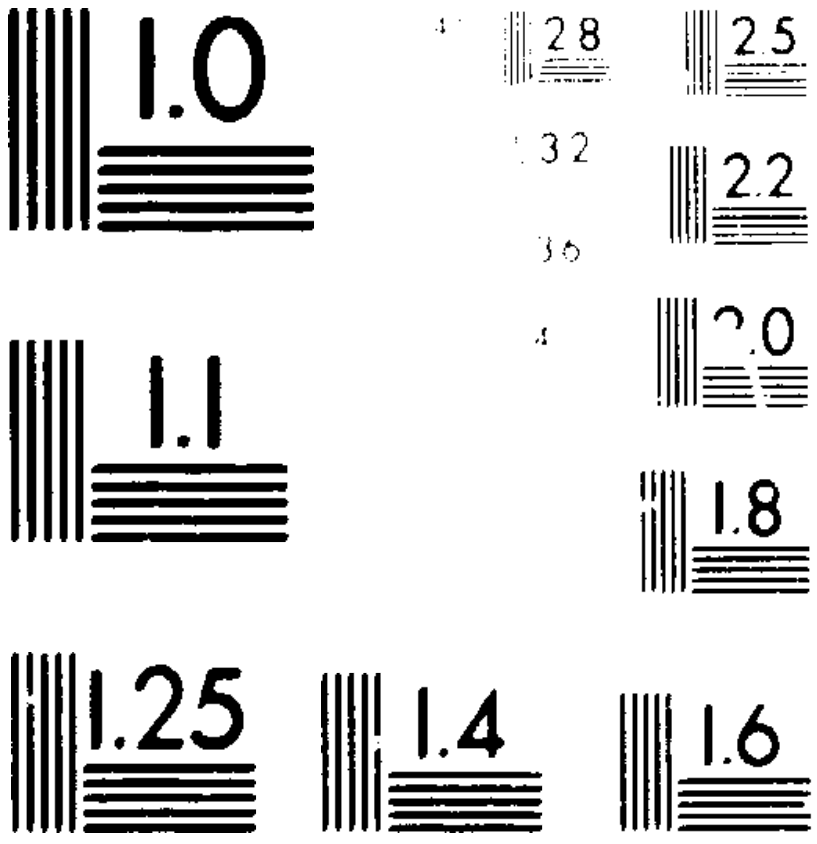
CONTACT

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





13845

INDUSTRIAL TRAINING AND DEVELOPMENT CENTRE

(ITDC)

ANKARA, TURKEY

Turkey,

MAINTENANCE PLANNING

DP/TUR/77/024/11-03/D3

FINAL REPORT

PREPARED BY:

JÜRGEN STEFFENS

MAINTENANCE CONSULTANT

JUNE 1984

Expert of ITDC in collaboration with the United Nations Industrial Development Organization acting as Excecuting Agency for the United Nations Development Programme.

---

cf. {13204 12684

CONTENT PAGE

1. INTRODUCTION 1

2. ACTIVITY REPORT 3

3. RECOMMENDATIONS 7

4. JOB DESCRIPTION 10

5. CONFERENCE PROGRAMME ANKARA (TURKISH) 15

6. STUDY REPORT I 17

7. STUDY REPORT II 29

8. STUDY REPORT III 39

9. CONFERENCE PROGRAMME ISTANBUL (TURKISH) 46

1. INTRODUCTION

The mission on maintenance planning was divided into two main subjects:

- to arrange and conduct a conference on maintenance planning.
- to prepare and conduct a problem oriented training programme in three selected companies.

Each of the main subjects was performed in two phases which are briefly described below.

The first and second phase of the mission was aiming at to motivate and promote the idea of industrial maintenance planning at the top management level by emphasizing the following topics:

- the importance of maintenance subject in relation to its influence on national and industrial economy.
- the concept of maintenance
- the idea of maintenance centers
- modern maintenance management
- computerized maintenance systems
- maintenance and its various activities
- presentation of special techniques for maintenance

The above was done during a two-day conference to which personnel from the Ministry of Industry and Commerce, Ministry of Finance, General Managers from Public and Private Enterprises and Maintenance Managers from various Industrial Companies were invited.

Lecture notes and practical arrangements for the above were done during phase one at home base of the expert.
The conference was aiming at to enlighten the participants to put the necessary emphasis on what can be done about maintenance and what can be gained with respect to national and industrial economy by doing proper maintenance.

The third and fourth phase of the mission was aiming at to upgrade the knowledge and skills of maintenance engineers, technicians, foremen and supervisors from three selected companies.
Phase three was used to identify maintenance problems in the selected companies and to establish a training programme.
This was done in co-operation with the company maintenance personnel. Also the above was presented to the management in order to get support for the training programme and for implementation of new systems, routines etc. to be presented during the training programme.
As a summery of the findings, a report was prepared for each company.
Finally, during phase four, the training programme in all three companies was conducted.

A complete job description is enclosed as appendix 1.

2. ACTIVITY REPORT

As can be seen in the job description the entire mission consisted of four phases.
Work done and observations made during these periods are given below.

PHASE 1

During this phase the conference was prepared. The work was done at home base and consisted of:

- preparation of lecture notes to be presented during the conference.
- contact with external experts for their participation in the conference.
- gather instruments and aids to be demonstrated.
- detailed planning of the conference in co-operation with ITDC.

As a result of the above work the following programme was established:

- Opening ceremony	DIRECTOR GENERAL ITDC
- Modern maintenance methods and their influence on economy.	B. KOCAALAN-BAKO
- Maintenance overview	J. STEFFENS UNIDO
- The idea of maintenance centers	C. IDHAMMAR IMC
- Maintenance in Turkish industry	S. AKBIYIKOGLU PETKIM
- Computerized maintenance	C. IDHAMMAR IMC
- Maintenance welding methods	K. ADSAN ESAB-KAYNAK AS
- Metal spraying methods	J.L. DESIRE CASTOLIN-EUTECTIC
- Brush plating	I. LUNDEVALL SELECTRON
- Ball and roller bearing handling	A. TEZER SKF
- Condition monitoring of ball and roller bearings	J. STEFFENS UNIDO
- Panel discussion	

A complete programme in turkish is enclosed in appendix 2

PHASE 2

During this phase the conference was conducted in conference rooms provided by the Ministry of Industry and Commerce in Ankara.
About 150 persons attended and showed great interest in the topics presented. Especially the panel discussion following the various presentations showed that maintenance is a topic of very graet interest in Turkey. This is especially valid for modern maintenance methods and equipment to be used in maintenance.

PHASE 3

During this phase the three selected companies were visited for a short study of the maintenance situation. The aim with the study was to identify existing maintenance problems and, based on that, establish a problem oriented training programme. This work was done together with counterparts from ITDC and in close co-operation with maintenance personnel in the companies. As a result suggestions on how to solve existing problems were established and required training was agreed upon. This was also presented to top management personnel for approval.

A summery of the above is described in a report for each company which are enclosed as appendix 3,4,5.

PHASE 4

During this phase the actual training was conducted in accordance with the seminar outline given in the reports. In general, the training consisted of three parts:

- theoretical lectures
- group work for practical application including discussions
- description of own routines, systems etc. to eliminate existing problems including time schedules for implementation

The description was presented to the top management personnel for discussion and approval.

Remark.
In general the participation in the seminars was good and so was the willingness to implement the described routines, systems etc. Also top management personnel agreed to the suggestions. Only in one company (OTOSAN AS) the training was not conducted as planned. Due to a large workshop-extension-programme only the maintenance engineers (7) were able to attend the programme. However, the result was satisfying since a time schedule for both training of technicians, foremen and supervisors and a plan for implementation was agreed upon.

In addition to the above training programmes, a one-day conference on maintenance planning was conducted at Bosporus University.The conference programme was conducted by J. Steffens (UNIDO). A summery of the programme is shown below.
- production and maintenance
- influence of maintenance on economy including results achieved.
- various maintenance procedures
- maintenance systems
- future aspects of maintenance
- training in maintenance
- modern techniques for repairs and condition monitoring

An original programme in turkish is enclosed as appendix 6

About 50 participants, mostly from industry around Istanbul attended. Again, the interest in the topic of maintenance was

great which shows in the number of participants and the large extend of questions and dicussions. Also several requests for training programmes were made to ITDC personnel.

3. RECOMMENDATIONS

The following recommendations are based on experience gained during this and previous missions and can be dividet into two groups:

- General recommendations
- Recommendations for follow-up

GENERAL RECOMMENDATIONS

Conducted conferences and seminars shows that the interest in the topic of maintenance is great in Turkey. Also visits in turkish industry shows that maintenance in many case is very much neglected due lack of training and awareness of what can be gained by implementing proper maintenance. This is also indicated by the numerous requests for maintenance training from ITDC.

