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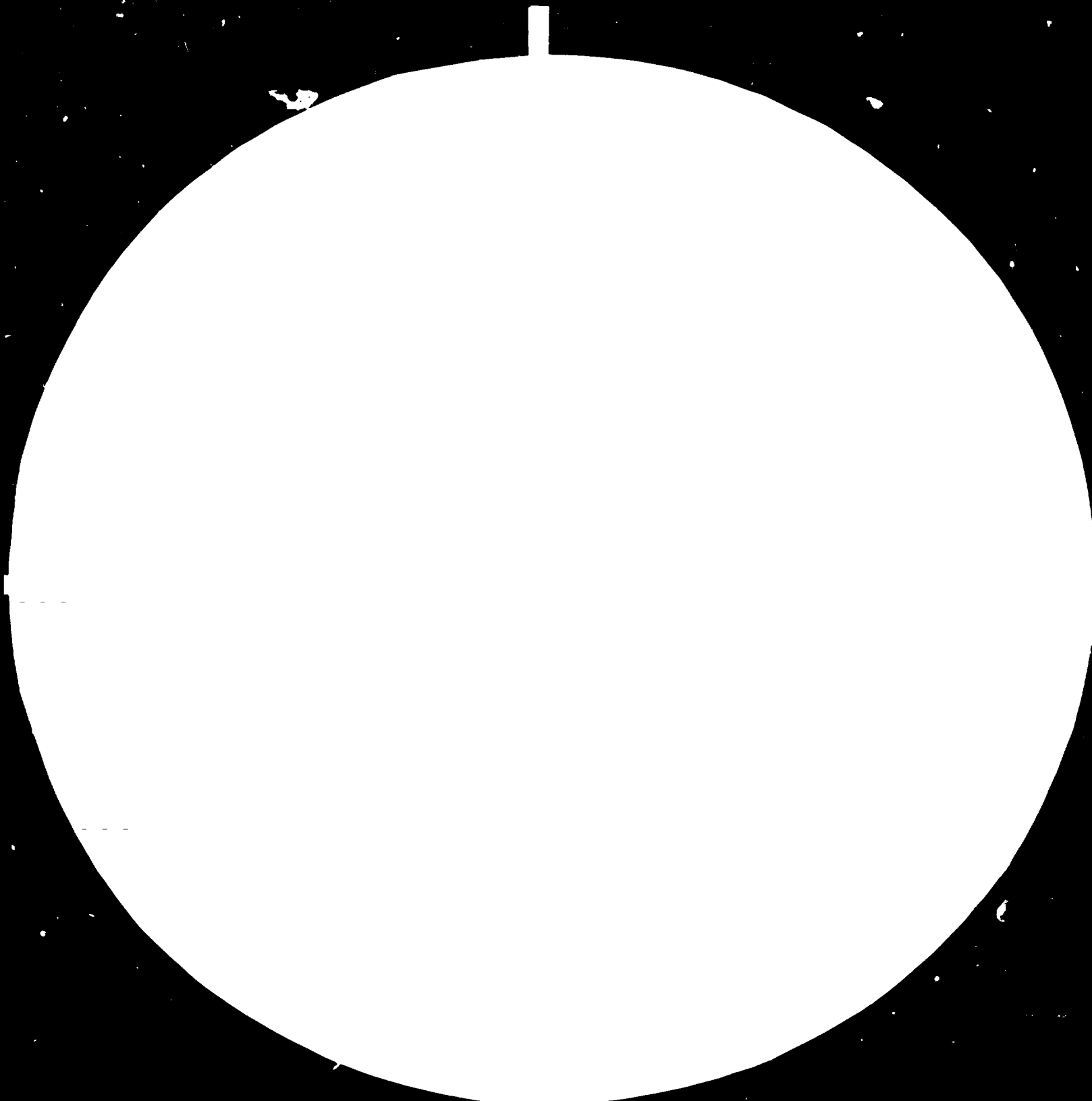
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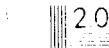
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DP/ID/SER.A/259
7 November 1980
English

INVESTIGATION OF PRODUCTION OF CONTRACEPTIVES

SI/CUB/75/808

CUBA

Technical Report: Review of equipment maintenance in
the pharmaceutical industry*

Prepared for the Government of Cuba
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Ian M. Maclean,
expert in the production of contraceptives

United Nations Industrial Development Organization
Vienna

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ABSTRACT

The expert was sent on mission to Cuba as part of the project "Investigation on the Production of Contraceptives" (SI/CUB/75/808) of which the United Nations Industrial Development Organisation (UNIDO) was the executing agency.

