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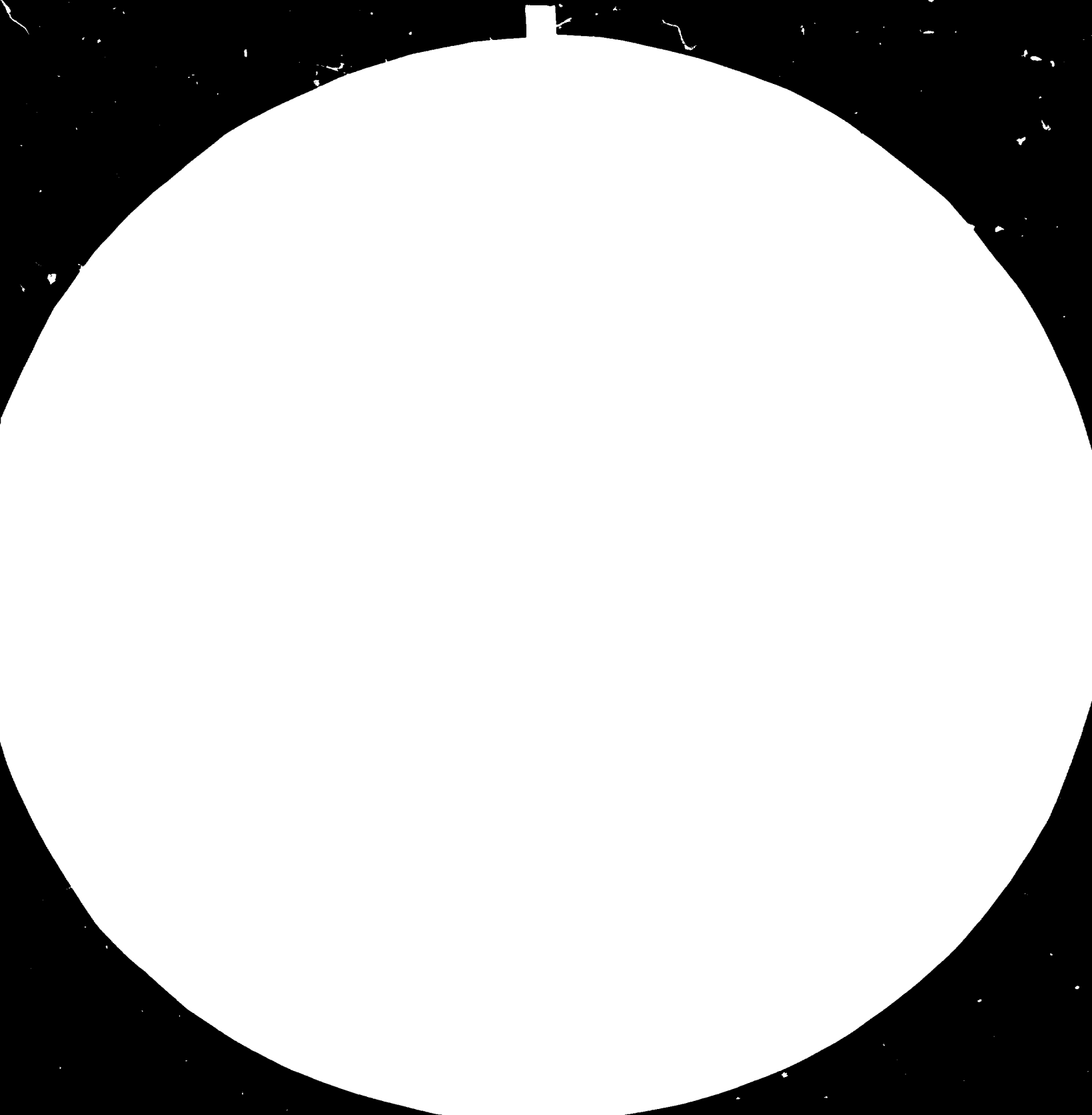