In view of the above and due to the fact that there seems to be very few qualified lecturers in the field of maintenance in Turkey it is highly recommendable that more personnel at ITDC is trained and assigned to maintenance.
Following the demands from turkish industry would result in many training programmmes and it can be estimated that 4-6 full time instructors are required.

During previous projects in maintenance planning about 40 lecture notes for maintenance training have been established by the expert and have been translated into turkish by ITDC counterparts. Unfortunately the time to establish a complete set of lectur notes was too short resulting in that most of the lecture notes only are brief descriptions and should only be used together with detailed oral explanations. Also the notes are not suitable for self study.
Therefore it is highly recommendable that existing lecture notes are revised and completed to cover all topics. Preferrably this

work should be done in co-operation with an expert and ITDC personnel.
A further recommendation is that the lecture notes are grouped for the various topics and assembled as compendiums.

Also during discussions it became obvious that personnel in industry is very interested in modern aids for maintenance administration i.e. computerized maintenance systems and in modern equipment for repairs and condition monitoring. Until now, some of these items were provided by the expert which was very much appreciated by the participants but involved high cost for airfreight ect.
In view of the above it can recommended that ITDC acquires such items for future training programmes. Also these items could be used to perform services for the industry.

RECOMMENDATIONS FOR FOLLOW-UP

During the training period of this mission the paricipants in the selected companies were trained in solving their own problems as well as to establish their own routines and systems which later on were approved by the management.
The next step is the actual implementation in accordance with the established time schedule.
Although both participants and top management personnel in all companies were very sincere with respect to the implementation phase it is recommended that ITDC personnel visits each company at regular intervals in order to follow-up the implementation.
The aim with these follow-up visits is to help the companies to solve problems faced during implementation and to give ITDC personnel the opportunity to gain practical experience.
Follow-up visits for 2-3 days/company every second month are recommended during which the following work should be done:
- learn about the progress of the implementation in relation to the established schedule

- learn about problems which have occured and how they were solved
- assist company personnel in solving remaining problems
- take part in the actual implementation work

The ITDC personnel should be prepared to conduct short repeating seminars or information meetings.
Also during the follow-up visits the necessity of further training required shoud be discussed.

A report on findings should be established for each follow-up visit/company.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
(UNIDO)

JOB DESCRIPTION

DP/TUR/77-024/11-03/A

POST TITLE : Expert in Maintenance Planning

DURATION : 9,5 weeks in total, excluding travel,briefing and debriefing periods (4 - phased Split mission)

Phases:

1st phase: February 6th to 12th, 1984
2nd phase: March 19th to 21st, 1984
3rd phase: March 22nd to April 18th, 1984
4th phase: May 14th to June 8th, 1984

DUTY STATION : Ankara, with possible travel in Turkey

PURPOSE : In the first and second phases of the mission, our aim is to motivate and promote the idea of industrial maintenance planning at the top management level by emphasizing the following topics;

- the importance of maintenance subject in relation to its influence on national and industrial economy.
- the concept of maintenance
- the idea of maintenance centers
- modern maintenance management
- computerized maintenance systems
- maintenance and its various activities
- presentation of special techniques on maintenance

Thus, the top management people from Ministry of Industry and Commerce, Ministry of Finance, General Managers from Public and Private Enterprises, and Maintenance Managers from various Industrial Companies will be enlightened to put the necessary emphasis on what can be done about maintenance and what can be gained with respect to national economy by doing proper maintenance.

In the third and fourth phases of the mission, our purpose is to upgrade the knowledge and skills of maintenance engineers from selected manufacturing or process plants and to assist them in establishing their own system of maintenance through a problem oriented training program on maintenance planning.

DUTIES : The expert and his counterparts from Industrial Training and Development Centre (ITDC) will prepare and implement a conference for top management and a problem oriented training programme on maintenance planning. The activities will be carried out in 4 phases as follows:

Phase 1 : During this phase the expert is expected to carry out the following activities:

. preparation of lecture notes, handouts, transperancies and other necessary documents covering the topics of
- What is maintenance
- The concept of maintenance, and
- The idea of maintenance centers

. gathering the instruments and aids to be used in exhibitions during the conference.

This phase of the programme, which is estimated to take one week, can be carried out in home-country of the expert. But, notes, handouts and other necessary documents should be forwarded to ITDC before February 17th, 1984 for translation, printing, etc.

Phase 2 : At this phase, a maintenance conference will be conducted. The expert is expected to be involved in a panel discussion which is going to take place during this phase.

Phase 3 : To conduct an "on-site" survey in previosly selected three companies. These companies will be medium sized and preferably will be located in the same region. During this survey, the following activities will be carried out:

. Study of the existing maintenance organizations, routines, systems, etc. and finding out the problem areas.

. Discussion of the survey findings and preparation of outlines for the activities to be carried out.

. Presentation of the aforementioned outlines to the company managements for commitment.

Phase 4 : To implement the actual training. This phase will include the following activities:

. Training the participants over the general principles of maintenance.

. Detailed training according to the findings obtained from the survey conducted.

. Conducting group works in order to solve the actual problem encountered in each company. These group works will be aimed at establishing the routines systems, forms, etc.

. Presentation of the results obtained from the group works to the company managements and discussions on recommended solutions. (Approved solutions will be implemented by the participants for a certain period which will be determined as of the time of approval)

The expert will also be expected to prepare a final report, setting out the findings of his mission and his recommendations to the Turkish Government on further action.

QUALIFICATIONS : Expert should have extensive experience in maintenance planning systems in either manufacturing or process industries. Training experience is also required.

LANGUAGE : English

BACKGROUND INFORMATION : Industrial Training and Development Centre (ITDC) is a joint project of Turkish Government and United Nations rendering training and Consulting services to the Turkish Industry. The aim of ITDC, at the highest level, is to upgrade the skills and capabilities of professionals in the industry hence to contribute to the national economy. Maintenance planning is of critical importance to the Turkish Industry and a growing number of organizations have requested from ITDC to

conduct training programmes in this field. In 1983, ITDC conducted a series of maintenance planning programmes and the results obtained were quite successful. However, in order to cover the subject completely, various levels of management must also be included in these activities. This point is also clarified by the participants from previous programmes. Therefore, ITDC has decided to conduct a conference on maintenance which will be directed to top management. The potential participants will be from Ministry of Industry and Commerce, Ministry of Finance, General Managers and Maintenance Managers from public and private Companies. This conference will be the starting point for the problem oriented training program which will be carried out in selected (three) companies.

TÜRKİYE CUMHURİYETİ
SANAYİ VE TİCARET BAKANLIĞI

BİRLEŞMİŞ MİLLETLER
SINAİ KALKINMA TEŞKİLATI

SINAİ EĞİTİM VE GELİŞTİRME MERKEZİ GENEL MÜDÜRLÜĞÜ (SEGEM)

ENDÜSTRİDE BAKIM PLANLAMASI
VE
UYGULAMA TEKNİKLERİ
(20-21 MART 1984, ANKARA)

PROGRAM:

20 MART 1984, SALI

09.30-10.00 . Açılış
10.00-11.00 . Modern Bakım Yönetimi ve Uygulama Örnekleri
(Bahattin KOCAALAN-BAKO YÖNETİMDE VERİMLİLİK)
11.00-11.15 . Ara
11.15-12.30 . Bakım Onarım Kavramı
(Mr.J.STEFFENS-UNIDO)
12.30-13.30 . Ara
13.30-14.30 . Bakım Onarım Merkezleri Düşüncesi
(Mr.IDHAMMAR-IMC)
14.30-14.45 . Ara
14.45-15.45 . Planlı Bakım Konusunda, Türk Sanayiinden Bir Örnek
(Süleyman AKBIYIKOĞLU-PETKİM)
15.45-16.00 . Ara
16.00-17.00 . Bakım Onarımda Bilgisayar Uygulamaları
(Mr.IDHAMMAR-IMC)

21 Mart 1984- Çarşamba

09.00-09.30 . Tamir ve Dolgu Kaynağı
(Kasım ADSAN, ESAB-Kaynak Tekniği San.ve Tic.A.Ş.
AS Elektrodları)

09.40-10.30 . Koruyucu Bakımda Kaynak Teknikleri
(Mr.J.L.DESIRE, Erden BİLGİNER, CASTOLIN-EUTECTİC-
Kaynak Tekniği San.ve Tic.A.Ş.

10.30-10.40 . Ara

10.40-11.30 . Koruyucu Bakımda Kaynak Teknikleri-Devam
(Mr.J.L.DESIRE, Erden BİLGİNER, CASTOLIN+EUTECTİC-Kaynak
Tekniği San.ve Tic.A.Ş.)

11.30-11.40 . Ara

11.40-12.30 . Fırça ile Metal Kaplama (Brush Plating)
(Mr.T.LUNDEVALL-SELECTRON)

12.30-13.30 . Ara

13.30-14.20 . Rulman Sökün Takma Aparatları ve Fonksiyonları
(Adil TEZER, SKF Bilezli Rulmanları Ltd.Şti.)