The duty of the expert was to review and evaluate the work carried out in Cuba based on the recommendations made by UNIDO mission in 1978; also to make recommendations to the government on further action which might be taken.

Some reasonable progress has been made on the previous recommendations particularly with regard to training, but until the people are available who have benefitted from training and until a greater measure of priority is given to staffing, the maintenance function progress will be slow.

The management structure still needs to be more clearly defined as well as the delegation of responsibility and a greater effort will have to be made to identify maintenance problems, to use more effectively procedures already existing and to expand them to ensure a more positive approach to the reduction of stoppages.

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INTRODUCTION

Arising from the project "Investigation of the Production of Contraceptives" (SI/CUB/75/808) commissioned in 1975 two experts visited Cuba for the months of February and March 1978.

A technical report was prepared for the Government of Cuba under the title "Equipment Maintenance in the Pharmaceutical Industry and Oral Contraceptive Production". This was published on 4th July 1978.

In July 1979 the Government of Cuba requested that a further mission should take place in connection with the maintenance aspect of the report. It took place between mid-May and Mid-June 1980.

The objective of this visit (Annexe 1) was to review progress with regard to recommendations in the report of July 4th 1978.

Prior to the arrival of the expert in Havana a "Working Programme" (Annex 1) had been drawn up. This included visits to factories and a training institution, and to workshops of the Maintenance Enterprise, also talks, discussions, and detailed examination of organization, operation, and workshop layout associated with maintenance and project work. The programme was assumed to be flexible and although many changes were made the substance of it was covered.

I. PROGRESS ON PREVIOUS RECOMMENDATIONS (Engineering).

1. A modification to the engineering organisation structure would be beneficial.

The structure is still under review and some internal discussions have already taken place. The importance of unified control is again emphasised.

2. An industrial engineer should be employed to study and improve methods of operation, materials handling and cost reduction.

An Industrial Engineer has been engaged for the Reinaldo Gutiérrez complex and this is a good step forward.

3. A more positive control of maintenance at all establishments is required. This includes costing methods and the provision and use of control information. The procedural paperwork in use is acceptable at present but this could be improved in the future.

Little progress has been made and more detailed discussion has taken place. Recommendations have been made. A "reconstruction" of the accounting system is taking place on a national scale.

4. The understanding and use of air-conditioning and ventilating systems must be developed.

No physical development has been seen but a senior engineer has spent six weeks in Hungary gaining experience on the design and operation of air conditioning and ventilation equipment as well as other engineering interests.

5. In-plant training of engineering personnel already in the factories

should have a high priority and should be linked with basic college training a theoretical and practical nature. There is a growing need for more professional engineers and technicians.

As mentioned in the following report a course is under way for training mechanical people.

Clearly some progress is being made and it is hoped that this will be a continuing source for providing mechanical staff with sufficient theoretical and practical knowledge not only to diagnose and rectify faults and failures in equipment but to bring to bear a constructive understanding of the importance of reducing machine down time. The need here is fundamental.

6. Professional engineers particularly in the pharmaceutical industry, should be given more industrial experience.

The value of such training at senior level is appreciated but there are difficulties about sending these managers overseas. However, efforts are being made in this direction as referred to in the report. Whatever can be done will certainly make a valuable contribution to the improvement of standards of operation and of manufacture.

7. Closer attention must be paid to the ordering of machinery to ensure that it serves the purpose for which it is intended.

The writer believes this is now fully understood.

8. Standards of hygiene are not good and can be improved in most of the places visited. The attitude of management needs to be changed, with support from the highest levels.

Following a visit to the Reinaldo Gutiérrez factory it is clear that little progress has been made and this is an area which is of primary importance in any manufacture of pharmaceuticals. Further reference is made in the current report.

9. Further rationalization of products and manufacturing sites is desirable.

Some steps have been taken towards better concentration of resources.

The advantages are appreciated and further plans are in hand but up to date only a little has been achieved.

