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REPORT

on

**GROUP TRAINING PROGRAMME IN THE ORGANIZATION OF INDUSTRIAL
MAINTENANCE SYSTEM AND DEVELOPMENT OF MAINTENANCE
ENGINEERING CAPABILITY FOR IRON & STEEL PLANTS FOR PTA**

**2nd COURSE
28th MAY TO 15th June 1990
Project Number US / RAF / 87 / 101**

1. S Y N O P S I S

The original objective of the second course was to deepen capabilities and competence to introduce and handle modern maintenance strategies in the participant's plants derived from the first course and the findings of the follow-up-mission. It was recommended after the follow-up-mission to split the course into 3 parts such as

- 1) Presentation of work done by participants since the first course.
- 2) To prepare economically proved solutions for the implementation of maintenance strategies.
- 3) Spares Administration - Classification and Specification.

As UNIDO was facing difficulties in recruiting the former participants and engineers selected during the follow-up-mission a change of the second course concept and content was necessary and agreed between UNIDO, PTA - Representative and VAIS. The participants for the course were all new recruited. The course content was adapted to suit the new forum of engineers and divided into two parts

- 1) Modern Maintenance Strategies, Planning and Systems.
- 2) Materials Management - Spares Administration-, Classification- and Specification.

The training methods used, were mainly case studies, group work, and discussions, i.e., methods which encouraged the participants to take an active part. The positive response shows that these methods were correctly chosen, although they are quite time consuming.

The group of participants was heterogeneous - in regard to level of knowledge and positions. Half of the forum were trainee engineers and therefore had only 1 - 3 years of experience in industrial engineering. For future courses the number of years experience should be increased.

The location selected for the training course was convenient. The training center offers all required facilities and ZISCOSTEEL willingly provided any needed support. One trainer of the training center took active part on the course and coordinated between the course and the plant site..

The planned course topics were covered, taking into consideration the reduced time available in relation to the first course. The sequence within each part of the course was sometimes changed to allow immediate handling of any issues arising.

The actual efficiency of the course cannot be evaluated yet, but the good response from the participants proved the correct programme chosen. The course participants were very enthusiastic and keen to learn the subjects being taught. It would therefore be wise to follow through with further courses to consolidate this learning.

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1. OBJECTIVE

The objective of the 1st part of the course was to develop competence and capabilities to introduce modern maintenance strategies in the participant's plants. To achieve this, problems which occur during the current maintenance operation had to be defined and solutions worked out, which could be implemented under the specific circumstances. On the basis of these solutions, action plans were developed by the individual participants.

The objective of the 2nd part of the course was an introduction of basic materials management strategies and store-keeping. Major emphasis was placed on practical training in the development of a material classification system as well as development of standard material specifications for spare parts and maintenance materials.

2. INITIAL SITUATION

... for MAINTENANCE

At the beginning of the course, the majority of the participants did not recognize the possibility to increase maintenance efficiency through improvement of the information flow, planning, etc. Thus, for example, some participants strongly rejected planned condition monitoring, on the grounds that the inspection itself causes failures. This showed a lack of confidence in the planning and also indicating that the technical possibilities of plant inspection / condition monitoring were known in only a very limited way.

Knowledge of maintenance cost and of costs resulting from breakdowns was particularly limited. Under such circumstances, it is nearly impossible to select the correct maintenance strategy and to convincingly implement new strategies and methods. Because the maintenance department is subordinate to the operations (production) department at most participant's companies, which generally leads to neglect maintenance, it was particularly important to emphasize the economic significance.

... for MATERIALS MANAGEMENT

Knowledge in materials management and store-keeping was very limited because non of the course participants had been involved in materials management functions in their companies. Nevertheless, all participants recognized the lack of efficient materials economy in their companies resulting in major difficulties for the maintenance departments due to non-availability of maintenance- and spare parts.

3. METHODS

From experience and success of the first course the preferred methods were workshops and didactic exercise. Lectures were limited to the necessary minimum (approx. 30 % of the course time).

Basic structure of course units:

- Theoretical block with constant discussion, so that the contents were generally broadened by the participants themselves.