14.30-15.20 . SPM(Shock Pulse Meter)
(Mr.STEFFENS-UNIDO)

15.20-15.30 . Ara

15.30-17.30 . Panel; Planlı Bakım Onarım Konusunun Önemi ve
Uygulamada Karşılaşılan Sorunlar

Panel Başkanı : Teoman TÜMER
(Genel Md.Yrd.-Teknik, SEGEM)

Konuşmacılar : Mak.Y.Müh.Bahattin KOCAALAN(BAKO)
Mr.IDHAMMAR (IMC)
Mr.J.STEFFENS(UNIDO)
Mak.Y.Müh.Süleyman AKBIYIKOĞLU(PETKİM)

17.30 . Kapanış

SEGEM Genel Müdürlüğü Selanik Cad.No.16 Yenişehir/ANKARA
Tel: 31 11 15 (4 hat)

REPUBLIC OF TURKEY
MINISTRY OF INDUSTRY & TRADE

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION (UNIDO)

INDUSTRIAL TRAINING AND DEVELOPMENT CENTRE

THE SURVEY REPORT

FOR

PROBLEM ORIENTED TRAINING PROGRAMME ON MAINTENANCE

(OTOSAN A.Ş.)

Prepared By :

Mr. J. STEFFENS (UNIDO)

Maintenance Consultant

T.Cengizhan PAMİR(ITDC)
Industrial Engineer

İsmail AKPINAR (ITDC)
M.B.A.

9-13 April 1984
İSTANBUL

I. PREFACE

As a result of previous experience in training programmes in the field of maintenance, it is agreed that to conduct seminars for a specific subject does not provide measurable outcomes.

Parallel to the suggestions from participants of previous programmes, it is detected that training only the maintenance engineers is not enough to achieve some improvements unless they have the full support of their management in addition to the requirement that the production people should have an understanding of the subject.

Therefore, it is decided to conduct training programmes oriented towards certain problems of a specific company and thus they are called "Problem Oriented Training" programmes. In carrying out these Problem Oriented Training Programmes, the purpose is to train people with respect to the problems they face. Thus, the first step of these programmes is to detect the most urgent and significant problems confronted by the maintenance people. So, the aim of this step is not carrying out a consultancy programme. Instead, the intention is to conduct a survey to detect the problems in the company and the need of training together with the company's responsible maintenance personnel.

II. INTRODUCTION

The survey mentioned above was conducted during April 9-13.1984. Inorder to have a general idea about the maintenance situation, different sections of the plant were visited. Also discussions were made with the Maintenance Manager, Chief of Planning,Chief of Mechanical Maint., and Chief of Electrical Maintenance on the following subjects;

- Organization for maintenance
- Types of maintenance activities carried out and their occurrance rate.
- Procedures for each type of activities (detailed inf.)
- Maintenance costs.
- Initiation of preventive maintenance activities by computer and the system that is followed.
- Procedures for spare parts and materials.
- Application of condition monitoring techniques (practical examples on use of instruments)
- Suggestions on possible improvements.

Based on the above the need of training was established together with Maintenance Manager and his subordinates which later was presented to the Factory Manager and Production Chiefs.

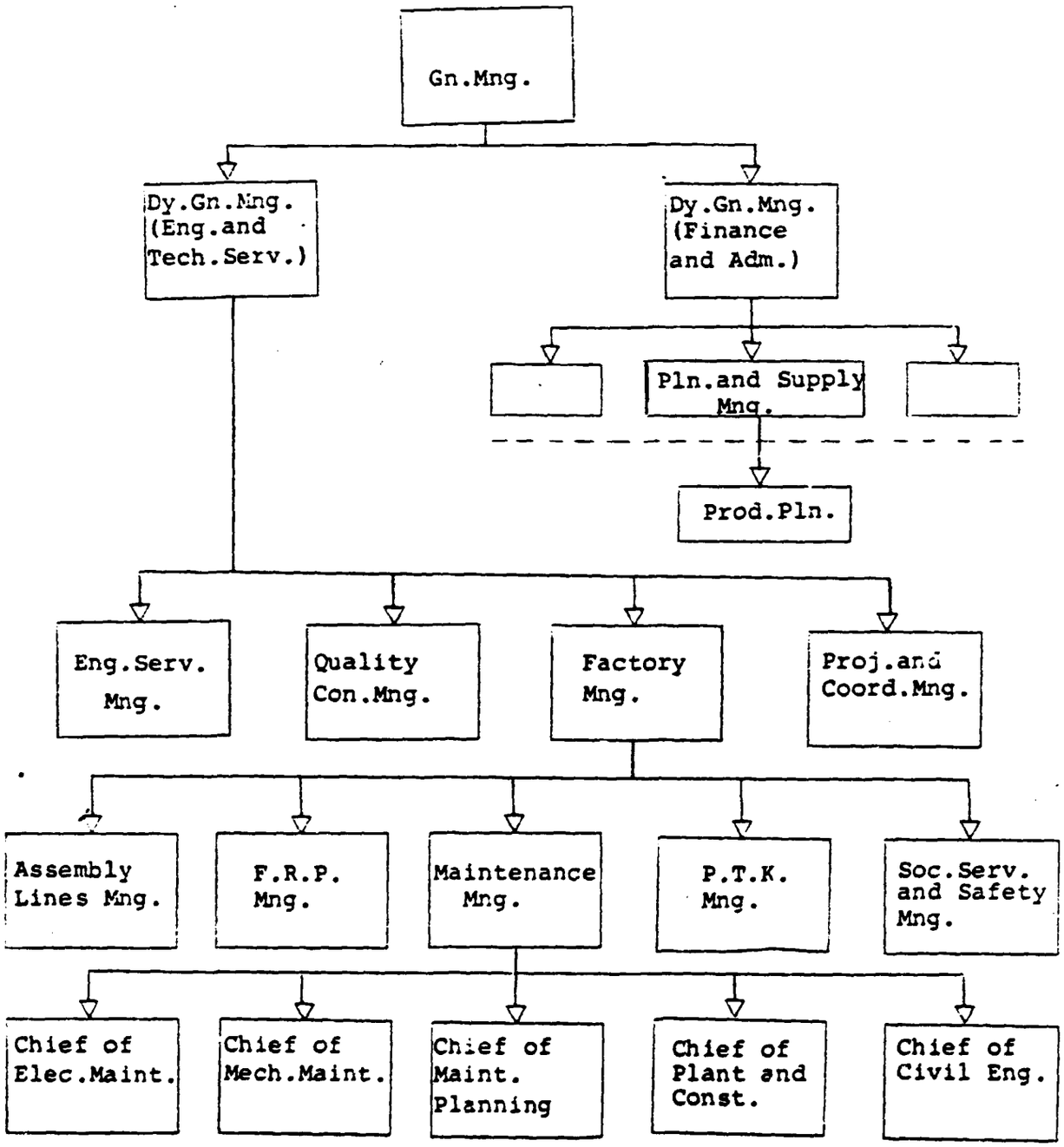
The outcome of above discussions is briefly presented in the below description of the present situation.

III. PRESENT SITUATION

(1) Organization for Maintenance :

The Maintenance Department is staffed as follows :

Name of the Section	Vacancy	No.	
	Maintenance Mng.		1
Electrical Mainten:	Chief Eng.	1	
	Foreman	1	
	Supervisor	1	
	Technician(Tech.Saf.)	1	
	Worker(Tech.Saf.)	1	
	Worker	12	
			17


Gn.Mng.
Dy.Gn.Mng. (Eng.and Tech.Serv.)
Dy.Gn.Mng. (Finance and Adm.)
Pln.and Supply Mng.
Prod.Pln.
Eng.Serv. Mng.
Quality Con.Mng.
Factory Mng.
Proj.and Coord.Mng.
Assembly Lines Mng.
F.R.P. Mng.
Maintenance Mng.
P.T.K. Mng.
Soc.Serv. and Safety Mng.
Chief of Elec.Maint.
Chief of Mech.Maint.
Chief of Maint. Planning
Chief of Plant and Const.
Chief of Civil Eng.

Mechanical Maintenance	:	Chief Eng.	1	
		Foreman	2	
		Supervisor	5	
		Worker	24	
				32
Maintenance Planning	:	Chief Eng.	1	
		Technician	1	
		Draughtsman	1	
				3
Plant and Const.	:	Chief Eng.	1	
		Foreman	1	
		Supervisor	4	
		Worker	28	
				34
Civil Engineering	:	Technician	1	
		Worker(Const.)	6	
		Painter	2	
				9
		TOTAL		96

As can be seen from the organization chart, maintenance department is organized as a centralized unit where all the maintenance sections are located in the maintenance workshop. Maintenance planning section is also responsible for the stock keeping of spare parts and consumables. Orders(requests) for the critical spare parts fall under the responsibility of this section. Shift is not applied unless there is demand for it.

