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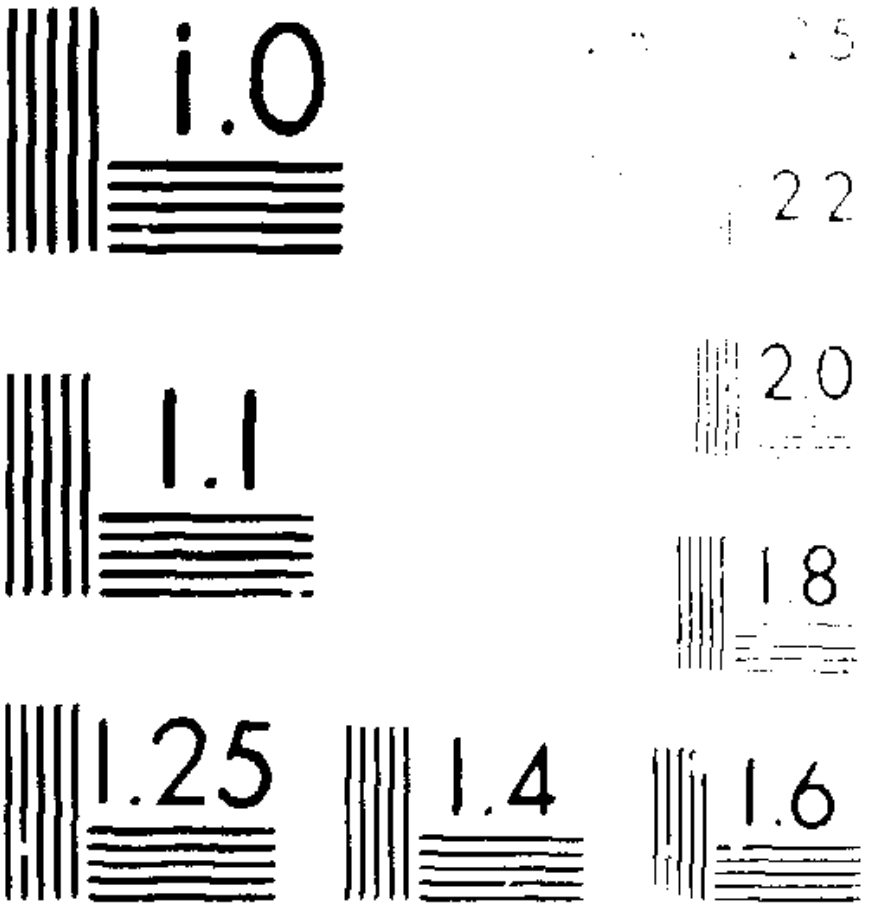
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10 August 1982
English

ASSISTANCE TO THE EGYPTIAN IRON AND STEEL COMPANY (EISCO)

SI/EGY/81/801

F I N A L R E P O R T

Prepared for the Government of Egypt

Based on the work of G.W. Duncan, UNIDO Expert

CAIRO - EGYPT

CONTENTS

A. OBJECTIVE

B. INTRODUCTION

1. Kit
2. Organisation
3. Personnel
4. Operation
5. Maintenance
6. Planning
7. Spares and Stores

C. CONCLUSIONS

D. RECOMMENDATIONS

OBJECTIVE:

To improve the production operations of the basic metallurgical shops in the Egyptian Iron and Steel Corporation specifically to:

a- Improve the standards of maintenance techniques in the shop with special reference to the working of the waste heat boilers.

b- To formulate the technological instructions on the same.

c- Provide on the job training to cover the above specific areas.

INTRODUCTION:

1.1 The plant consists of 3 x 80 ton convertors equipped with forced circulation waste heat boilers and wet gas cleaning plant. Three accumulators are used to stabilize the pressure into the steam network at 10 atm abs. The boilers generate saturated steam at 47 atm abs.

2.2 The steam from the waste Heat Boilers is fed into the works steam network at an average design rate of 35 tons per hour. It is considered to be a main source of steam. On the project design it was calculated to supply 602×10^3 tons annually which amounts to 45% of the total works steam requirement.

1.3. Feed water to the Boilers is fed from the works water treatment plant and the chemical condition of the feed water is the responsibility of the laboratory in this department as is the analysis of samples of boiler water which are sent to the laboratory by the Boiler Engineer.

1.4. The total package of kit under the responsibility of the Senior Power Engineer for both operation and maintenance is:

a) Three Waste Heat Boilers

b) Four circulating pumps per boiler.

c) Three gas cleaning systems.

d) Three accumulators

e) Three Exhauster fans

f) Three lance cooling pumps

g) The oxygen system in the shop.

h) The natural gas system in the shop.

i) The compressed air system in the shop.

j) The mixer.