- Working on case studies (referring to ZISCOSTEEL data as much as possible) in groups of four participants. The use of computer printouts in the course for flexible retrieval for efficient treatment of the case studies was important. Practical work on the computer aided planned maintenance system was not performed due to the time limit of the course programme. It turned out that over 50 % of the participating companies already use Personal Computers in other areas than maintenance and this technology is increasing (Kenya, Zambia, Zimbabwe) significantly.

- Presentation of results as a united group and in discussions
 - * definition of the correct procedures
 - * recording of existing problems
 - * implementation problems in individual plants.

The high degree of interaction within the groups as well as among participants and trainer was gratifying. The example which had been selected for the case study (rolling mill overhead crane) was chosen for greater identification of the participants with the task.

Plant visits were carried out (electrical workshops, mechanical workshops, rolling mills plant, wire drawing plant, warehouse and buying departments) to involve the reality as much as possible.

4. PARTICIPANTS

The group was heterogenous (see Appendix 1, List of Participants) - from sectional engineer to planner.

A number of the ZISCOSTEEL participants were trainee engineers with not more than 3 years of industrial experience and their input was limited.

The qualification of the trainees varied according to their positions. Generally, the hierarchical level of the participants was low and therefore the trainees will face great difficulties to implement or to start implementation modern maintenance strategies in their plant.

Involvement of ZISCOSTEEL plant personnel proved to be effective, because existing problems on the application of modern maintenance strategies were discussed. But efforts had to be made to keep the course from focusing one-sidedly on ZISCOSTEEL.

For future programmes it is suggested to recruit personnel from other industrial companies in Zimbabwe.

5. COURSE PREPARATION

After evident difficulties with recruitment at the outset, there were no other organisational problems.

The trainer for materials management arrived two days later because of transport difficulties. The delay caused no change of the programme content.

6. TRAINING CENTER FACILITIES

The training center offers basically all facilities required for the course. The copy machines could use improvement to ensure adequate quality of course materials. All other equipment such as video, TV, overhead projector, etc. are in good condition.

7. PARTICIPATION OF ZISCOSTEEL TRAINERS

The support provided by the ZISCOSTEEL trainers was excellent. Discussions with the head of ZISCOSTEEL projects department (previous head of maintenance department), safety engineers, buyer and stores personnel were extremely lively and prove that there is great deal of interest in discussing the problems with management personnel.

8. COURSE CONTENTS

All subjects were covered. The sequence was sometimes changed, since an attempt was made to react immediately to the questions that came up in the discussions.

Questions raised by the participants showed that the subjects were all considered to be relevant.

Some participants felt that the topics of costs and critical path planning were not covered sufficiently and store keeping discussed too long.

However, the great interest shown in costs was a positive result, in view of the fact that most participants did not believe cost considerations to be the task of maintenance at the beginning of the course.

More visits to other plants were suggested, but these could not be carried out within the limited time framework of the course. The optimum duration of such courses would be 4 weeks splitted into 3 weeks for maintenance engineering and 1 week for the materials management. This would allow to precisely work on the case studies and workshops which are an essential part for such courses.

The participants strongly expressed the need of improvement of the materials management in their plants. Warehouse, buying department and purchasing are lacking of a functional information system. Upgrading of materials specifications will lead in significant cost saving (foreign currency). The participants suggested to prepare a separate course to cover all aspects of materials management such as material engineering, material planning and control, storekeeping, procurement, warehouse-planning, spares manufacturing- and refurbishing. This course should be addressed to a separate forum.

9. COURSE DURATION

Most participants complained that the course duration was too short.

The selected methods of encouraging the trainees to take active part on each subject is time consuming as well as the work on case studies and workshops.

The most reasonable time frame would be 3 weeks for the maintenance part and 1 week for the materials management part. On the other hand, the absence of the participants from their companies, in the light of low availability of qualified personnel must be considered.

10. FUTURE ACTIVITIES AND ACTION PLANS

Plans for action were drawn up by each participant. It is assumed that the plans are too ambitious and too optimistic.

Regular visits to the plants of the participants should be made to encourage their activities before their positive attitudes are lost in the face of lack of interest and support by their management.

The success of implementing the new strategies will certainly depend on the willingness of senior management.

A seminar for the senior management is proposed to improve their awareness as to the importance of the programme and needs of the junior staff to have their support.