At the present situation, the total overtime for maintenance per week is about 25 % of available man-hours. This overtime is mostly utilized on sundays.

(2) Routines :

In performing maintenance work, mainly three different procedures are applied;

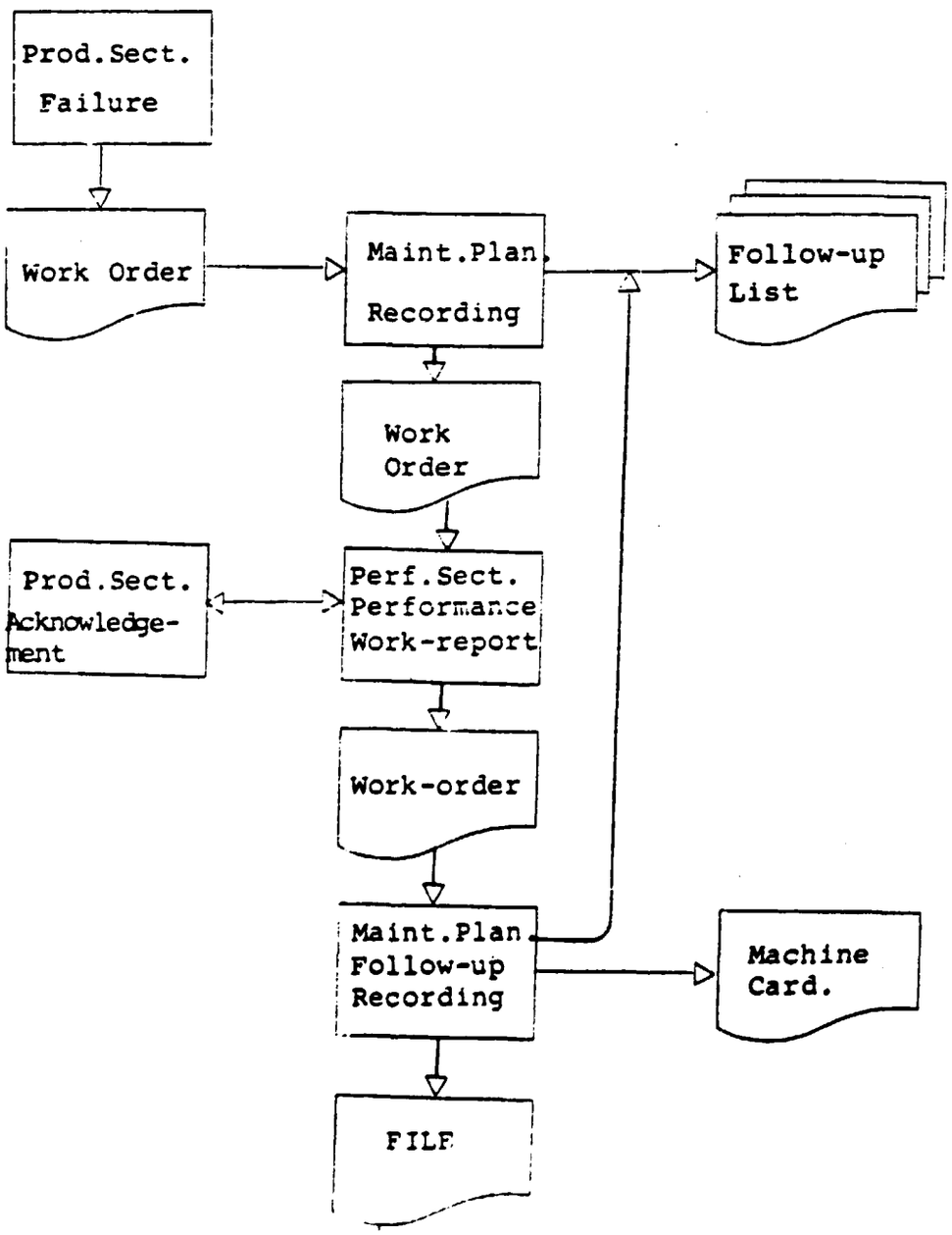
(a) Operate to failure

(b) Preventive maintenance (only for painting shop)

(c) Revisions

Operate to failure :

This procedure stands for 70 % of the total work load (except for painting shop). In this procedure repairs and replacements are done whenever a failure occurs. In performing this, following procedure is applied ;



NOTE: It must be mentioned that, the the recording in the follow-up list and machine card is very brief. For instance there are no information about cost and time used. Also, there is no reference for work order and spare parts used.

Preventive maintenance :

A computerized preventive maintenance system is established and only applied in the painting shop. The system gives weekly print outs about the activities to be carried out by various categories. The planning about the performance of these activities is done by the respective maintenance section chief. After performance the jobs are reported to the computer section and as a result those jobs not completed are included in the next weekly list.

The system does not allow to separate jobs to be done during operation from jobs to be done during a stop. In the painting shop all of the jobs are regarded as to be done during the stop which results in that most of the jobs are done during the week end.

NOTE: Lubrication is done in accordance with the prepared schedule showing the lubrication times for each machine or machine component in some cases. These lubrication times are scheduled only on weekly, 3-month, 6-month and yearly bases. Daily checks are sometime pointed out on this schedule but the time interval is not shown.

Revisions :

Revisions are done on the basis of schedule which is prepared in advance. The required number of production workers who will be assigned as helpers for the maintenance people are requested

from the respective production section in advance. The revision jobs to be performed are discussed in meetings with production chiefs on fridays.

Stock Control for Maintenance :

V-belts are purchased in large lots because of the large amounts of consumption. Since there is no problems associated with their procurement, there is no stock control policy with respect to V-belts and things of similar properties. So these uncritical spares are ordered to the central store whenever needed.

The critical spares are procured from the foreign countries. Depending on their usage and duration of the lead time, Maintenance planning section determines the minimum levels of stocks for each critical spare. Of course, the stock control of these items is carried out by information processing systems.

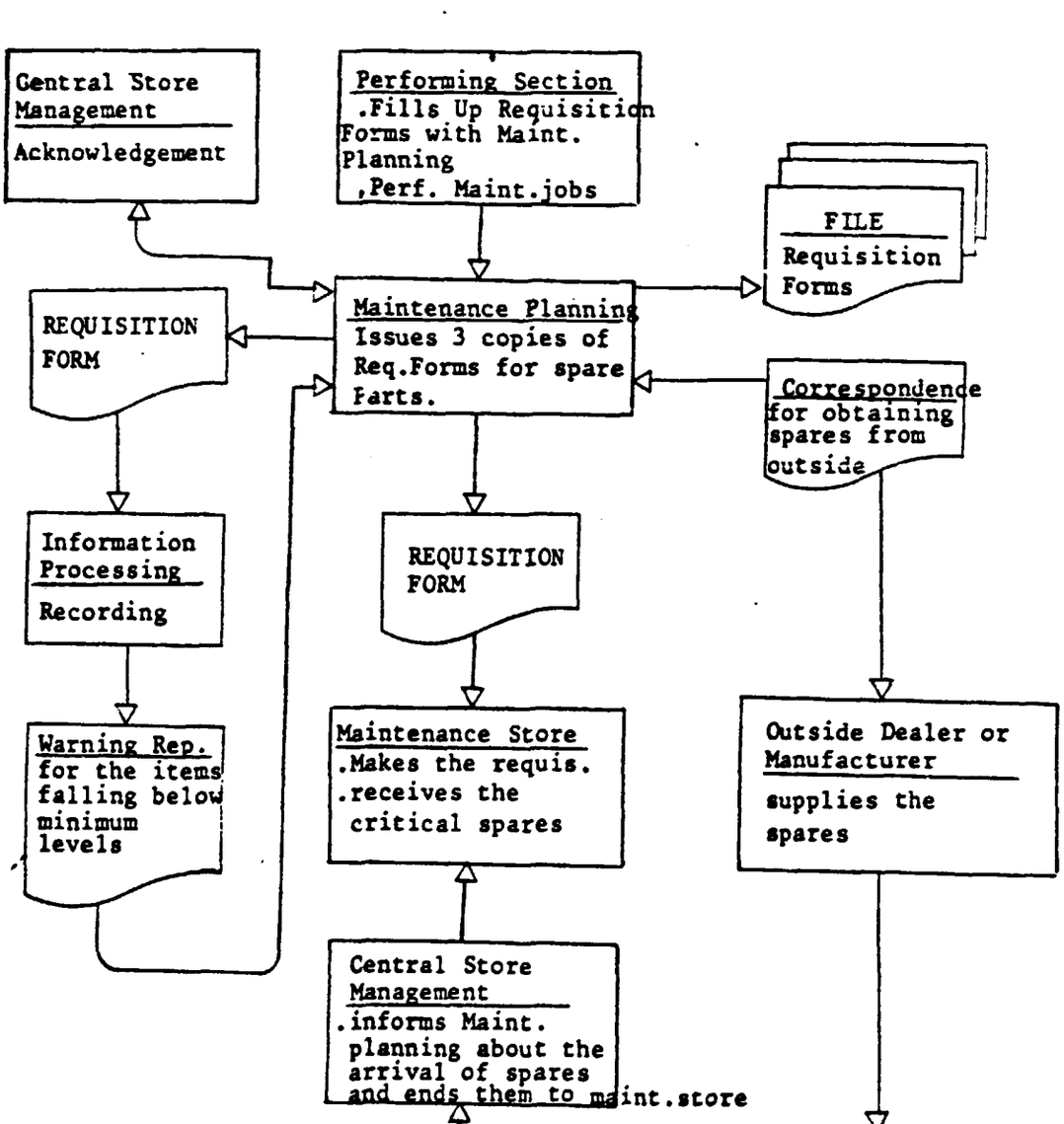
Each order praced for the critical parts is recorded by the information processor. All of the paperwork is taken care of by the maintenance planning section concerning the order and receipt of critical spares. Upon the arrival of critical parts from outside dealers to the central store, the maintenance planning section is informed and receives the parts to the maintenance store. Maintenance planning determines the minimum levels of critical spares according to their past usage trends and notifies these minimum levels to the information processing section. For the each spare received from the maintenance store, a work order form is issued. These forms are sent to the information processing and accounting sections. The initial amounts of all of the spares are recorded in the memory in advance. The amounts of new parts arriving are reported to the information processing section and the amounts used are deducted from the amounts available for each item. When the available amounts for the critical parts fall below the minimum levels, information processing section reports