1.5. A separate department responsible for water treatment operates and maintains two settling ponds to clarify dirty water from the gas cleaning plant.

2. ORGANISATION

2.1. In order to undertake the work of maintenance and operation on the boiler and auxilliary plant the Senior Power Engineer has a staff of 2 engineers,one covers maintenance, the second is responsible for operation.
Both cover for each other during time off.

They control:

10 craftsmen + 10 helpers on the Boilers

10 " + 10 " on rotating plant

10 " + 10 " on gas and water systems

10 welders who with 5 helpers are flexible to cover the complete kit.

15 operators per shift are spread across 3 control rooms,these being the boiler, exhauster fans and the accumulators.
A Chief of shift is included in the 15.

2.2. The boiler water treatment and gas cleaning water clarification is serviced by the Power Sector.See Appendix 1.
Four separate sections from this Sector are involved.
The General Manager for Steam, Air, Chemical Water Treatment, Oxygen and Acetylene is responsible for the boiler feed water purity and rate of supply. The General Manager, Water being responsible for the operation and maintenance and purity of water from the settling ponds. He has an Engineer to cover maintenance and a separate Engineer for operations. The water purity is controlled from the Water Treatment Laboratory.

3. PERSONNEL

3.1. The Engineers are all highly qualified and are very competent technically but lack confidence to undertake some jobs without the assistance of their colleagues.

3.2. The craftsmen are a willing team who work hard in a breakdown situation but convey that the rest of the time life should be easy.

3.3. The Engineers have no confidence in their colleagues who service or maintain the other parts of the total kit, e.g. It is three years since water treatment was last done on the Boiler because the chemists and boiler engineers could not agree the accuracy of the results.

3.4. The boiler operators have become sloppy and a questionaire has been written to sharpen them up.Appendix 2.

4. OPERATIONS

4.1. The operation of controls is mostly done by hand control. The automatics have not been used in a number of years. Only token attempts are made to try and re-establish them.

4.2. Operators have been allowing the control of the boilers to wander outwith normal safe working parameters, e.g. Water levels being allowed to rise or fall out of sight of the top or bottom of the monitor. Feed water valves are being opened full from the shut position or closed from the full open.

4.3. Routine duties normally associated with good boiler practice are not being carried out, e.g. no water samples, no log sheets, gauge glasses are not operable and alarms are not tested.

5. MAINTENANCE

5.1. The plant is now 10 years old and maintenance, if the past three months has been the norm, has only been done in the panic of a breakdown. During which time they work straight through, sometimes 32 hours at a stretch to get the item of plant back into life.

5.2. During breakdown the three senior engineers stay in attendance in order to render assistance by comparing opinions.

5.3. The craftsmen team attending a breakdown is often as many as 10 to 12 men. This is extremely wasteful in terms of labour. However, because of the nature of tools used it become necessary for the team to take turns at working and resting.

5.4. A test of the spray water on no. 3 Converter gas cleaning plant revealed that 50% of the nozzles were not lined up properly to be effective and they all required cleaning.

5.5. Drain valves on the boilers were passing so badly that it is reckoned that 25 tons of water an hour is passing straight through the boiler to waste.

5.6. The time allowed for boiler maintenance is governed by the time it takes to re-line a vessel. This is generally insufficient time to put right all the known problems and the vessel goes back into production to be forced off at some stage of the campaign to carry out a panic repair.

5.7. There is no statutory requirement to carry out boiler inspection as there is in the United kingdom.

5.8. The settling ponds for the gas cleaning plant dirty water are not well maintained. Several centimetres of sludge has been allowed to accumulate in the outlet flume and an uneven build up of solids on the top of the weir causes uneven velocity across the pond and inefficient clarification.

6. PLANNING

6.1. There has been no system of planned maintenance used in the past. A department does exist to perform this function together with arranging spare parts. There is no evidence of any assistance from this end and if anything they are a hindrance. The Senior Power Engineer is having to spend too much of his time fighting to justify his needs to the planning Engineer. It is obvious that the lack of boiler maintenance experience of the planners prevents them from being effective .

6.2. No attempt is made to assess the rate of thinning of hood tubes in order to prevent bursts during steelmaking .
Tubes bursting are not seen as a major problem. There have been no stoppages during the past three months due to tubes bursting.