11. Copies should be purchased of Good Pharmaceutical Manufacturing Practices, 1977, published in English by Her Majesty's Stationery Office in London.

Copies had not been obtained and one has now been handed over to the Vice-Director (Technical) of the Maintenance Enterprise.

THE MAINTENANCE FUNCTION

2 Organisational Structure.

The workshops of the Maintenance Enterprise and the Reinaldo Gutiérrez Factory were visited. Detailed discussion took place with regard to previous recommendations and the current situation.

The management structure has not changed noticeably since 1978 and reference is made to the previous report of 4th July 1978 and to recommendations 1 and 3 referred to under Organisational Structure on pages 8 and 9. The intention here was to ensure that by unified technical and administrative control of engineering good common standards would be maintained and also to ensure that there should be adequate communication between all areas of engineering operation. A close association between the departments of engineering and training is essential so that by selection and training the whole engineering operation is adequately staffed. The maintenance and projects functions should be consulted on all machinery purchases.

It is understood that the recommendations with regard to developing the maintenance capability at the manufacturing sites has been accepted in principle but it would appear that there is no clear cut policy with regard to division of responsibility between the sites and the Maintenance Enterprise. This is necessary for efficient working and to ensure that proper records are kept on costs and machine history.

Annexe III shows the line responsibilities in the Maintenance Enterprise, and here the Director has the workshops directly responsible to him although clearly the Technical Vice-Director will handle the technical,

and most administrative matters. It is recommended that the Technical Vice-Director should be fully responsible for the workshops.

An establishment list should be in existence for the whole engineering operation with a breakdown into departments and the various disciplines and when this has been approved it should not be changed except at the highest level. If people move they should be replaced as soon as possible.

In the course of a detailed examination and discussion on the technical administration of the Maintenance Enterprise and having in mind the problem of liaison between factory engineering and the Maintenance Enterprise a helpful suggestion was made by the Technical Vice Director.

This was that some of the time of his senior mechanical engineer might be made available to set up a contact with the senior engineer and head of production at the factories. This would be establishing the functional link referred to in the previous report and could provide advice which would anticipate maintenance failure and improve machine availability. The extension of this contact to the projects department to provide a two way flow of information would also be useful.

It was also noted that because of separate maintenance workshops there is a man in charge on each site.

Annex III shows the control of metrology straight to the Director although in fact it is administered by the Technical Vice Director.

The following list shows the people responsible to the Technical Vice Director..

T.V.D. ----- Secretary

- | | |
|--------------------------------|--------------------------|
| (1) 1 Senior Mechanical Eng. | Head of 1st.
Workshop |
| (2) 1 Preventive Maintenance | |
| (3) 1 Refrigeration Technician | |
| (4) 1 Electronics Technician | |
| (5) 1 Industrial Engineer | |
| (6) 1 Draughtsman | |
| (7) 1 Office Junior | |

Position 3 and 4 have been vacant for some time and position 5 has been established in recent months but is still vacant. The department is therefore operating well below its potential.

The Workshops

Maintenance Enterprise Workshops are sited in two widely separated areas of Havana. On one site the crafts of welding, sheet metal, electrical, mechanical, plumbing and carpentry are carried out and this includes specialist work on air conditioning and refrigeration. Some maintenance work, development and installation are all a part of the responsibility of the Maintenance Enterprise.

On the other site is a workshop where the replacement parts for machinery in various (approximately 18) manufacturing units of the industry are made on the usual machine tools and supporting equipment. The storage for materials is situated a short distance from the workshop.

In the near future the electrical repair work is to be moved to a position already allocated in the workshop.

The day to day scheduled maintenance and the planned maintenance is carried out by factory maintenance sections having a group of semi skilled mechanical and electrical people. Specialist support is given as required by the Maintenance Enterprise but there is a view that the cross flow of information from the factories is inadequate with regard to enabling the Maintenance Enterprise to provide the best possible service. The writer understands that a few years ago a system of recording and communicating maintenance information existed but some of the

people doing this work moved or were moved. It is also understood that a few technical administrative people have gone from the main workshop.

It would seem to be essential that more technical people should be reallocated to assist the Head of the Workshop with the substantial extra-load arising from the requirement of spare parts now being ordered by the factories.