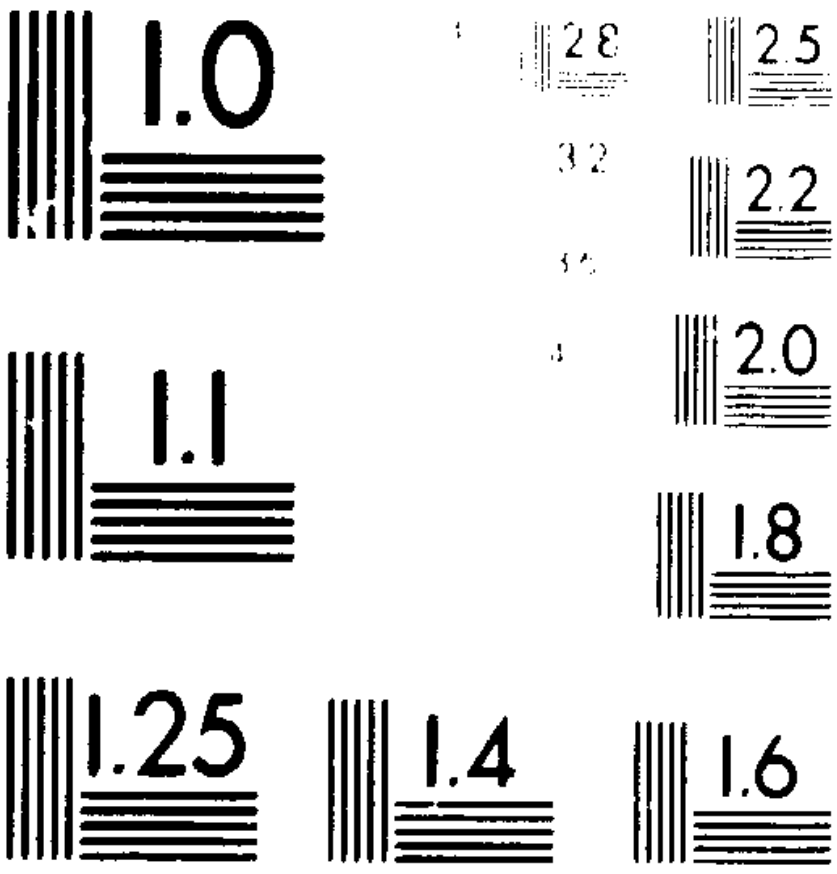

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English

PDR of Yemen.

Production of plastic articles

S I / P D Y / 8 3 / 8 0 1 / 11 -02

People's Democratic Republic of Yemen

Final Report

Prepared for the Government of P.D.R.Yemen by the United Nations Industrial Development Organization, executing agency for the United Nations Development Programme.

Based on the work of ARUTJUNOV SERGEI, expert in Plastics Processing

United Nations Industrial Development Organization
Vienna - Austria

LIST OF ABBREVIATIONS

LDPE	-	Low Density Polyethylene.
HDPE	-	High Density Polyethylene.
PP	-	Polypropylene.
PS	-	Polystyrene
PVC	-	Polyvinylchloride
UNDP	-	United Nations Development Programme .
UNIDO	-	United Nations Industrial Development Organization.
AGPF	-	AL Gundi Plastic Factory.
TCDC	-	Technical Cooperation among Developing Countries.
CIPET	-	Central Institute of Plastics Engineering and Tools.
PU	-	Polyurethane.

A B S T R A C T

The objectives of the project " assistance to the AL-Gundi Plastic Factory in the Establishment of Quality Control Laboratory and Processing of Plastics", SI/PDY/83. were to support and strengthen the expansion of the plastics processing industry so that it may make a continuing contribution to the economic development of the country. The duration of Expert's mission being reported on is 7 weeks, including briefing and debriefing at UNIDO Headquarters in Vienna - Austria.

The Plastics processing industry represented by a public sector company "AL Gundi Plastic Factory" really faces certain difficulties due to the lack of quality control of the products, shortage of trained personnel (of all levels) and the lack of facilities for maintenance and repair of equipment and moulds.

To improve the situation the following main recommendations were given :-

- to train engineers and technicians at CIPET, Madras, India.
- to establish testing laboratory at the AGPF;
- to establish workshop to provide smooth running of production.
- to prepare feasability study for future diversification of production involving new processes and materials.

All these actions should be assisted by UNIDO through UNDP.

Work Programme for improvement quality of finished products was designed. It consists mainly of the following:-

- training machine operators on-the-spot.
- permanent registration of important processing parameters;
- purchase some additional equipment to broaden the range of controlable processing parameters.

TABLE OF CONTENTS

INTRODUCTION

The Expert's activities on this project began on the 8th of April 1984 and lasted till the 26th of May 1984.

This project had a range of objectives which can be described as assistance to the Government of the PDRY in supporting and strengthening the expansion of the plastics processing industry so it will be able to contribute to an economic development of the country - development objective, and immediate objective, aiming at improving the knowelidge of the AGPF staff in the modern techniques of the plastics processing technology, improving quality control of raw materials and finished products, and examinning the possibilities of diversification of products involving new materials, processes and applications.

The counterparts were given basic information about plastics, their types, properties and methods of their processing. Priority for training engineers and technicians abroad was stressed. Recommendations for establishing system of training workers on-the-spot were given. Programme for improvement quality control of raw materials, in process control of processing parameters and quality control of finished products was prepared . But the lack of both testing equipment and trained personnel did not allow to begin carrying out this programme. The list of necessary additional equipment for injection moulding plant (see Annex 3) as well as the list of equipment for workshop (see Annex II) were also given.

The possibilities of diversification involving new materials, processes and applications were also examined and recommendations were given.

RECOMMENDATIONS

1. Observing carefully the importance of expansion of the AlGundi Plastic Factory and stressing priority which should be given to the problem of training personnel it is strongly recommended to the Government of the P.D.R.Y. and UNIDO:

   - To provide training for the AGPF personnel (engineers and technicians) at CIPET, Madras, India on the basis of TCDC through UNDP.