6.3. There is no formal system of keeping records of maintenance carried out. A plan for one year's maintenance of the total kit has been formulated. see Appendix 3.
Sufficient time will be necessary to carry out this work but with so little plant history to build on it is impossible to estimate with any degree of accuracy. One thing is certain, if they are forced to continue in the haphazard ways of the past, the boilers will end up more often off than on.

7. STORES AND SPARES

7.1. An inspection of the stores revealed that the bulk of the stores items are probably there because they have never been needed in the past and will seldom if ever be needed e.g. all manner of files, screwdrivers, taps and dies and ring spanners in the wrong range of sizes for the steel plant etc.

There are no spare bearings, pump impellors, gland sleeves, valves or the general parts that are known to require replacement.

7.2. There are no chemicals for the water treatment of the boilers and it will take two months for any to be made available.

7.3. The tools available to the craftsmen are useless by today's standards, e.g home made hammers, open ended spanners. There should be impact wrenches for dealing with nuts, hydraulic pullers and jacks to remove couplings and bearings and to aid the alignment of heavy plant.

8. CONCLUSIONS

8.1. The overall picture of the Waste Heat Boiler and Gas Cleaning plant is one of despair.

For a variety of reasons the plant is now an embarrassment to all who are involved with it.

In its present condition the boiler is a liability.

The losses from leaking valves are of such proportions that when on natural gas firing there is insufficient heat to make steam at a suitable pressure for use on the plant. The pressure falls to 8 bars from a designed 35 bars.

This condition could be partially avoided if the exhaust fan was reduced to half speed and the butterfly valve to control the draught was made operational at times of natural gas firing. Leaving the fan at maximum speed is drawing in sufficient air to cool the gasses to less than half their useful heat.

8.2. All three boilers are knownto require a complete set of new valves. The existing valves are all suspect. The Drains system makes it impossible to establish the valves which are passing and those which are tight, if any .

8.3. The lack of water treatment for three years has probably shortened the life of the boilers. It is impossible to estimate by how much. Thought should be given to drawing up plans for the replacement of the boilers.

8.4. The three lance cooling water pumps have each in turn had panic repairs in the past three months. Now there are no spares and difficulty is found in getting replacement parts.

8.5. Instruments which break down are left off and are seldom repaired. The reason given is again no spare parts.

8.6. The economiser on No. 2 Boiler is past repair and will involve a major plant stoppage once it is decided on what alternative replacement to choose.

8.7. The organisation of Engineers associated with the care of the Boilers needs to be considered. The Senior Power Engineer is the Engineer directly responsible for the boilers. A tremendous gulf exists between him and his colleagues from the other departments who should be providing him with a service, e.g. Water treatment and analysis etc. They are part of the organisation responsible for the boiler and as such should be seen to be of more direct help.

There should never be a situation where it is possible for plant to be neglected for three years because men cannot agree.

8.8. There are more than sufficient men to keep on top of all the tasks arising to maintain and control the boilers properly. The shift teams are not fully utilized and a shift work schedule needs to be produced.

8.9. There is a big discrepancy between the volume of feed water as measured at the water treatment plant and as measured at the Boilers. Differences such as this require to be sorted out before sense can be made of the operation.

8.10. The gas cleaning plants have proved adequate in the past and only during the past nine months have they become a problem. One of the reasons for this problem has been the poor quality of lime. Lime dust being carried over in the waste gasses when mixed with water solidified and blocked the venturies. The method used to clean this condition, pneumatic hammers and high pressure water, had misaligned the water jets to such an extent that 50% were directed in such a manner as to be useless.

8.11. The time allowed to undertake this abnormal work load was never sufficient and the gas cleaning deteriorated with each campaign. Extra time is now being allowed and the gas clea plant should be restored to its former efficiency.

8.12. The settling ponds associated with the gas cleaning plant are now clarifying the water effectively. The position three months ago was that no floculant or coagulant was being added and the clean water return to the gas cleaning plant was slowly becoming mud. The water is now being clarified from 5930 mg/l to 48 mg/l. the design level. This muddy water, when it was being .

used for gas cleaning could have been a significant factor in the blocking of the gas cleaning venturies. The solids precipitating out onto the hot surfaces. Although this water is now clean there is a question of whether the chemical used to assist clarification may in fact be being carried over in the water and thus causing precipitation problems. The chemical supplier should be brought in to eliminate this doubt.

9.RECOMMENDATIONS

9.1. The boilers are now 10 years old. The apparent lack of proper maintenance over the years suggests that they now require a proper examination to determine corrosion in the drums and boiler tubes. Attempts were made to try ultrasonic testing but the interest died when the proper equipment was not ready to hand.