It has been stated that about 60% of the workshop loading is associated with machine breakdown, which is an indication that maintenance is not as effective as it should be. It is appreciated that, while this figure should be cut by more than half it will have to be a gradual process over the next 2 or 3 years and it has been noted that in some areas positive steps are being taken towards an improvement although possibly not fully coordinated. Time has been spent on examining and discussing the role which the Maintenance Enterprise and the workshop in particular will be expected to play in the manufacture of spare parts for the various factories. Discussion included the organisation, staffing, and machine requirements for the extra load on the workshop.

It seems clear that technical staff previously referred to as having gone will have to be replaced, but it will be realised that if there is any concern with regard to the extra cost of these people it was previously recommended that not only could maintenance costs be reduced but "hard" currency expenditure would be much lower if more manufacturing of parts and equipment could be done in Cuba. It is therefore gratifying to hear that the factories are now providing the Maintenance Enterprise with their estimated spare part requirements on an annual basis.

Because of the expected increase in the load on the workshop it will be necessary to consider not only the increase in throughput as far as

the machine tools are concerned but also the technical and administrative support which will be necessary for proper planning and progressing. Another draughtsman will be required and two or three technically qualified people referred to later, to assist the Head of the Workshop with the administrative work preparatory to issuing manufacturing instructions to the shop. This refers to the estimating of machine times, estimating the quantity and specifying the quality of material to be used, and preparing a machine plan for routing the article through the workshop.

It was accepted that for the first two or three years the staff requirement may be higher than would be necessary when a stock of drawings and processing records has been built up. A final decision on the staffing needs to cover the initial load and for subsequent operation would be taken by the head of Engineering.

We have considered workshop capacity and since the hours worked are at present 07.00 to 15.00 there should be no problem - indeed another shift would improve the machine utilisation.

Some concern, however, must be expressed with regard to the age of some machines. This varies, it is understood, from 7 or 8 years to 50 years. As stated in the previous report, age alone is not a reason for discarding a machine, but with lathes and milling machines a stage is eventually reached where wear on certain parts can only be rectified by the manufacturers and at considerable cost even if they would be prepared to do the work. For example, when wear takes place on the head, tail stop, and bed of a lathe the accuracy is impaired, and considering the age of some of the machines the workshop people produce some very creditable results.

It is not being suggested that the Ministry should immediately embark

on a heavy expenditure programme, but it would be wise, before more serious wear takes place, to plan a replacement of the oldest machine over the next few years, priority being agreed with the engineers. In a very general way good quality machine tools should, with care, give good service for up to 20 years - sometimes more if not heavily used. It is understood that a plan is under discussion and that one new lathe and milling machine may be obtained next year. A small grinding machine for obtaining an accurate polished finish would be useful.

Returning to the question of staff, it is important from the point of view of planning machine load that a record of machine times should be built up and that a person be employed for this purpose. Even if an experienced person is not available records can be gradually built up over a year or so by an unskilled person from the times actually taken on the various machine operations and experience will be gained at the same time.

Another one or two people should be available to operate and coordinate a system which will ensure that every part ordered is fully identified by a code which will also ensure that when another similar part is ordered all manufacturing information is immediately available. It will also be useful to ensure that a group of machines are kept on repetitive spare part work while some machines are set aside for breakdowns (in view of 60 % breakdown maintenance) This will confine interruption to a specific group and avoid more general disruption.

Some detailed discussion took place on workshop planning and some of the documentation was examined but time was not available to assist in the preparation of further paperwork. It is understood that some documentation existed previously but has lapsed through loss of staff. It is also believed

that the objectives are fully appreciated and that the capability exists to introduce the appropriate records and procedures.

When the spare part estimates are obtained from the factories it could save time later if the less straight forward orders are set aside so that any special requirements such as drawings, technical information, special materials, etc. are available before the order is passed into the workshop.

Safety of the workpeople should be a major consideration at all times, not only with regard to the work itself but also in providing a satisfactory environment. It was obvious that the workshop is already somewhat congested. It was noted that goggles could be used to a greater extent.

There is an intention to start building up a second shift in the near future and not only should plans be made for extra machine operators but also for adequate supervision as this might be more difficult to provide.

It must be understood that the Maintenance Enterprise and the workshop are embarking on a major manufacturing programme and in the first year many administrative and technical problems will arise requiring "on the spot" solution. The question of priorities is likely to be one of the most common.