   - To organize for that purpose preliminary mission to CIPET for Director General of the AGPF and one of the AGPF engineers in order to find out the facilities existing at CIPET , to work out draft training programmes covering all theneeds of the AGPF.

2. Realizing the urgent need of the AGPF in testing quality of raw materials and finished products the testing laboratory should be established at the factory to meet all the requirements of the factory at present and in future.

3. Taking into account the fact that the establishment of workshop for maintenance and repair of equipment and moulds will greatly contribute to successful expansion of the AGPF, it should be created at the factory.

4. In order to increase quality of finished products the following steps should be undertaken to introduce into practice the system of training the machine operator including theoretical and practical training. They also should be instructed annualy in fire prevention and safety measures as well as in operating the machines they work on.

- to include into the "Purchase Order" for raw materials the terms of specimens preparation, testing methods, inspection, rejection and packaging till the AGPF has its testing laboratory.

- to registrate permanently in the "log-books" all the important processing parameters in order to provide possibility to analyse reasons for reject and to collect data for statistical analysis of factors affecting the quality of finished products.

- to oblige engineering staff dealing with processing to work out "Flow sheets " for each article to be produced.

- to purchase some Automatic Mold Cooling Circulators (Chillers) to make the production more independent of the temperature of the water in cooling system.

- to consider the possibility of convertion of the most important moulds from semiautomatic into fully automatic, introducing for that purpose the "hot runner" technique.

- to purchase in future moulds adjusted for installation of temperature sensors and pressure transducers.

- to purchase some sets of temperature sensors, pressure transducers and signal converting devices.

5. An organized visit to a plastic exhibition at least once a year should be made by the Director General of the AGPF to keep up dated with the latest achievements in plastics, their processing and applications.

6. Bearing in mind future expansion of the factory and necessity to diversify production of the AGPF feasability studies for such plants as " Pipe Producing Plant". "Blow moulding plant", "Woven sacks producing plants" should be prepared with UNIDO/ UNDP assistance.

II - F I N D I N G S

A. Project Background

There are two enterprises engaged in the production of plastic products in the People's Democratic Republic of Yemen. One of them is a public sector company "AL Gundi Plastic Factory "and the other is a private sector "Middle East Factory". The AGPF is controlled and operated by the Ministry of Industry. The Government of the P.D.R.Y. conducts a policy of planned economy. Now the 2nd Five Year Plan is going on. One of the main purposes of the 2nd Five Year Plan is to establish and expand an efficient plastics processing industry. That is why the Government of the PDRY has given priority to the AGPF as the only basis for reaching this purpose, and the AGPF is being considered as a core around which all future steps in establishing and expanding national plastics processing industry must be undertaken.

The AGPF faces certain difficulties because of the lack of raw materials and finished products testing facilities, the shortage of trained personnel (engineers, technicians, workers), the lack of equipment and moulds maintaining and repairing facilities, and an efficient application of technology and equipment.

The findings and recommendations of Dr. Clark-UNIDO Expert, who was fielded for three months to Aden according to the first UNIDO project of technical assistance to the AGPF (1977) were taken as basis for the preparation of the second project proposal. In 1982 this proposal was submitted to the Government of the PDRY and the Government requested UNIDO assistance in order to solve urgent technical problems at the AGPF. In April 1983 the project proposal was approved by UNIDO.

The mission of three experts (see Annex 2) in testing, processing,and mould design and mould making, correspondingly, has started at the first decade of April 1984 and will last till the end of May 1984.

B. Existing Plastics Processing Facilities at the AGPF

The Expert considers it possible first to describe the all components of the technological process, then stress and elaborate problems facing the AGPF and while giving recommendations, underline what has already been done and what is to be done.

As it was mentioned above the AGPF started in 1972 with three injection moulding machines. In 1975 it began producing PE films and making bags, with five extruders and one bag making machine. In 1978 the AGPF expanded its injection moulding plant by purchase of two injection moulding machines. So, at present, the AGPF is equipped with six injection moulding machines of the KUASY type produced in GDR. (for the exact type of the machine see Annex 3) It is not the latest word in injection moulding equipment, but nevertheless it is good equipment capable to provide good output. The first five injection moulding machines (as they are given in Annex 3) are installed in the old Factory's Building and the sixth machine are in the new production area, where the first five machines will be moved to. The growth of the AGPF output is given in diagram I.

There are also about forty four moulds both second hand and new for producing various articles. They are all imported from Denmark, Japan, West Germany and Italy. All the moulds are semiautomatic except only a few purchased lately.

Raw materials such as HDPE, PP and PS are also imported from abroad . Master batches and powdered colors also imported are used at the AGPF for colouring plastics.

The growth of the AGPF Output

* The decrease in 1981 took place because of the nonfulfilment of obligations by Government Enterprises.

There are now two independent cooling lines for cooling hydraulic units of the machines and moulds.