The Department responsible for undertaking such work should be more accessible to the Boiler Engineers and a demonstration of the technique should be arranged.

9.2. When failures occur photographs should be taken to have on record a suitable report of the failure.

9.3. The other functions who make up the team who have an interest in the Boiler i.e. the engineer responsible for water treatment, settling ponds, steam usage and instrument maintenance should have a formal communications system in order to discuss the contribution each makes towards keeping the plant in good repair.

9.4. The operators should be given a more definite remit. The type of job they do is boring and they require some stimulus to keep them interested. Log sheets should be established to get them on the move every hour and would be a system of keeping records as well as making sure that the operator did actually look at the control board.

9.5. The Operations Engineer should devote more time to ensuring that the plant is being operated as it was intended. All of the automatic controls are inoperative and a major effort should be made to re-establish them.

9.6. To utilize the craft force to better advantage the shift team should be reduced to the bare minimum. They would undertake a routine schedule of work, e.g. checking glands on valves and pumps etc., and repairing valves as required in the workshop. A second group would undertake planned mintenance and a third group to be recognised as the breakdown gang. The groups should be flexible and interchangeable.

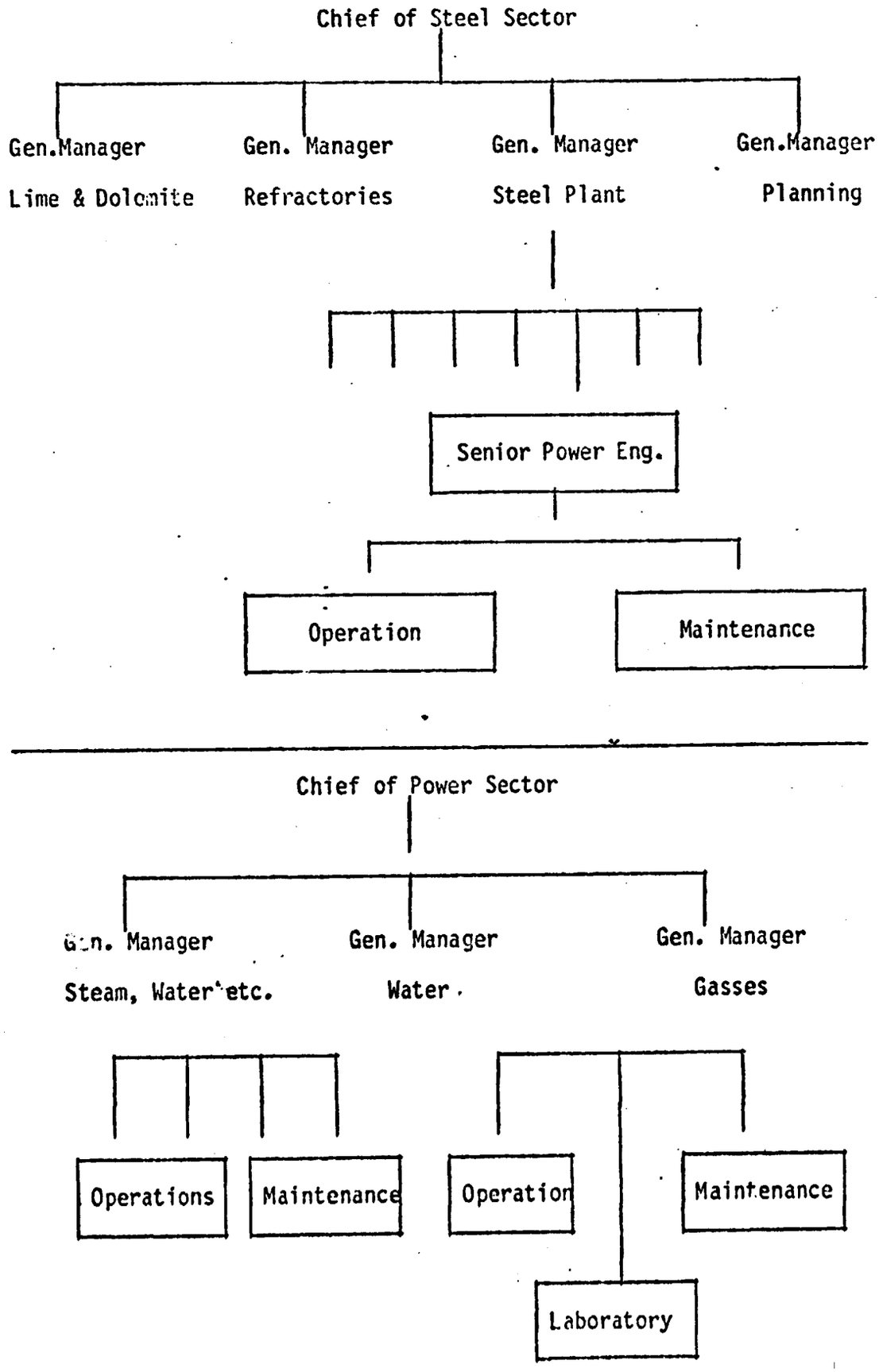
9.7. Modern tools should be purchased in order to speed up the work. A hydroulic test rig should be purchased to enable valves to be tested for tightness following their repair.