Earlier reference was made to the fact that the Maintenance Enterprise operated from different sites at some distance apart. It is appreciated that there may be difficulties of cost and availability in considering the possibility of finding a single site of suitable size. As mentioned in the earlier report there are obvious advantages and savings in

rationalisation wherever this is possible.

Some detailed discussion on this time took place with representatives of maintenance and projects departments, and workshop layout and maintenance techniques and technology were prominent in this discussion.

It was suggested that at least the related work of the Enterprise such as Welding, Sheet Metal, Electrical, Electronic and Instrumentation, Mechanical, and Machine Tools should be brought together on one site along with offices for control and administration and storage of tools and materials. Anticipating this possibility, an outline sketch was drawn showing a proposal for a workshop layout with the various disciplines and offices in relationship to one another and with an indication of services such as lighting and ventilation.

A meeting was organised to talk about maintenance and to discuss some of the problems. Seven people attended including the Director of Reinaldo Gutiérrez, heads of maintenance in other enterprises, representative of the projects department, Technical Vice Director of the Maintenance Enterprise and an Electrical Engineer.

The meeting was centred on the following headings:

The objective of maintenance.

Purchase - design - spares - records of machines.

Types of Maintenance - breakdown - scheduled - planned - preventive.

Planning with production.

People - selection - training - theory and practice.

Diagnosing faults - initiative - correct tools.

Costs - depreciation - repair costs - parts and labour
annual cost of maintenance - replacement.

Lost time - machines out of service - account for time
and reasons - distinguish production and mechanical -
and electrical.

Information to be used - not stored.

Leave the repair job tidy.

Safety and cleanliness - ventilation.

Problems of maintenance - training - experience
design - parts - operation - lubrication.

Attitude of Management - general policy.

TRAINING

It was reported that an 18 months course in practical and theoretical studies has been underway for 3 months and this would produce 20 trained mechanics for 1981. Although the duration of this course could be extended with advantage it is a good step forward. Another course for 30 is due to start later this year.

For Reinaldo Gutiérrez an electrical engineer is in training and will be available in 1981 and an industrial engineer has already been employed. The Projects Section now have an industrial engineer and one is listed for the Maintenance Enterprise but no mechanical engineers appear to be forthcoming at the present time.

The senior engineer reporting to the Director of Projects has recently spent six weeks in Hungary to strengthen his knowledge of operating and environmental conditions in the Pharmaceutical Industry.

Three production technologists are at present completing a six week visit to Sweden for working experience in good manufacturing practice and in standards of hygiene in the Pharmaceutical Industry of that country.

One morning session was devoted to a detailed examination of the curriculum for the course for mechanics referred to above which involves about 2600 hours of study. A breakdown of the subjects is shown at Annexe IV and records were seen which described in detail the subject matter used by the teaching staff. Some suggestions were made but it would appear that if the knowledge contained in the syllabus is imparted to and absorbed by the students, the maintenance performance could be much improved. One suggestion was that, in the light of experience, the course could be extended by adding new material or developing existing studies wherever the advantage of doing became evident. It was also suggested that some instruction on the properties of packaging materials and the maintenance problems associated with them should be included in the courses.

It is clear that positive steps are now being taken to provide qualified workers and considerable time and effort has been devoted to this need. Although positions are vacant at higher levels of training the shortage appears to be a matter of allocation rather than one of training itself.

In the afternoon a visit took place to a technological institute "Julio A.Mella" where 750 students (about 20% residencial) are trained for industry

in general and where the 20 student mechanics for the Pharmaceutical Industry are studying. As will be seen from the curriculum they have some specialist training for the industry. Students were seen at work on theoretical and practical studies and the standard of machines and equipment available to them was up to the standard of many European colleges. It included the casting of different metals, heat treatment and a metalurgical testing laboratory. The only question which occurred was whether the practical instruction available on welding and metal spraying was comprehensive enough but it was understood this was under review.

3. PROJECTS.

Design.

A question was raised regarding the need to carry out design work within the Project Department and the possibility of setting up a design section. It was appreciated that the requirement was not for original design but to retrieve from known sources information on engineering techniques and technology and to apply it in practice.