There are also two grinding machines for crushing rejected articles and technological wastes. One of them is installed in a separate room in the old factory's building, and the other is installed in a new production area, crushing the rejects from the machine 6.

As it was mentioned above the AGPF faces certain difficulties There are as follows:-

Equipment

Regular maintenance of the equipment both technological and auxiliary is being carried out on a regular basis, but when a machine breaks down it is necessary to replace broken part or repair it.

Here are two of the main problems:

- the lack of spare parts.
- the lack of workshop for repairing (that concerns also moulds).

In table 1, there are data on idel time of the machines in 1983 (in hours)

Month	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
HOURS	342	351	222	75	162	305	105	210	255	454	148	249

Total per the year - 2 8 7 8 hours, almost 4 months.

In 19?? the Film Production Plant was closed because the percentage of waste was 60%. Hence, now all output of the AGPF is based on Injection Molding Plant.

MOLDS

The state of some molds can be determind at unsatisfactory from the point of view of quality of finished products. That results from the very moist and warm climatic conditions. The surfaces of some molds are rusty and the lack of maintaining facilities makes it difficult to put them in order, because it requires a lot of hand-work time. Beside that , there is another problem due to a very high content of different chemicals in water, and cooling channels of molds should be cleaned regularly. Unproper surfaces of mold cavity and sometimes poor cooling bring to difficulties with the injection of molded articles and decrease output of Injection Molding Plant.

RAW MATERIALS

The raw materials used at present at the AGPF such as HDPE, PP and PS, are all imported, as a rule they are of suitable qualities, but however when difficulties in processing arise it is better to test real characteristies of that particular batch and to correct on that basis the technological parameters of the process. At present the AGPF does not possess any testing equipment. That is why testing of finished products, except visual and the simpliest dimensional control is also impossible.

According to the recommendations of Dr. Clark, concerning reuse of scrap at AGPF, possible additions of scrap to the virgin materials were limited . The maximum percentage of scrap to add to virgin material now is 10% ÷ 30% depending on the requirements to the articles to be produced . In some cases when there are difficulties in processing with ejection of molded articles, there is a practice to use a mold lubricant The reuse of rejects becomes in that case more difficult because of the mold lubricant existance in scrap.

C. PLANS FOR FUTURE EXPANSION

During the first unofficial meeting with Mr. Nasson M.A. Rehman, Director General of the AGPF taken place on the 11 April , the Experts were informed on future expansion of the factory.
It will be provided on a step-by-step basis . The first stage of the plan is to put into operation Film Producing Plant.

The next step is to put into operation blow molding plant in 1975 ; at a later stage Pipe Producing Plant and Woven Sack Plant are envisaged to be put into operation most likely during the Third Five year Plan.

When the Experts were received by Mr. Fadhle Hasson Yehia, Asst. Deputy Minister for Planning Ministry of Industry on 15th April 1974 they were told that Experts' recommendations would be kindly appreciated by the PDRY Government and asked to reflect in their final reports the matters as follows :

- Possible diversification of products;
- Training personnel (workers and technicians);
- Equipment needed for expanding plastics processing industry and diversifying the range of products.
- Applications of plastics in different branches of economy.

That wish was taken into account while preparing this document.

The meeting was attended by a number of engineers representing different department of the Ministry of Industry.

D. PROJECT ACTIVITIES AND UTILISATION OF THE PROJECT RESULTS

1. TRAINING OF THE COUNTERPART STAFF

The counterpart staff (see annex 2, and annex 4 for their background) have been trained in the modern techniques of plastics processing technology including the following :

- Compression molding
- Injection molding of thermoplastics and thermosets
- Extrusion
- Blow Molding
- Vacuum forming

The information on specific features of each process, equipment and molds, auxiliary equipment , requirements to raw materials has been given to the counterparts.

Training of the counterparts has been carried out in the form of lectures and discussions of both, given information, and technical problems existing at the MAP.

2. Quality Control Improvement Work programme

In order to design a work programme aiming to improve quality of finished products it is necessary to define factors influencing quality at all stages of technological process beginning from the selection of raw material and up to quality control of finished products.

The scheme (see Annex 5) containing all important elements of succesful technological process allowes us to define these factors.

Proper quality control should be established at all stages.

RAW MATERIALS

Here the counterparts were given the information on applications of various types of polymers, the approach to the problems of selection raw materials. Necessity of testing properties of each batch of raw materials after delivery and before processing was stressed, additional testing can be also required , if there are problems with processing. Content of " Purchase Order" was also elaborated. Utilization here seems to be problematical untill there are some testing facilities at the AGPT

EQUIPMENT AND MOLDS

Requirements to the conditions of technological and auxiliary equipment as well as of molds were discussed with counterparts. Pieces of advice were given to the counterparts regarding maintenance and repair of equipment and molds. Necessity to define molds which are of prior importance for the AGPT and then to put them in order was underlined. First steps in that direction were undertaken . Two molds were disassembled, then cleaned and polished. But the LACK of properly equiped workshop and of spare parts makes the complete solution of these problems difficult.