Dirscher

Stadler

*List of Participants of Group Training
Programme in Organization of Industrial
Maintenance System for Iron and Steel
Plants for PTA Countries*

US/RAF/87/101

No.	Name	Country	Position/Organization
1	Mr. Desta Bekure Ayalew (31)	Ethiopia	Senior electric engineer/National Metal Works Corp.
2	Mr. Mamo Tefera (34)	Ethiopia	Electrical engineer/National Metal Works Corp.
3	Mr. Wilberfforce Mwanja (37)	Kenya	Development engineer/Kenya United Steel Co., Ltd.
4	Mr. Wima Mohamed Ahamadi (34)	Tanzania	Design engineer/Ubungo Farm Implements Mfg.
5	Mr. Paul Mwanbu Isaya Aron (45)	Tanzania	Maintenance engineer/Ubungo Farm Implements Mfg.
6	Mr. Henry Nasilele Musiyalela (36)	Zambia	Sectional engineer/Zambian Consolidated Copper Mines Ltd.
7	Mr. Benso Kaacha (37)	Zambia	Sectional engineer/Zambian Consolidated Copper Mines Ltd.

*List of Participants of Group Training Programme
in Organization of Industrial Maintenance System for Iron and
Steel Plants for PTA Countries*

US/RAF/87/101

No	Name	Country	Position/Organization

all Trainee-Engineers			
8	Mr. Wilson Rutsate	Zimbabwe	Zimbabwe Iron and Steel Co.
9	Mr. Emmanuel Chicheko	Zimbabwe	Zimbabwe Iron and Steel Co
10	Mr. Augustine Borerwe	Zimbabwe	Zimbabwe Iron and Steel Co
11	Mr. John Usare	Zimbabwe	Zimbabwe Iron and Steel Co
12	Mr. A.Amiratsi	Zimbabwe	Zimbabwe Iron and Steel Co
13	Mr. D. Mhuru	Zimbabwe	Zimbabwe Iron and Steel Co
14	Mr. C. Chihave	Zimbabwe	Zimbabwe Iron and Steel Co
15	Mr. M. Hodzi	Zimbabwe	Zimbabwe Iron and Steel Co

(Qualquel)

SUMMARY OF EVALUATION OF GROUP TRAINING PROGRAMME

Number of participants: 15

Host country: Zimbabwe

Programme: Group Training Programme in the Organization of Industrial Maintenance System and Development of Maintenance Engineering Capability for Iron and Steel Plants for PTA (US/RAF/87/101)

Year: 28 May - 15 June 1990

I. Pre-programme information:

1. How was the introductory information you received in your home country about: (Please mark an x in the suitable column).

	<u>Sufficient</u>	<u>Not sufficient</u>	<u>Missing</u>
Aim of programme	11	3	1
Contents of programme	9	5	1
Level of programme	9	5	1

Comment:

practice oriented training and computer coding appreciated (Ethiopia, Kenya)
more information on controlling planned maintenance system including project evaluation (Zimbabwe)
introduction of industrial progress in a country where seminar is staged (Tanzania).

2. How many weeks before the beginning of the training programme did you receive the following information:

Information about the programme: average 8 weeks before.

Being accepted to the programme: average 2.6 weeks before.

Comments:

Information: They received the programme information from sufficient time for preparation (Ethiopia), airticket arrived very late (Kenya), information should be communicated 1 month before start of programme (Tanzania), information did not cover aspects in question 1 just a notification of attendance of course of planned maintenance.

11. Programme Content and Organization:

3. What is your opinion of the total duration of the course:

Too long	1
Just right	7
Too short	5
No comment	2

If not "just right", what, in your opinion would be the most suitable duration for the course ?

Weeks

Comments:

3 weeks theoretical and 3 weeks practical training would have been better - more time for detailed lectures and working on the computer (Kenya, Tanzania), material management course should have been compressed and held in 2 days (Zambia), material management should cover 3 weeks - for 1 week it was too lot - breakdown in communication between computer and participants (Zimbabwe).