It was accepted there was much to be done by way of local replacement, adaptation and modification and therefore a small design or technology section could be justified. It was therefore recommended that this development should commence with the selection, from within the organisation if possible, of a university trained engineer who has studied metalurgy. An understanding of the different metals, coatings and finishes available and the treatment of them by heating, welding, and machining would be necessary. Initially the engineer would deal with mechanical design problems particularly those involving the location and selection of suitable materials as mentioned above since this type of work is likely to be a prominent part of the total.

This person should be assisted to make contact with colleges, national institutions, and other branches of industry with a view to obtaining help and information in this field and with the object of acquiring and recording knowledge of metal technology. As the work begins to develop a draughtsman may be added. From this point natural expansion would take place to form a small general design section provided that it can be shown to be justified by

the results from the earlier stages with regard to saving of costs, and/or improving performance. Possibly 2 or 3 draughtsmen might be envisaged including one electrical. One clerical person may also be required.

Various techniques of welding, metal spraying, electrolytic depositing, X-raying and ultrasonic testing were discussed. From a safety point of view the testing, including hydraulic (for pressure vessels) was emphasized and it was suggested that the national inspection and certification organization would be a further contact of a technical nature.

Reference was made to the possibility of using computer time in connection with the storage of maintenance and design information but it was strongly recommended that this should be approached with caution. While a computer can provide significant advantages in time and cost saving it can create considerable problems unless handled by people having complete knowledge and understanding of the work. The writer has some experience of the use of computers in engineering work and would suggest that a manual system should be run in parallel with a computer until complete confidence has been established.

Environmental Reuquirements.

At the request of the Projects Department a talk was given, through an interpreter, to a group of 9 engineers and technologists. The subject was "Environmental Conditions in the Pharmaceutical Industry". The following headings were used taking approximately one hour and followed by questions and answers:

Environment - quality of product-health and safety of people.

Cleanliness - cross contamination - cleaning of walls, floor, etc.,

- disposal of refuse.

Clear air - filtered - positive pressure

-1 micron for contraceptive or any other objectionable materials

-5 micron - innocuous material

Air Conditioning - 50% relative humidity 21°C for tableting and packing.

Air Changes per hour - Manufacturing 20 - Packing 10 - sterile 30/40.

Construction - no projections or ledges - sloping cills

- coved wall/floor/ceiling joins - wall and floor finishes - light fittings - separation of processes, - design of ducting and for cleaning, -cleaning of filters and disposal of refuse.

Dust from processes - removal by suction - hoods - filters.

Electric motors - short connections and other services sealed at entry -

Avoid excess lubrication.

Advice and sampling from Quality Control.

Protective Clothing - type of material.

Attitudes - logic and common sense.

Examples quoted from factories visited.

The booklet "Good Pharmaceutical Manufacturing Practices 1977" which was handed to the maintenance Technical Vicedirector would be found to be helpful.

CONCLUSIONS AND RECOMMENDATIONS

1. A management problem still exists. Positive direction is necessary supported by a published management structure and job descriptions (at least for senior levels) defining responsibilities.
Policy decisions should be clear and understood by all concerned.
2. Departments of Maintenance, Projects and Production should be consulted on all machinery purchases.
3. The establishment should be maintained at full strength according to an approved list.
4. The Maintenance Enterprise workshops and stores being situated on separate sites increases costs and reduces efficiency. Workshops, stores and offices should be brought together as a unit as soon as possible.
5. The technical staff of the main workshop should be increased to improve control and performance bearing in mind the increasing work load.
6. The technical staff who have been lost should be replaced up to establishment level.
7. A medium term machine tool replacement programme is recommended and the purchase of a small grinding machine should be considered.
8. Safety matters should receive special attention.
9. Responding to an enquiry from the Projects Department with regard to design work it was suggested that this should be very gradual and each advance to be justified by results.
10. The use of a computer should be approached with caution.

.../

11. The provision of a better standard of environmental conditions would reduce maintenance and safeguard product and people.
 12. Training plans for mechanics and technicians are satisfactory but should be reviewed at regular intervals. The position regarding electricians appears to be satisfactory.
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UNITED NATIONS



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNIDO 31 January 1980

Request from the Government of Cuba
Special Industrial Services

JOB DESCRIPTION

INTERNAL

SI/CUB/77/802/11-01/32.1.D

Post title Expert in the maintenance of pharmaceutical equipment.