these items to the maintenance planning and maintenance planning section takes the necessary steps.

Stock levels are determined according to their significance. If the spares are being consumed in large amounts, then the first order to be placed is % 20, of the spares existing on the machine. The list of these existing parts for each machine can be obtained from the machine catalogue. If the spare is not consumed in large amounts, only one spare part is ordered for the first time.To determine the stock levels later on, the consumption trend for that specific spare is followed carefully. Routines about the stock control activities for the critical parts are depicted on the following flow chart.

Receipt of non-critical parts from the central store is carried out by the use of part order cards. The performing section under the maintenance management uses these non-critical spares as many as it needs after these parts are brought into the maintenance store. Respective section notifies the amount and place of spare usage to the maintenance planning department. Maintenance planning department reports these to the accounting section all together. And the central store reports the amounts of spares withdrawn to the accounting section.

Routines about the Stock Control activities for the Critical Spares.



IV. MAINTENANCE COSTS FOR 1983

Cost of Consumed Materials and Spares	57.735.099 .- TL
Labor Cost	44.059.541 .- TL
Cost of Temporary Labor(subcontractors)	20.956.379 .- TL
	122.751.019 .- TL in total

V. FINDINGS

The present work order system at OTOSAN does not obtain information about cost of each spare or material used timing of repairs or replacements. Thus, it does not allow to perform the appropriate analyses about costs and time spent. As a result it nullifies ones ability to take corrective actions since there is no yard stick to measure the outcomes of the system.

On the other hand, condition monitoring techniques at the company are quite conventional in terms of both aids-instruments and the techniques utilized. As a result of the deficiencies in the condition monitoring techniques, preventive maintenance activities cannot be carried out scientifically.

Another point that should be clarified here is the fact that operate to failure procedures in the maintenance activities stand for % 70 of the total work load.

Also the time spent for revisions seems to be a little bit too much. Above all, it can be stated that preventive maintenance activities are not carried out systematically.

A final point that should be emphasized here is the fact that there are no appropriate routines for recording of the necessary information.

VI. RECOMMENDATIONS

In order to improve the Preventive Maintenance System the scientific condition monitoring techniques should be implemented.

Also the failure report system needs some revisions. Routines for recording and follow-up of maintenance work, especially of costs and downtimes, should be established and implemented.

Much of operate to failure activities can be elimenated by improving the Preventive Maintenance System. As a result the costs of spares and materials and workload of the maintenance personnel can be reduced in a certain extent. Thus, it may be possible to avoid the over-time work practices.

On the other hand, by using the appropriate work order routines necessary analyses of cost and time can be carried out.

Finally the time spent for revisions can be shortened by improving the over all Preventive Maintenance System.

As a result, it is suggested that a problem oriented training programme in condition monitoring techniques and preventive maintenance system should be conducted.

Outline of the Suggested Problem-Oriented Training Programme:

Topics To Be Covered	Duration in Days
1.General Maintenance	1
2.Preventive Maintenance System	1
3.Condition Monitoring Techniques	2
4.Group Work(Preventive Maintenance System)	2
5.Discussions(Plans for Implementation)	1
6.Introduction to Planning,Preparation and Work Order System	1-2
	8-9 Days in total

REPUBLIC OF TURKEY
MINISTRY OF INDUSTRY & TRADE

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION (UNIDO)

INDUSTRIAL TRAINING AND DEVELOPMENT CENTRE

THE SURVEY REPORT FOR

PROBLEM ORIENTED TRAINING PROGRAMME ON MAINTENANCE (BOZKURT MENSUCAT A.Ş.)

Prepared By:

Mr.J.STEFFENS (UNIDO)
Maintenance Consultant

T.Cengizhan PAMİR (ITDC)
Industrial Engineer

İsmail AKPINAR (ITDC)
M.B.A.

2-6 April 1984

İSTANBUL

REPORT FOR BOZKURT TEXTILE IND.INC.

I. PREFACE

As a result of previous experience in training programmes in the field of maintenance, it is agreed that to conduct seminars for a specific subject does not provide measurable outcomes.

Parallel to the suggestions from participants of previous programmes, it is detected that training only the maintenance engineers is not enough to achieve some improvements unless they have the full support of their management in addition to the requirement that the production people should have a full understanding of the subject.

Therefore, it is decided to conduct training programmes oriented-towards certain problems of aspecific company and thus called them "Problem Oriented Training" programmes. In carrying out these Problem Oriented Training Programmes, the purpose is to train people with respect to the problems they face. Thus the first step of these programmes is to detect the most urgent and significant problems confronted by the maintenance people. So, the aim of this step is not carrying out a consultancy programme. Instead, the intention is to conduct a survey to detect the problems in the company and the need of training together with the company's responsible maintenance personnel.

II. INTRODUCTION

Survey was conducted during April 2-6,1984. Several sections of the factory have been visited, information has been gathered about the routines and procedures associated with the maintenance as has been proceeded at the factory. Following the plant visits, long hours of discussion with the maintenance chief engineers and with the other personnel has been carried out as seen necessary. As a result of these visits and discussions information has been obtained about;

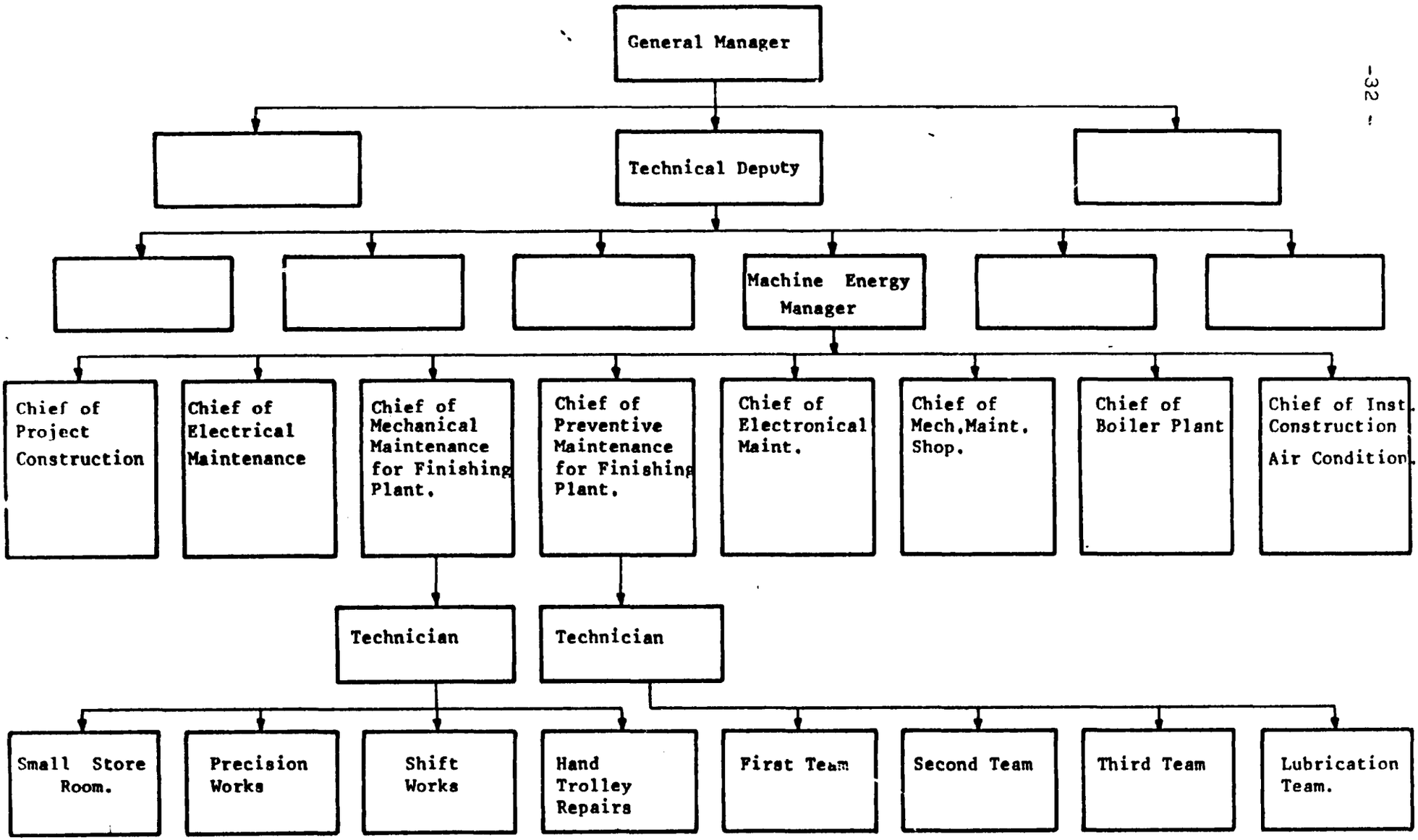
. procedures
. routines
. failure reports.
. production down-time
. maintenance costs
. attitude of the maintenance personnel in general.