4. State your opinion about the daily schedule:

Too heavy	2
Just right	12
Too light	1

Comments:

lunch break should be longer - afternoon session 2 - 4.30 (Ethiopia) topics were covered very fast (Kenya), daily schedule adequate - properly organised with visits to companies, participants were fully occupied for the entire duration of the course, materials management could be improved through a study of a practical operating system, (Zambia, Zimbabwe)

5. Would you suggest any changes in the general nature of the training programme?

practice oriented training - computer aided data processing (Kenya, Tanzania, Zimbabwe), programme should be held in Vienna - more facilities for computer systems, follow-up to the progress of participants necessary, more examples of 3rd World should be given - solution should be exhausted, use of more visible aids (Zimbabwe).

6. Do you feel that the training corresponded to your professional needs?

To a very large extent	7
To a large extent	4
To a sufficient extent	4
To a small extent	0
To a very small extent	0

Comments:

training corresponded to professional needs of participants, helped to understand storage and coding methods for spare parts, most of the course material had relevance to job of participants (Ethiopia, Zambia), material management part was not directly corresponding to maintenance engineering (Zambia), planning techniques and equipment usage was essential, future apprentices should have lectures on maintenance engineering (Zimbabwe).

7. Please give your opinion about the study visits (if any):

study visits good, educational, beneficial - responsible people very helpful, showed steel industry related to other industries, more study visits needed, just factory tours - very few. study tour to ZISCO was the only relevant one - enabled to see missing parts in the implementation of maintenance engineering but for ZISCO employees not interesting, one participant pointed out that much what they've learnt was not in use at the places they visited - visits had no engineering bias - were not relevant to the course.

Please suggest other study visits that might have been valuable:

most of the participants stated that they would like to see where computerized maintenance and store keeping systems are implemented on a practical basis; wanted to see coal plants; study visits were sufficient; enterprises that should be visited: Lancashire Steel Wire, Salwine, Thornbul, Harare; visits to more modern companies that have a computerised system would have been more interesting.

8. What do you think of the general level of the training?

Much too high	0
Too high	1
Adequate	14
Too low	0
Much too low	0

Comments to 8.:

participants pointed out that they won't be able to use all parts that they have learnt because of the bad communication (Ethiopia). level was adequate - was an eye opener - participants did not know what planned maintenance and materials management entailed: more practical bias needed (Kenya, Zambia, Zimbabwe).

- 9. Which subjects of the programme did you find most valuable? (Please state reason: for example, new subject, my specialty, relevant to my work, new information, etc.).

<u>Subject</u>	<u>Reason</u>
Planned maintenance and material management	relevant to work, new information (stated by nearly all participants)
inspection of spare parts and and computerised inventory system	relevant to work, time saving
coding maintenance schedules	new information,
purchasing	relevant to work, new subject
organisation/communication materials classification	ZISCO (Zimbabwe) needs much of this relevant to work

- 10. Which subjects of the programme did you find least valuable? State why (for example too elementary, inadequate instruction, irrelevant to my work, etc.).

<u>Subject</u>	<u>Reason</u>
goods handling in stores	other participants had knowledge (Ethiopia)
material management	not directly relevant to job but good to have learnt about it not properly presented
communications	too elementary
store keeping, purchasing	irrelevant

- 11. Were there in your opinion any relevant subjects that were not adequately covered in the programme?

Yes	11
No	4

If yes, what did you miss?

Practical exercise, more facilities (Kenya, Zambia, Zimbabwe); technics for qualitative maintenance ways to reduce foreign purchase - maximization of local purchase through PTA member countries, technical supervision and workshop management (Tanzania); computer programming, planned maintenance - more time should have been spent on how to plan a job, how to plan a major shutdown, how to use the computer as an aid to meet maintenance objectives (Zimbabwe).

12. Which changes would you have preferred in the methods of instructions?

	<u>no changes</u>	<u>more</u>	<u>less</u>
a) lectures	10	2	3
b) group work	4	11	0
c) demonstrations	2	12	1

Comments:

demonstration were not many, intensive lecturing should cover as much time as possible, more group work (Ethiopia, Kenya, Tanzania, Zambia); lectures well presented, ideas exchanges, but language barriers, more demonstrations on largescale with practical situations, case studies (Zimbabwe).

13. How did you find the general standard of the instructors with respect to:

	i) <u>command of English</u>	ii) <u>method of instruction</u>
Very good	2	3
Rather good	1	3
Fair	10	9
Poor	2	0
Very Poor	0	0

Comments:

in general participants could follow instructors, sometimes difficulties to get meanings of the words, instructor had difficulties to speak fluently in English (Ethiopia, Zambia, Zimbabwe).