Duration One months

Date required March 1980

Duty station Havana

Purpose of project To review and evaluate the work already carried out in Cuba based on the recommendations made by UNIDO missions in 1978.

Duties The expert will be attached to the Ministry of Health and will be expected to evaluate the present conditions considering the recommendations given by the previous mission for the improvement of the oral contraceptives production unit and the extent of which these recommendations have been effectively implemented.

 To prepare final report, setting out the findings of his mission and his recommendations to the government on further action which might be taken.

Qualifications Mechanical engineer with extensive experience in the maintenance of equipment used in the pharmaceutical industry.

Language English

Background information

The production of oral contraceptives in Cuba started in 1968 and since then it has been one of the major sectors of the pharmaceutical industry which the government has wished to expand and develop with the aim to satisfy the country's demand and if possible for export purposes to other countries in the region.

In January 1978, a UNIDO mission consisting of one expert in the production of contraceptives and one mechanical engineer visited Cuba for two months to evaluate the existing facilities and to study the quality and quantity of oral contraceptives produced in Cuba. In the final report submitted to the government, the experts made some recommendations regarding additional equipment required, methods of improving the technology and quality of manufactured goods.

The government of Cuba has requested a second visit of one consultant to evaluate the progress of the work carried out in the production facilities based on the recommendations of the previous mission.

NO CANDIDATES REQUIRED AT THIS TIME

ANNEXE II

"WORKING PROGRAM - MR. I. MACLEAN"

Thursday 22/5/80 - 6 a.m.	Arrival at the airport.
" 2:30 p.m.	Presentation of the Program.
Friday 23/5/80 9:00 a.m.	Discussion of the Program.
Saturday 24/5/80 9.00 a.m.	F r e e
Saturday 24/5/80 1 p.m.	Lunch
Sunday 25/5/80	F r e e
Monday 26/5/80 9 a.m.	Visit to the Maintenance Enterprise.
" " 2 p.m.	Visit to the Work Shop.
Tuesday 27/5/80 9 a.m.	Visit to Reinaldo Gutiérrez.
" " 2 p.m.	" " Andrés Berro.
Wednesday 28/5/80 9 a.m.	Working section at the Work Shop. a) Technological development of the shop (equipment, personell, etc.), b) Structure recommended for this shop, c) General recommendations. Spare part planning: a) Methods and organizations, b) Operative methods to comply with the plan.
Thursday 29/5/80 9 a.m.	Preparation of draft report and review.
Friday 30/5/80	F r e e.
Sat. 31/5/80 (morning)	Preparation of draft report and review (cont.).
Sunday 1/6/80	Discussion on the machine shop report.
Monday 2/6/80	Meeting to analyze problems of Maintenance of Pharmaceutical Industry. Planning, costs, labor, etc. Aspects of maintenance in new investments.
Tuesday 3/6/80 9 a.m.	
Wednesday 4/6/80 9 a.m.	