Based on the information above, certain ideas about the present situation have been extracted and concluding remarks and suggestions associated with the maintenance system have been presented. Finally, the contents and timing of the problem oriented training programme have been determined in close collaboration with the company's responsible personnel.

III. PRESENT SITUATION

3.1. The Structure of Organization for Maintenance

(Organization chart is on the following page)


General Manager
Technical Deputy
Machine Energy Manager
Chief of Project Construction
Chief of Electrical Maintenance
Chief of Mechanical Maintenance for Finishing Plant.
Chief of Preventive Maintenance for Finishing Plant.
Chief of Electronical Maint.
Chief of Mech,Maint. Shop.
Chief of Boiler Plant
Chief of Inst. Construction
Air Condition.
Technician
Technician
Small Store Room.
Precision Works
Shift Works
Hand Trolley Repairs
First Team
Second Team
Third Team
Lubrication Team.

The survey was carried out in the Finishing (or Conditioning) Plant including all of its subsections.

As for the number of personnel and their position, the following information is available.

- One foreman in the small store room
- One foreman and one worker (apprentice) in the precision works shop.
- Three foremen in the shift works.
- One foreman and one welder (Worker) in the hand trolley repair shop.
- One supervisor, two assistant supervisors and one worker in the first team
- One supervisor and two assistant supervisors in the second team.
- One supervisor and two assistant supervisors in the third team.
- One supervisor and two assistant supervisors in the lubrication team

It should be noted that all of the personnel under the technician who is responsible for preventive maintenance have the worker status. Moreover, as can be observed from the organization chart, there are two technicians who are responsible for all of the maintenance jobs. One of these technicians is supervisor and the other one is his assistant.

3.2. Routines

The working routines are briefly described in the following explanation and flow chart:

a. Smaller Emergency Repairs

Failures detected by operators will be directly reported to the assigned repairmen. In cases where the repair time is expected to exceed ten minutes, the supervisor / technician or chief maintenance engineer will be informed. In general the above repairs will not be recorded.

b. "Planned" Repairs

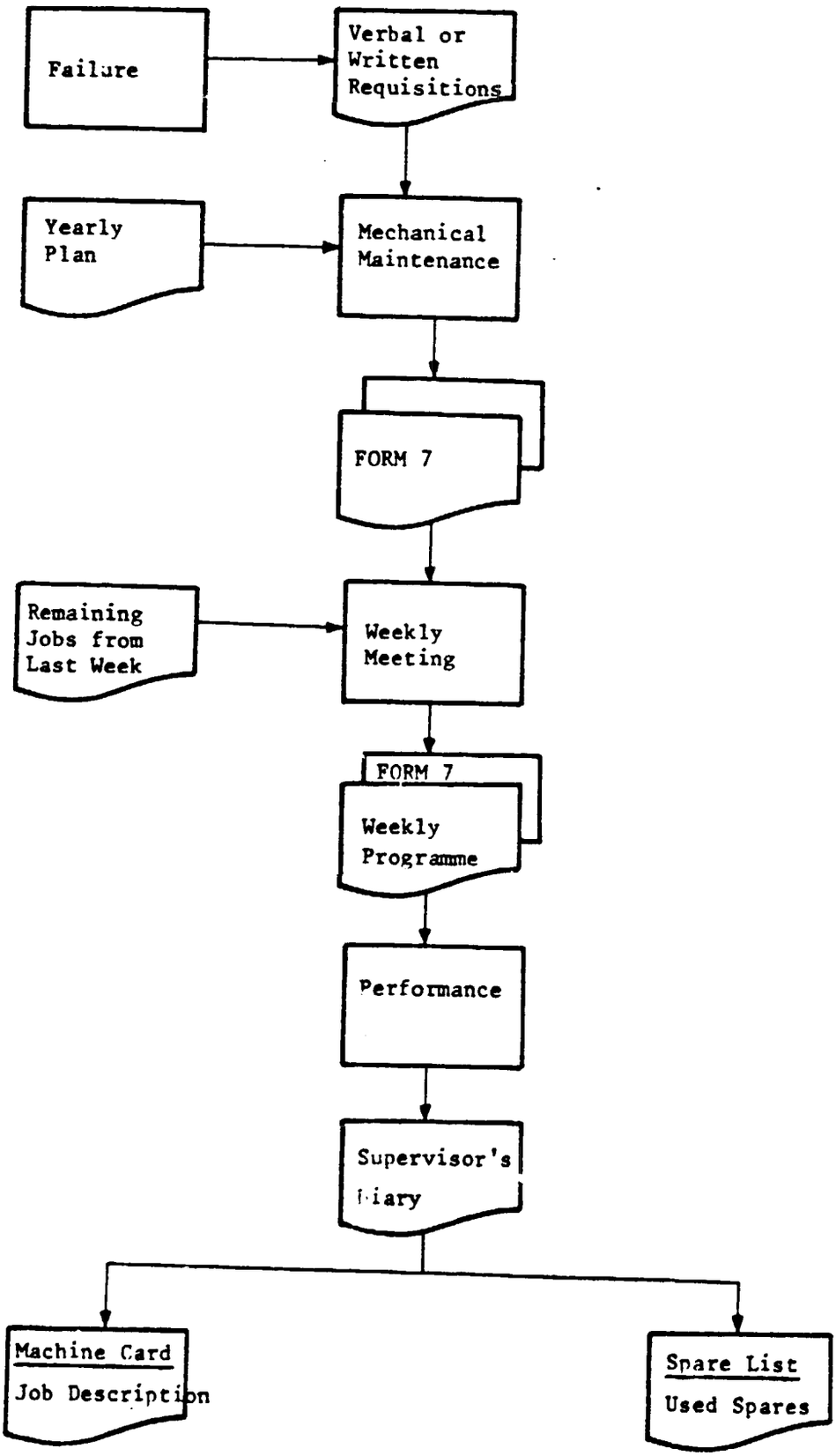
Planning, production and Maintenance Units always meet on wednesdays and discuss the weekly maintenance programs. Before these meetings, annual programs are transformed into weekly programs and verbal or written work orders for that period are recorded on form 7 along with the weekly program works. During these meetings they discuss on the performance of the jobs recorded on these form 7's and on the remaining Jobs from last week. If some of the remaining jobs are to be done for the following week, they are also recorded on form 7. 15 Copies of the weekly programme are prepared and distributed to the participants of this weekly meeting. The prospective participants of this meeting are the following people :

- Planning Manager
- Production Manager
- Machine and Energy Manager and His Deputy
- Production Department Heads
- Mechanical Maintenance Chief
- Electrical Maintenance Chief
- Technical Manager
- Finishing Plant Manager
- Technical Research and Process Control Manager
- Auxiliary Plants Manager

  and so on.

A performance schedule is prepared during the meeting and it is sent to the assigned maintenance people in order to take the necessary actions. These jobs are recorded on supervisor's diary upon their completion. Respective machine cards are also filled out for the repairs done for that specific machine. They also have spare lists in which used spare parts are recorded. The flowchart showing the routines for the planned repairs is depicted on the following page

Routines for the "planned" repairs



c. Other Routines

Lubrication is done in accordance with an established schedule.

Condition Monitoring is carried out for specific machines.