14. Did you have sufficient time for professional exchange of views with:

	i) <u>the programme staff</u>	ii) <u>fellow-participants</u>
Yes	8	12
No	4	3
No comment:	(3)	

15. How much did you benefit from the these exchanges of views with:

	i) <u>the programme staff</u>	ii) <u>fellow-participants</u>
A great deal	2	5
Much	8	7
Somewhat	5	3
Little	0	0
Not at all	0	0

Comments:

participants could gain from ideas exchanges with the others, could get to know problems faced by the others, could have been enhanced through more practical exercises. programmes staff did not give adequate information about their own work situations on regards to maintenance engineering.

III. Relevance and Applicability:

16. Did you find the contents of the programme relevant to conditions in your company (institute)?

To a very great extent	7
To a great extent	7
To a sufficient extent	1
To a small extent	

Comments:

maintenance schedules have to be finished (Kenya), company is an iron & steel company - wants to have a well planned maintenance system, spare parts control - introduction of computer (Tanzania); content of programme relevant to company because it is developing a computer system (Zambia); planned maintenance is the thing of the moment and the future, ZISCO needs planned computerised maintenance and material management - much improvement if contents of programme are pursued (Zimbabwe).

17. Do you feel that by participating in this training programme you have benefitted professionally?

To a very great extent	6
To a great extent	8
To a sufficient extent	1
To a small extent	0
To a very small extent	0

Comments:

yes, instructors promised that participants can contact them in case of problems in practice. now able to analyse causes of breakdowns (Ethiopia, Zambia), training can be improved through utilization of computerized maintenance, gathered information, gained a lot of structural organization of the central workshops, plant inventory and materials classification. most ideas will facilitate work and bring interest. 100 % planned maintenance system needed (Tanzania, Zimbabwe).

18. Do you think you will have an opportunity to apply your newly acquired knowledge and experience in your present job?

To a very great extent	2
To a great extent	4
To a sufficient extent	7
To a small extent	1
To a very small extent	1

What difficulties, if any, would you expect to meet?

insufficient documentation, staff - lack of appreciation and job description - bad communication (Ethiopia), proper checking of machines. setting up the system a proper planning unit, equipments and aid for execution (Tanzania, Kenya), company has another system - difficult to adopt new knowledge, supervisor will determine the extent of application, participants not in the position to decide which system has to be used, personnel won't comprehend inspection instructions (Zambia, Zimbabwe).

19. Will you be in a position to transfer your acquired knowledge to others in your home country?

To a very great extent	2
To a great extent	7
To a sufficient extent	5
To a small extent	0
To a very small extent	1

20 How will this transfer be done?

- a) In a day-to-day work to colleagues and subordinates: 12
- b) In specific training activities inside present employment: 3
- c) In specific training activities outside present employment: 0

What difficulties, if any, would you expect to meet?

difficulties if people will have to do more work in addition to their routine job, difficulties - supervisor decides which system should be used (Kenya, Tanzania), no problems - supervisor wanted the participant to attend the course, ZISCO has already the system (Zimbabwe).

IV. Social Aspect of the Programme:

21. Please state your opinion about the leisure time activities organized by the programme staff:

well organized, visit to enterprises and historical places; duration too short - most time they were travelling; not sufficient to get to know more about the Host country; poor arrangements for trips - no bookings in the hotels were arranged for ZISCO members (Zimbabwe); visits to Harare and Clinhoy caves very well.

What additional activities would you have appreciated?

sports facilities, more entertainment and visits, trip to Victoria Falls, lack of television and radio - no opportunity to listen to the world news, camping trip during week-end.

22. Please give any comments to choose on aspects not adequately covered by this questionnaire:

instructors should be given copies of nonforms (annexes) of participants to have a good orientation about participants (Ethiopia); participants should be of the same level, follow-up seminar should cover former participants to review their progress (Tanzania); name of programme should be changed to "Organisation of Industrial Maintenance Systems for Strategic Plants of PTA countries" - this would cover all industries, not only Iron & Steel Plants (Zambia); follow-up programme to acquaint participants with planned maintenance and materials management system, feedback to the instructors should be given, visit to iron & steel plants in developed countries.