9.8. Valves once repaired and tested should be stored in an orderly manner on suitable shelves or racks.

9.9. More responsibility should be given to the foreman. Too much of the engineers time is spent standing over jobs so that he is on hand to offer advice or make the decision for the foreman.

9.10. Above all there is a need to keep records and to get the planning department to be more effective.

APPENDIX 1.


Chief of Steel Sector
Gen.Manager
Lime & Dolomite
Gen. Manager
Refractories
Gen. Manager
Steel Plant
Gen.Manager
Planning
Senior Power Eng.
Operation
Maintenance
Chief of Power Sector
Gen. Manager
Steam, Water etc.
Gen. Manager
Water
Gen. Manager
Gasses
Operations
Maintenance
Operation
Maintenance
Laboratory

APPENDIX 2.

Water

1. How many water level alarms and level indicators are on the boilers?
2. What is the pressure of the feed water going to the Boiler?
3. Where are the Boiler feed pumps situated?
4. When filling a boiler, feed flow should be strictly controlled, why?
5. What should the water lvel be in the boiler before the circulating pumps are started?
6. How is the feed water into the boilers controlled?

Boiler

7. What important procedure must be carried out before the boiler is flashed up?
8. Which damper must be opened and where is it situated?
9. Which fans must be running before the natural gas burners are lit?
10. What is the purpose of interlocks on the boilers?
11. How do you check the interlocks?
12. What sequence test is carried out with the co-operation of the production foreman?
13. Name the valves after the boiler stop valve?
14. What pressure must the boiler not be allowed to drop below when on natural gas firing?
15. What pressure does boiler reach when at peak of blow?
16. Why must the air release valve be opened before flashing up a boiler?
17. When can the air release valve be closed?

APPENDIX 2 (Continued)

18. When a boiler is being depressurised, at what pressure should the air release valve be opened and why must it be opened?
19. What is the continuous blowdown and why is it required?
20. At what pressure does the boiler safety valves lift?
12. How many safety valves are there?
22. What is the steam from the Boiler used for?

Fans

23. Where are the exhauster fans situated and who starts and controls them?
24. Where are the forced draught fans situated?
25. If an exhaust fan trips for any reason what happens to the forced draught fan and the natural gas?

General

26. How does the Boilerman cancel a blow in an emergency?
27. Who do you contact before using extra feed water?
28. Why is it necessary to take water samples?
29. Why is it necessary to chemically charge each boiler independently?
30. Why must gauge glasses be blown through and how is it done?
31. Describe the gas and water flow through the boiler?

STEAM ACCUMULATOR

Appendix 3.

	No. 1 Internal	No. 2 Internal	No. 3 Internal	No.1 Pressure ReduceV/V	No.2 Pressure ReduceV/V	No. 3 Pressure Reduce V/V	No. 4 Pressure ReduceV/V	Dump V/V	Pressure Clearing V/V
Jan.		x							
Feb.			x		x		x		
March	x							x	x
April				x		x			
May		x			x		x		
June			x					x	x
July	x								
Aug.				x		x			
Sept.		x			x		x		
Oct.			x					x	x
Nov.	x								
Dec.				x		x			

E I & S Co.
Steel Shop
Boiler Dept.

BOILER PLANNED MAINTENANCE

Gas Cleaning Unit		Descending Pass	Ascending Pass		Steam Valves		Drum.			Blow Down valves		Feed Water Valves				Salt Section			Clean Section				Equipment
Primary Sprays	Secondary Sprays		Burner Nozzles	Heat Insulation	39	38	Internal Testing	Chemical Valves	Safety Valves	126 & 127	42 & 43	7 & 8	3 & 6	2 & 5	1 & 4	Ascending Pass	Secondary Evaporator	First Evaporator	Left Screen	Right Screen	Back Screen	Front Screen	Year
																							January
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