IN-PROCESS CONTROL OF PROCESSING PARAMETERS.

The importance of regular measuring parameters and recording data obtained by each shifts was stressed. For that purpose . " The sample of the page of the log-book for injection molding machine " see Annex 6 was prepared and discussed with counterparts and with Mr. Nasser N. Alalak. " Personnel Instruction Card " Form (see Annex 7) and

" Draft plan for training programme for operators of injection molding machines " (see Annex 5) were also prepared, discussed with persons mentioned above , and given to Mr. Nasser M. Alalah. Necessity of working out " Flow chart " for each articles to be produced was also mentioned . Some improvements in that respect have been already obtained. The full realization of the recommendations on that particular matter is impossible untill the operators are trained, measuring tools for operators (micrometers, liners, callipers, balances) are available .

FINISHED PRODUCTS-

In that respect the counterparts were given " the tables of possible defects and remedies " for all processes mentioned in items I of this section. The dependence of quality of finished product on processing parameters and quality of raw material as well as on conditions of equipment and molds was shown and stressed.

II. DIVERSIFICATION

Taking into account the fact that even less than 1 percent of the PDRY total area is arable, the first possible area of plastics application is in agriculture, where LDPE - , and soft PVC - films PE-, PP- and PVC-pipes, PP - woven sacks, etc can be beneficially used. Another area of plastics application is their use in building and housing, water supply systems, where PVC sections, PVC -, PE-pipes, PU-foam and some other plastics can be utilized.

PLASTICS IN AGRICULTURE

Films made of LDPE, and soft PVC can be used in covering plantations, and tunnels storing agricultural products, sealing sewers and pools. Pipes made of PE, PP and PVC can be used for irrigation. PP-woven sacks can be used for storing and transportation of vegetables and fruits. They can also be used for the packaging of fish meal.

PLASTICS IN BUILDING AND HOUSING

Sections of different profile made of PVC are widely used as panels and sidings, Pipes and fittings of PVC for water supply systems, PE - pipes and fittings for sewage systems, PP-pipes for floor heating, and also for pressure pipes, ~~PE - foamfloor heating, and also for pressure pipes,~~ PU-foam for insulation , etc.

So even partial application of mentioned above materials in appropriate spheres will result in introduction of new processes, and in diversification of products.

The Expert limits his comments with this because application of plastics in the economy of the country was very well elaborated by Dr. Clark in his report.

The list of Manufacturers Names and Addresses producing equipment for Blow Molding , Pipe Extrusion, and Tape Extrusion and Weaving Sacks is given in Annex 12.

F. Further UNIDO/UNDP assistance to the AL Gundi Plastic Factory

The plastic processing industry of the P.D.R.Y. presented by the AGPF has certain difficulties in testing raw materials and finished products, mould design and mould making, and in processing, because of :-

- the lack of testing facilities
- the lack of mould designers
- the lack of workshop.
- the shortage of skilled personnel of all levels.

Successful development and expansion of plastics processing industry in the People's Democratic Republic of Yemen depends considerably on the earliest establishment of such facilities and realization of training personnel.

These areas can be indicated as areas of further UNIDO/ UNDP assistance to the AGPF.

Concerning the problem of training , the Expert would like to give some considerations on this matter.

Nowdays there are no facilities for training personnel/ (engineers and technicians) inside the country in the field of plastics, their processing and application, mould design and mould fabrication, testing raw plastic materials and finished products. That is why these facilities should be found abroad.

In that respect Central Institute of Plastics Engineering in Madras, India seems to be the most appropriate variant for trainees from P.D.R.Y. because of the following reasons :-

- the Institute was established by the Government of India with the UNDP assistance late in the 60s. It was called on to accelerate the development of plastics Industry in India. The Institute offers now highly specialized and practical-oriented training, meeting the requirements of international standards in all aspects of Plastics Industry.

- India has successfully overcome all the difficulties having faced the country in the way of developing and expanding its industry. It possesses a good experience now, which can be of considerable benefit for the P.D.R.Y. helping to avoid many difficulties on the way of establishing and expending national Plastics Industry and to gain substantially from that cooperation, which can be realized through UNIDO under the TCDC programme;

- The climate conditions in India are rather similar to these in PDRY and the adaptation of trainees in India will not take much time. That means that they will be able to benefit fully from that training.

Details of the courses offered by CIPET are given in Annex 9 as well as the processing equipment available at CIPET.

As to training programmes, the Expert considers it necessary to provide trainees with basic information on plastics , their properties, classification and their application in industry agriculture and everyday life. And only after that to begin with the selected programme. List of items to be included in the training programme for trainees to be specialized in plastics Processing is given in Annex 10.

A C K N O W L E D G E M E N T

The Expert wishes tp express his gratitude to Mr. Hasson M.A. REHMAN, the Chairman of the Board of Directors and Director General of the AGPF, to Mr. Nasser H. ALALAH, the Chief of the Technical Section of the AGPF, the Leader of the Counterpart Project Staff, to Mr. Maher A. RABEE and Mr. Anwer Y. GAZI - the Expert's Counterpart staff for close collaborations during the Expert's work on the project.