IV. MAINTENANCE COSTS AND DOWN TIMES (1983)

Spares and Materials Consumed : 128.000.000.TL

Labor Cost (Without administ.costs): 987.696.-TL/worker/year

Present Stock : 44.495.296.-TL.

Internal Orders : 15.416.000.-TL.

Machines	Down-times			Down-times in Total
	Preventive Maintenance	Mechanical Repairs	Electrical Repairs	
Heating - Bleaching Mach.	395'25"	370'40"	54'24"	820'30"
New Hot Flue	55'25"	55'50"	38'10"	149'25"
New Printing Machine	11'35"	65'45"	11'40"	149'
Stretcher II	36'	124'30"	76'15"	236'45"
Pad Steam	142'	229'20"	19'15"	390'34"

V. FINDINGS

It has been observed that lubrication is not carried out systematically. There have been efforts, in the past, to systematize the lubrication job. However, it has not been put into use yet. But the chief maintenance engineers know what they lack.

Another point that should be emphasized here is the fact that condition Monitoring activities are not performed systematically. Activity descriptions for condition monitoring are established, but not implemented. Also the descriptions do not include intervals and criterion for measurements, etc.

It should also be clarified that the maintenance costs are not recorded appropriately and other records such as down times for specific machines or spare parts used for a certain machine are kept in a manner which does not allow a proper analysis.

VI. RECOMMENDATIONS

In general it is observed that mechanical maintenance in the finishing plant is very well aware of the problems and applies appropriate routines. However, improvements can be accomplished by;

- implementing proper routines for condition monitoring. This will reduce the
  - . down time due to planned maintenance
  - . down time due to emergency repairs
  - . work load of the maintenance people

Also the costs for spare parts can be reduced since the life-time of components can be fully utilized.

- making proper records of the maintenance activities and analyzing them satisfactorily.
- doing necessary corrections within the routines or within the system according to the results of the analysis.

Therefore, it is suggested that a problem oriented training programme in condition monitoring techniques be conducted.

Outline of the suggested problem oriented training programme:

Topics To Be Covered	Duration in Days
1. General Training	1
2. Preventive Maintenance System (PMS)	1
3. Condition Monitoring Techniques	2
4. Group Work (PMS)	2
5. Discussions Establishment of PMS and Presentation	2-3
	8-9 Days in total

REPUBLIC OF TURKEY
MINISTRY OF INDUSTRY & TRADE

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION (UNIDO)

INDUSTRIAL TRAINING AND DEVELOPMENT CENTRE

THE SURVEY REPORT

FOR

PROBLEM ORIENTED TRAINING PROGRAMME ON MAINTENANCE

TÜRK DEMİR DÖKÜM FABRİKALARI A.Ş.

Prepared by:

Mr. STEFFENS (UNIDO)
Maintenance Consultant

T. Cengizhan PAMİR (ITDC)
İndustrial Engineer

İsmail AKPINAR (ITDC)
M.B.A.

26-30 March 1984
İSTANBUL

I- PREFACE

As a result of previous experience in training programmes in the field of maintenance, it is agreed that to conduc seminars for a specific subject does not provide measurable outcomes.

Parallel to the suggestions from participants of previous programmes, it is detected that training only the maintenance engineers is not enough to achieve some improvements unless they have the full support of their management in addition to the requirement that the production people should have a full understanding of the subject.

Therefore, it is decided to conduct training programmes oriented towards certain problems of a specific company and that they are called "Problem Oriented Training" programmes. In carrying out these Problem Oriented Training Programmes, the purpose is to train people with respect to the problems they face. Thus, the first step of these programmes is to detect the most urgent and significant problems confronted by the maintenance people so, the aim of this step is not carrying out a consultancy programme. Instead, the intention is to conduct a survey to detect the problems in the company and the need of training together with the company's responsible maintenance personnel.

II- INTRODUCTION

The survey mentioned above was made during March 26-30, 1984. The whole plant was visited by the accompany of Mechanical Maintenance Chief. Also discussions were made with him on the following subjects;

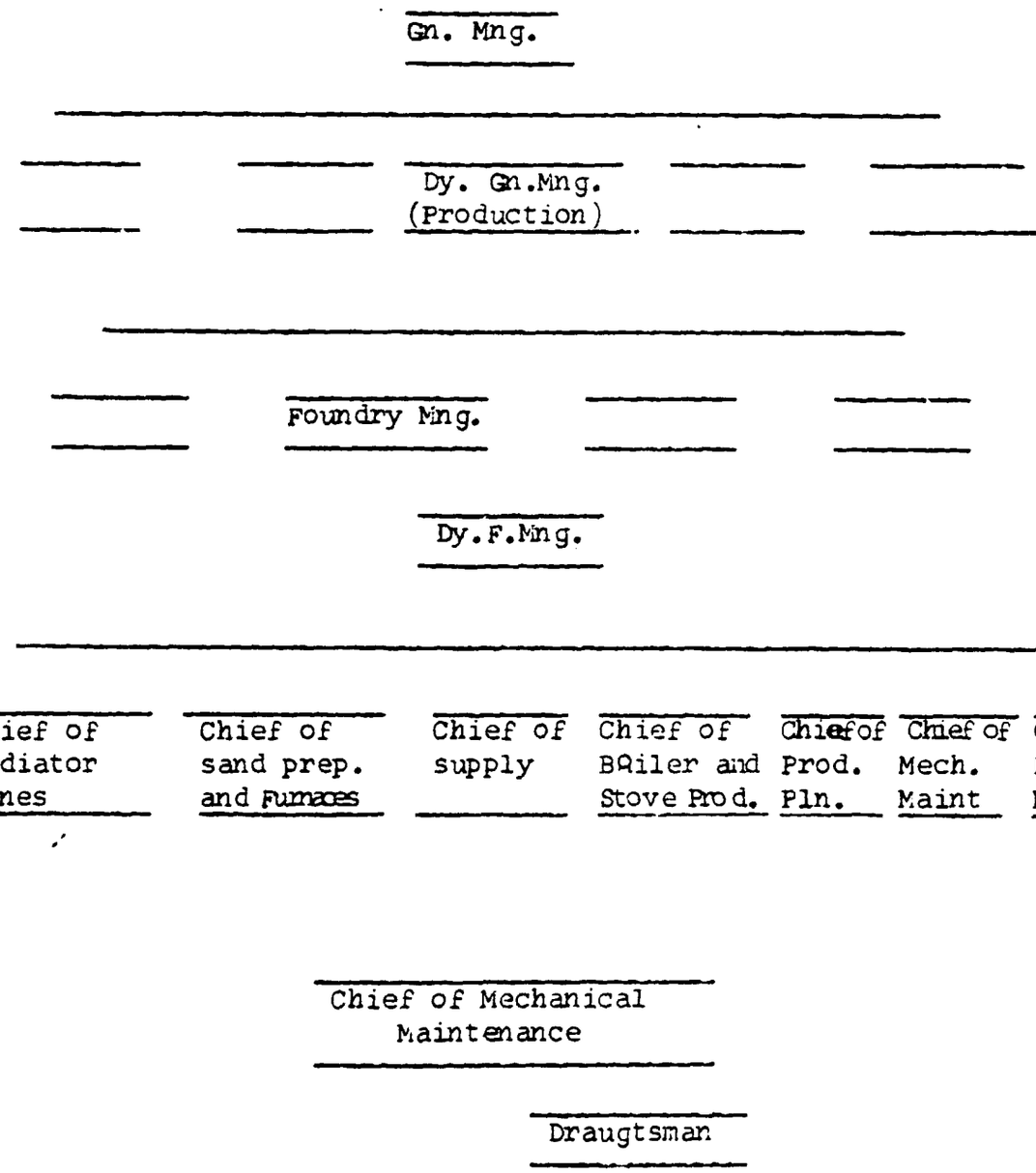
- Procedures and routines applied for maintenance
- Organization of maintenance
- Failure reports
- Production downtime
- Maintenance cost
- Personnel attitude and technical background of maintenance personnel in general.

Based on the above the need of training was established together with chief of mechanical maintenance which later was presented to the management by means of a meeting.

The outcome of above discussions is briefly presented in the below description of the present situation.

III - PRESENT SITUATION

(1) Organization ofor Maintenance:



NOTE: By request from Chief of Mech. Maint. only the mechanical maintenance section was studied since this was regarded to be the section where problems exist.

The mechanical maintenance section is staffed as follows:

Name of the section:	Vacancy :	No.	
Mechanical Maintenance S.	Chief Eng.	1	
	Draughtsman	1	
			2
Group for Sand Preparation:	Foreman	1	
	Supervisor	1	
	Worker	8	
			10
Group for Furnaces, Stove production, Pattern prod., Boiler production :	Foreman	1	
	Supervisor	1	
	Worker	8	
			10
Group for Radiator lines :	Foreman	1	
	Supervisor	2	
	Worker	8	
			11
Group for supply and Mech Workshop :	Foreman	1	
	Supervisor	1	
	Worker	4	
			6
Maint. Shop and Store :	Foreman	1	
	Supervisor	1	
	Worker (Maint. Shop)	9	
	Worker (Store)	4	
	Worker (room keeper)	1	
			16
Lubrication :	Worker		3
Welding :	Worker		5
		TOTAL:	63

As can be seen from the organization chart, the mechanical maintenance section is organized as a decentralized unit. Four main maintenance units have been formed inorder to cover the whole production area. Each unit in it's self work in shifts and in case of major breakdowns, personnel may be withdrawn from any of these units.