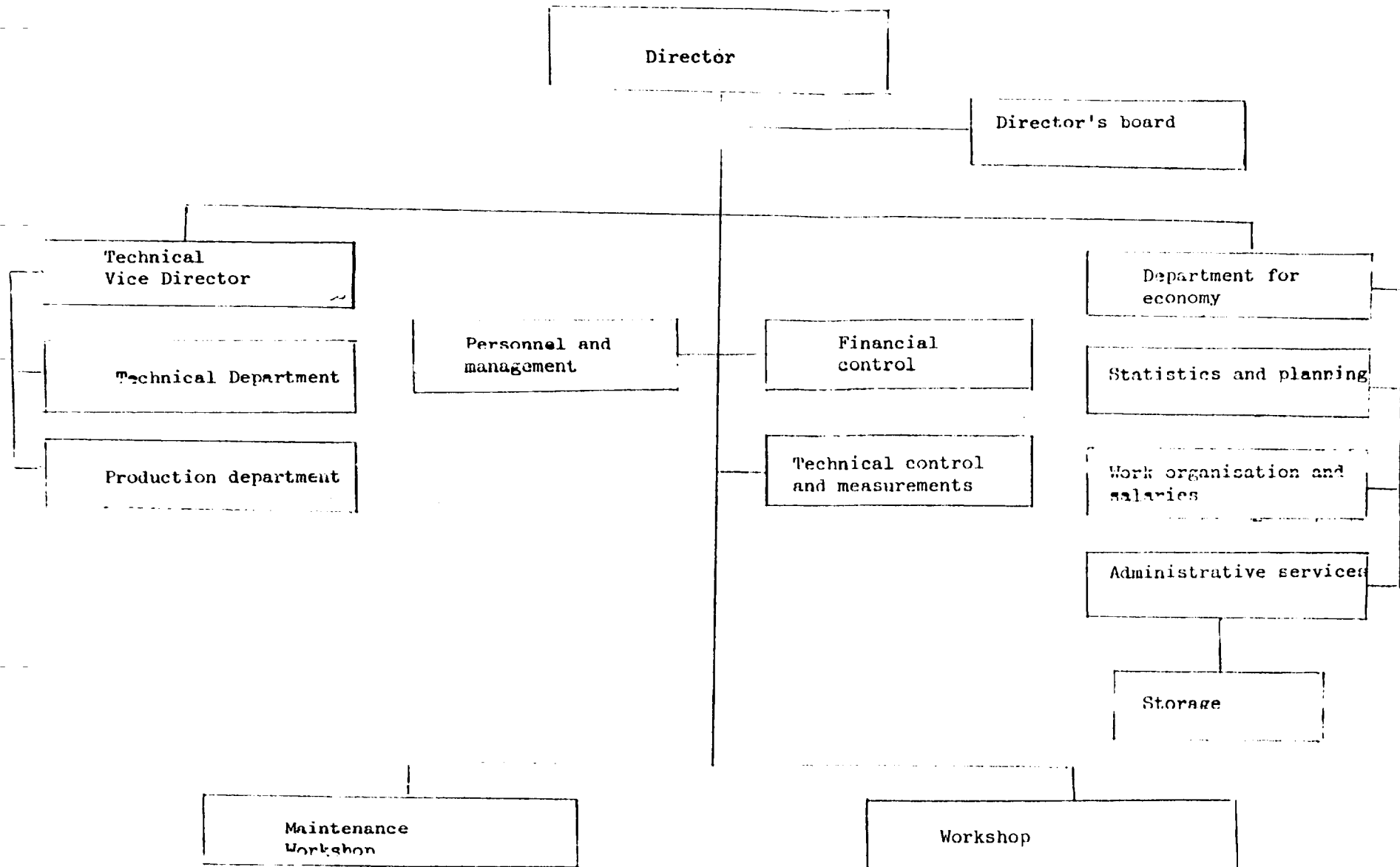
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	2 p.m.	Meeting on environmental conditions in the Pharmaceutical conditions.
		Technical evaluation of equipments: air conditioning, ventilation, etc.
Thursday 5/6/80	9 a.m.	Discussion of maintenance structure: a) Technical personell and loaders, b) Fields of discipline, c) Recommendation for the execution of remodeling laboratories or installations.
Friday 6/6/80	2 p.m.	Preparation of review on points discussed.
Saturday 7/6/80	9 a.m.	Discussion of the review.
Sunday		F r e e
Monday 9/6/80	9 a.m.	Discussion of the maintenance structure proposed by Mr. Mac. Lean. Evaluation of maintenance cost of equipments through the time.
Tuesday 10/6/80		Discussion on training programs for mechanics.
Wednesday 11/6/80	9 a.m.	Visit of the Technological Institute "Julio A. Mellia".
	2 p.m.	Interchange of opinions on the practical work being done at the Institute.
Thursday 12/6/80		Terminal report.
Friday 13/6/80		
Saturday 14/6/80	9 a.m.	Discussion of the Terminal Report.
Sunday 15/6/80		Departure.

23/5/80

Structure of Maintenance Enterprise

Annex III



ANNEXE IV

TRAINING COURSE - MECHANICS

Technical Drawing	120	hours
Metalurgy	60	
Machine Tools	60	
Electrical	80	
Metrology and Norms	40	
Adjustment & repair of machines	220	
Machine Elements (Medical and Pharmaceutical)	120	
Practical work on adjustment & repair of machines	1300	
Maintenance of Machines in the Industry	600	
Practical Examination	<u>36</u>	
	<u>2636</u>	



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