Thanks are extended to the Expert's colleagues, Dr. K. RAMAMURTHY, UNIDO Expert in testing raw plastic materials and finished products, Mr. M. REUSS, UNIDO Expert in mould design and mould fabrication, and to their counterpart staff, Mr.ASHRAF R. KHAN, Mr. Adnan A. RAMADAH, and Mr. Hisham A.R. MOHAMED, and also to the staff of the AGPF.

Grateful acknowledgement is made for the attention and assistance by Mr. Abdul K. SURANI, the UNDP Deputy Resident Representative, Mrs. Katarina Moberg, Junior Programme Officer and other member of UNDP office.

Personal appreciation is also to Mr. Robert G. GUMEN, the Backstopping Officer, Chemical Industries Section of UNIDO for his close attention and guidance in fulfilling the Expert's duties on the project.

A N N E X - 3

ANNEX I

The Expert was assigned to the Al-Gundi Plastic Factory in Aden and was expected to :

- Demonstrate to and train local personnel in the modern techniques of plastics processing technology including the following :
  - Injection molding of thermoplastics and thermosets;
  - Compression molding;
  - Extrusion;
  - Blow molding;
  - Vacuum forming;
- Design and carry out a work programme at Al-Gundi Plastic Factory aiming to improve quality control of raw materials, in-process control of processing parameters, quality control of finished products;
- Advise on the selection of materials, equipment and processes as well as the maintenance of the equipment.
- Examine the possibilities of diversification involving new materials, processes and applications;
- Recommend additional plastics processing equipment necessary for the Al-Gundi Plastic Factory.
- Prepare a final report, setting out the findings of the mission and making recommendations on futher actions which might be taken.

ANNEX II

International and Counterpart Project Staff

List of International Experts

Post No.	Post Title	Name of Incumbent (and Nationality)	Arrived (mo/yr)	Departed (mo/yr)
01	Expert in Testing of New Plastics Materials and Finished Products	N.Ramamurthy, India	04.84	05.84
02	Expert in Plastics Processing	S.A...rutjunow, USSR	04.84	05.84
03	Expert in Mold Design and Mold Making	M. Reuss, Hungary	04.84	05.84

LIST OF COUNTERPART PROJECT STAFF

Post No.	Post Title	Name of Incumbent	Starting Date (mo/yr)	Concluding Date (mo/yr)
* 1.	Electrical Engineer	A.Y. Gazi	04.84	05.84
* 2.	Maintenance Supervisor	M.A.Rabee	04.84	05.84
3.	Mechanical Engineer	A.R. Khan	04.84	05.84
4.	Molding Technician	A.A. Hamdah	04.84	05.84
5.	Chemical Engineer	H.A. Mohamed	04.84	05.84

* - The Expert's counterparts.

ANNEX 5

LIST OF EXISTING INJECTION MOULDING MACHINES

Type of Machine	Injection volume cm^3	Diameter Screw mm	Mold Assembly Dimentions mm	Year of Purchase
KuASY 250/650	650	55	500 x 500	1972
Ku ASY 260/100	175	45	360 x 360	1972
Ku ASY 25/ 32	32	28	230 x 160	1972
Ku ASY 260/100	175	45	360 x 360	1978
Ku ASY 100/ 25	50	28	300 x 210	1978
Ku ASY 1000/4000	4300	125	1000 x 800	1980

LIST OF ADDITIONAL EQUIPMENT AND DEVICES TO BE PURCHASED

1. Automatic mold Cooling Circulator
2. " Hot runner " Technique Nozzle
3. Temperature sensor and signal converting device.
4. Pressure transducer and signal converting device
5. Hopper Dryer.

[illegible]

Counterpart Staff

1. MR. [illegible] ALI [illegible]

He had been trained abroad three times.
First it was in Cairo, Egypt, 1967-1968 (for one year).
He was trained at Telecommunication Institute in the field of electricity (production and supply).

His second training took place at Bournville College, in Birmingham, U.K., in 1971 - 1973 (for two year) in the field of electronics.

Third course of training was at Henrich Rau Institute of Magema in Neubrandenburg, GDR, in 1981-1983 (for two years). The trainee was trained in the field of machine building.

He has been working at the AGPF for 10 years. Now he works as a maintenance superviser, so he is responsible for providing the smooth running of all the equipment. Ten persons are working under his supervision.

He has a good working knowledge of English and German. He puts considerable efforts into his work, has an engineering mind. Has expressed high spirit of cooperation during the Expert's work since 11th April 1984 till 21st May, 1984.