In addition to above there is a maintenance unit for the maintenance workshop which also includes the store personnel.

Finally there are lubricators and welders who can be assigned to any of the above maintenance units according to the requirements.

Mechanical Maintenance section is responsible for store keeping and materials and spare parts handling. In general materials and spare parts are purchased by Boiler and Stove production section upon request by mechanical maintenance section.

(2) Routines:

Maintenance units perform their activities mainly according to the method of "operate to failure" which means repairs and replacements are done whenever a failure has been detected.

The chief Mech. Eng. is informed only for the failures occuring on critical production equipment. Otherwise the necessary action is taken by the respective maint. unit.

All major maintenance jobs done are recorded in a log book. The log book is also used for recording the detected failures during production hours. These reeords constitudes the jobs to be performed by the next shift and especially by the night shift. Otherwise the log book is not kept in a systematic way and is not subject to analysis.

There are no written instructions or schedules for lubrication, condition monitoring etc. Lubricators are said to know where and how to lubricate and perform their job according to that. Systematic condition monitoring is not done.

For critical m/c and equipment, the production sections keep a record of downtimes for each shift. A copy of these records is sent to the Chief of Mech. Maint. Section for information. The average down time in these critical m/c and equipment is said tc be about % 10.

The maint. units assigned to production sections are working three shifts and saturday and sunday although there is no production on night shifts and on sundays. This time is used for repairs and replacements recorded in the log book and for other job detected by foremen and supervisors.

(3) Maintenance Costs:

Total Cost of maintenance for 1983, is appreximately 175 x 10 TL which is distributed as follows:

Spares and materials for repairs and replacement	:	61 460 000 TL
Materials and spares for revisions	:	11 238 000 TL
Internal Orders(9.962.000x0.40)	:	3 984 000 TL
Subcontractors	:	3 000 000 TL
Temporary employment	:	300 000 TL
Labour costs ($1,5x10^6$ TL/worker/Yr)	:	94 500 000 TL

In addition to the above figures the purchase value of parts in stock is approximately 63 752 000.00 TL

IV- FINDINGS

The present decentralized organization structure in connection with the present work routines does not allow a systematic approach of maintenance. Performance of preventive maintenance and better planning in connection with reorganization will allow to reduce the number of work hours and costs of maintenance. During the visit to the foundry and discussions, it became clear that the preventive maintenance activities are neglected. This results in higher costs, more breakdowns and a fluctuating workload which will end up with less oppurtunity for planned maintenance activities. It is not possible to carry out preventive maintenance activities including lubrication without any written instructions and schedules. The present recording of downtime and repairs does not allow an analysis. More engineering capacity should be utilized to do the analysis properly.

V- RECOMMENDATIONS

As a first step it is recommended to implement proper routines for preventive maintenance. This means:

- to do an inventory of the production equipment and thereby find required PM activities such as;
  - . daily caretaking (by operators)
  - . cleaning
  - . lubrication
  - . Inspections or condition monitoring
  - . Programmed replacements or repairs.
- to establish a preventive maintenance system where all above found activities are recorded and which makes it possible to plan and prepare these activities.
- establish proper routines and organization for the performance of above.

In doing this, the machinery and equipment will be taken care of in a better way and the information about the symptoms of failures will be available and can be used for preparation for and planning of repairs.

This will result in more equal work load for the entire work force while at the same time the life time of components will be fully utilized resulting in lower cost for spare parts.

The second step should be to establish proper routings for;

- . recording of performed jobs.
- . preparation for and planning of repairs.
- . analysis of performed repairs.

In the light of above recommendations, the proposed outline for the problem oriented program is as follows,

Subjects	Half Days
General	2
Condition Monitoring	4
PM System	2
Group Work (PM)	2
Discussions about group work	1
Establishment of PM system	3
Discussions and Presentation	1
Plans for implementation	1
TOTAL	=16 half days

APP. 6

SEGEM HAKKINDA :

Sınai Eğitim ve Geliştirme Merkezi (SEGEM) Genel Müdürlüğü T.C.Hükümeti ile Birleşmiş Milletler Sınai Kalkınma Teşkilatı (UNIDO)'nun ortak projesi olarak Bakanlar Kurulu'nun 10.11.1978 tarihli kararı ile kurulmuştur.

SEGEM'in AMAÇLARI :

.Sınai gelişmeyi hızlandırmak gayesi ile mevcut ve kurulacak sınai kuruluşlar için gerekli olan teknik ve idari personelin hüner ve kabiliyetlerini geliştirmek,

.Üniversite ve yüksek okullardan yeni mezun olanlara, mesleklerinde iyi bir başlangıç yapmalarını sağlamak ve görevlerini yürütürken eksikliğini duyacakları temel tecrübeleri kazandırmak için sınıf içi seminer tipi ve fabrika içi uygulamalı eğitim programları düzenlemek,

.Kamu ve özel sektör sanayi kuruluşlarının problemlerinin çözümüne yönelik eğitim programları hazırlamak,

.Türkiye'de mevcut yüksek öğrenim kurumlarının sınai kalkınmadaki yeri göz önüne alınarak üniversite-sanayii işbirliğinin sağlanmasında yardımcı olmak,

.Türkiye ile kalkınmakta olan diğer ülkeler arasında teknik işbirliği bağlarını kurmak ve geliştirmek.

SINAİ EĞİTİM VE GELİŞTİRME MERKEZİ
GENEL MÜDÜRLÜĞÜ (SEGEM)

Selanik Caddesi No.16 Yenişehir/ANKARA

Tel: 31 11 15 (4 Hat)

SINAİ EĞİTİM VE GELİŞTİRME MERKEZİ

GENEL MÜDÜRLÜĞÜ

(SEGEM)

ENDÜSTRİDE BAKIM PLANLAMASI KONFERANSI

28 Mayıs 1984

Boğaziçi Üniversitesi
Mühendislik Binası

İSTANBUL

KONFERANS HAKKINDA

Günümüzde en gelişmiş ülkeler bile bir çok sınai tesislerde bakım konusunun uzun vadeli bir unsur olarak ele alınmasından dolayı ortaya çıkan büyük problemlerle karşıkarşıyadırlar. Çünkü bakım konusununun ihmali ulusal ekonomi için uzun dönemli maliyetler yaratmaktadır. Mevcut kaynaklardan başkasına yönelmeden atölyelerin verimliliğinin arttırılması, duruşların en aza indirilmesi ve bakım faaliyetlerinin daha etkin şekilde gerçekleştirilebilmesi için planlı bakım-onarım politikalarının oluşturulması ve uygulanması gerçek bir ihtiyaçtır.

Konferans, Bakım Onarım yöneticileri ve mühendisleri düzeyinde, planlı bakım konusunun üretim faaliyetleri içindeki önemini tartışmak ve endüstrideki uygulama fikrini teşvik edip geliştirmek amacıyla düzenlenmiştir.

Bu amaç doğrultusunda planlı bakım uygulamalarının ekonomik yönleri üzerinde durularak, çeşitli bakım onarım yöntemleri gözden geçirilecektir.

Konferans ülkesinde ve Dünyanın çeşitli ülkelerinde Bakım ve Onarım konusunda müşavirlik ve eğitim çalışmaları yürütmüş olan Birleşmiş Milletler Sınai Kalkınma Teşkilatı Uzmanı İsveç'li Mr. Jürgen K.H. STEFFENS tarafından verilmektedir.

- Dökümanlar ücretsiz olarak dağıtılacaktır.
- Program ücretsizdir.

PROGRAM YÖNETİCİLERİ

T.Cengizhan PAMİR - End.Müh.Bl.Bşk.V.
İsmail AKPINAR-MBA

KONFERANS PROGRAMI :

28 Mayıs 1984- Pazartesi

10.00-12.00
- Bakım-Onarımın üretim sistemi içindeki yeri.
- Bakım-Onarım uygulamasının ekonomik yönleri.
- Sonuçlar.
- Çeşitli Bakım onarım yöntemleri.

12.10-14.00
- Ara

14.00-16.00
- Bakım-Onarım yöntemleri ve üretim sistemi içinde yer alan diğer ilgili fonksiyonlarla bağlantıları.
- Bakım-Onarımın geleceği.
- Bakım-Onarımda eğitim.
- Modern tekniklerin kullanımı ve bunların ekonomi üzerindeki etkileri.