2. MR. [illegible] YASSIN [illegible]

He graduated from the Varna University Bulgaria, in 1983, in electrical engineering. In the same year he joined the AGPF. During 1983 he was sent twice for one-month training at the Aden Training Center. The first course of training was towards maintenance of equipment in general. The second course of training was "Quality Control of Production." Late in 1983 he was sent to Bulgaria again for 6 months. He spent 4 months at the Varna University and then 2 months at the Plovdiv Electrical Motors Plant. He was trained in the field of maintenance and repair of transformers and electric motors.

At present he is electrical engineer at the AGPF, responsible for organizing and conducting all work on maintenance and repair of electrical parts of injection molding machine and other equipment

......2/=

cont.....Annex No. 4

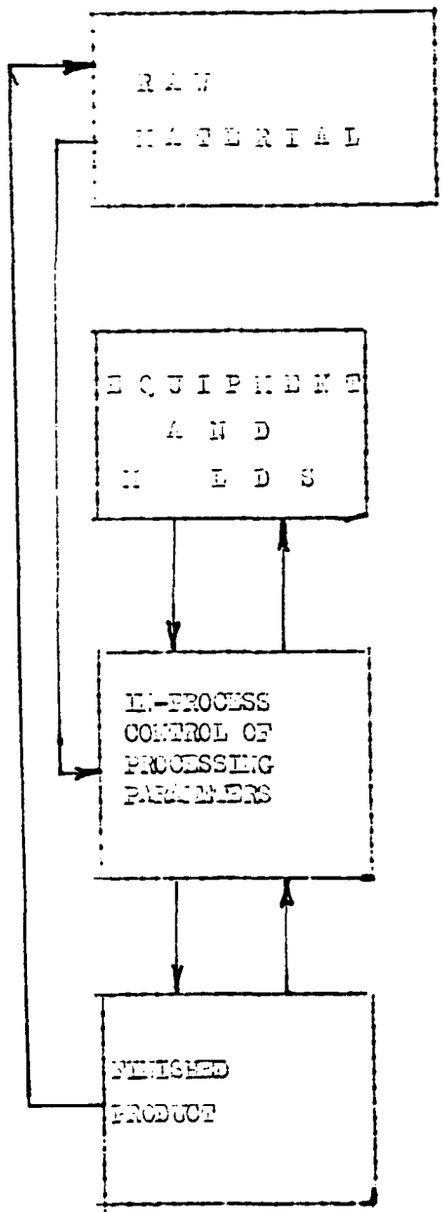
existing at the factory. Two electricians are working under his supervision.

He knows Bulgarian fluently and can understand and speak English. He has an engineering mind and after proper training in plastics processing and management will be capable of additional responsibilities.

He has given good cooperation and work during the Expert's work since 11th April , 1984 till 21st May, 1984.

ANNEX 5

OUTLINE OF QUALITY CONTROL EDUCATION WORK PROGRAM



1. Trained Personnel
2. Proper Selection of Raw Material.
3. Purchase of Pilot Batches
*4. Testing of Raw Materials.

1. Maintenance of Equipment and Molds.
*2. Proper stocks of Spare Parts and their Registration.
*3. Repair Facilities.
4. Trained Personnel

1. Trained Personnel
2. Permanent Registration of All Processing Parameters.
3. Flow Sheets.
*4. Additional Equipment.
5. Measuring Tools.

1. Trained Personnel
* 2. Testing Equipment.

* - Not available at present.

Output : (pcs/h) (pcs/shift)
Waste : (pcs/shift)

Some other parameters can be added if there is a possibility to control them. (for example mold cooling water inlet and outlet temperature etc.)

ANNEX 6

DETAILED OF THE PAGE OF THE LOG-BOOK FOR INJECTION MOULDING MACHINES

Date :

Shift: Shift Leader(or Operater)

Article : Material :

Parameters of the process

Time (hours)	t° - Cylinder				t°-runner		Pressure(kg/cm²)				Screw		Remarks
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 1	Zone 2	Injec-tion	clamping	After pressure	Mold pressure	cm³/min	Stage	Tc Sec	
7. 00														
8. 00														
9. 00														

ANNEX 7

"PERSONNEL EDUCATION CARD" Form.

Name :

Date of Birth :

Date of Joing in the Factory :

Speciality :

Name of Instruction	Instructor	Date of instructing	Signature of employee
I. Instruction on fire prevention and safety measures.			
II. Instruction on Operation of the injection molding machines.			

These Cards for each worker should be field and kept by the person responsible for training and instructing personnel.

Annex 3

Draft Plan

For training programme for operators

of Injection molding machines"

I Theoretical Course

1. Introduction
2. Plastics, their types and properties.
3. Basic methods of Plastics processing
4. Injection molding.
   - 4.1. Process of injection molding.
   - 4.2. Molds
   - 4.3. Characteristics of Molding Compounds.
   - 4.4. Advantages and Limitations.
5. Injection Molding Machines.

II Practical Course.

1. The design of Injection Molding Machine
   - 1.1. Injection Unit.
   - 1.2. Clamping Unit.
   - 1.3. Auxiliary Equipment
     - 1.3.1 Power Unit
     - 1.3.2 Time Controling Devices.
     - 1.3.3 Temperature Controling Devices
     - 1.3.4. Hydraulic System
2. The design of Molds.
   - 2.1. The types of Molds
     - 2.1.1. Semiautomatic Molds
     - 2.1.2. Automatic Molds
   - 2.2. Location of Runners and Gates (simple - cavity / multiple- cavity)
   - 2.3. Ventilation of the Mold cavity.
3. Visual control of finished products.
4. How to use the table of defects and remidies.

ANNEX 5

Details of the Courses Offered by CIPET

No.	Title of the Courses	Duration
1.	Plastics Mould Technology	* 3 Years
2.	Plastics Moulds Design	* 1 Year
3.	Plastics Processing Technology	* 1 Year
4.	Plastics Tool Engineering	* 1 Year
5.	Plastics Engineering	* 1 Year.

* - Duration of courses as well as their programme for each group of trainees from the AGPF, IDIM, PDIU can be coordinated well in advance.

PLASTICS PROCESSING EQUIPMENT AVAILABLE AT CIPET.

Injection Molding Machines (up to 300 ten clamp), Compression Press, Transfer Molding Press, Thermoset Injection Molding Machines, Pelletiser, Preheater, Regrinder, Drying oven, Chilling plant, Blow molding machines, Vacuum forming machine, Ultrasonic welding machine, Extruders.

ANNEX 10

List of Items to be Included in the Training Programme for Trainees to be Specialized in Plastics Processing.

1. Plastics and their properties.
2. Application of Plastics.
3. Structure of Polymers.
   - 3.1. Basic Information on Polymers' structure
   - 3.2. Methods of Producing Polymers.
   - 3.3. Reological Properties of Polymers.
4. Testing of Plastics.
   - 4.1. Methods of Testing
   - 4.2. Technological Properties.
   - 4.3. Physical Properties.
   - 4.4. Corrosion Resistance of Plastics.
   - 4.5. Testing of Finished Products
5. Processing of Thermoplastics
   - 5.1. Injection Molding
   - 5.2. Extrusion
     - 5.2.1. Pelletizing.
     - 5.2.2. Extrusion of sheets and profiles.
     - 5.2.3. Extrusion of Pipes and Hoses.
     - 5.2.4. Extrusion of Films
   - 5.3. Blow Molding
   - 5.4. Vacuum Forming
   - 5.5. Welding of Thermoplastics
   - 5.6. Printing
6. Processing of Thermosets
   - 6.1. Compression Molding
   - 6.2. Injection Molding

ANNEX II

LIST OF EQUIPMENT FOR THE WORKSHOP

1. Engine lathe
2. Vertical drilling machine
3. Vertical knee-type milling machine.
4. Resiprocating table horizontal spindel surface--grinding machine.
5. Tool-and-cutter grinding machine
6. Measuring devices (vernier callipers, micrometers, set of gauge blocks, dial indicators , etc.)
7. Oven
8. Stright - sided screw press hand - operated,
9. Sets of tools for each machine (lathe tools, drills, milling cutters, etc.

ANNEX 12

LIST OF MANUFACTURING NAMES AND ADDRESSES

Blow Molding Equipment

1. " BATTENFELD " FRG

   BATTENFELD FISCHER BLASFORMTECHNIK GmbH
   HERMANN - LÖNS - STRASSE 7.
   D - 5204 LOHMAR 1. POSTFACH 1120
   TEL. 02246 / 4051
   TELEX 889426 BAFI - D

2. " BEKUM " WEST BERLIN

   BEKUM MASCHINENFABRIK GmbH
   LANKWITZER STR. 14/15, D1000 BERLIN 42.
   TEL 030/7490-1
   TELEX 01 - 84580

3. " KAUTEX " FRG

   KRUPP - KAUTEX MASCHINENBAU GmbH
   POSTFACH 30 05 20 D-5300 BONN 3 (HOLSLAR)
   TEL 0228/489 - 1
   TELEX 886765

PIPE PRODUCING EQUIPMENT

1. " REIFENHÄUSER " FRG

   REIFENHÄUSER GmbH & Co. MASCHINENFABRIK,
   POSTFACH 1545, SPICHER STR. , D-5210
   TROISDORF - SIEGLAR
   TEL 02241/801 - 1
   TELEX 889525

2. " CINCINNATI MILACRON" AUSTRIA

   LAXENBURGER STRASSE 246
   P.O. BOX III
   A-1232 VIENNA, AUSTRIA.

3. " MUT " ITALY

   MUT SPA VIA CAMPANI 16,
   I-20100 NOVARA, ITALIA
   TEL 0321/471701
   TELEX 200176 MUT I

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WOVEN SACK PRODUCING ENTERPRISES

1. " LEIPZIGER PLASTIC WORKERS" AUSTRIA
   CHEMIEFASER LENZING AG
   A- 4860 LENZING
   TEL 07672 / 2511
   TELEX 026 - 606 LENZ A

2. " FELDMÜHLER " FRG