



**TOGETHER**  
*for a sustainable future*

## OCCASION

This publication has been made available to the public on the occasion of the 50<sup>th</sup> anniversary of the United Nations Industrial Development Organisation.



**TOGETHER**  
*for a sustainable future*

## DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as “developed”, “industrialized” and “developing” are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

## FAIR USE POLICY

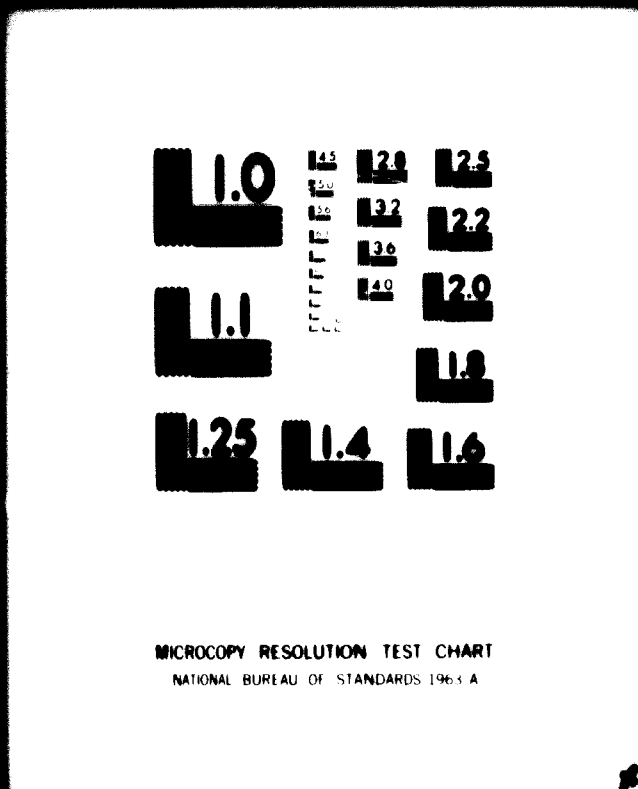
Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

## CONTACT

Please contact [publications@unido.org](mailto:publications@unido.org) for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at [www.unido.org](http://www.unido.org)

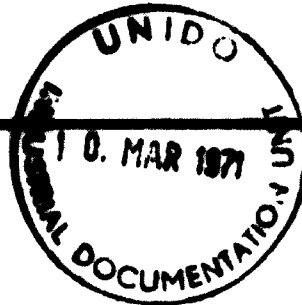
1 OF 1



24 x  
E

02112

UNITED NATIONS INDUSTRIAL  
DEVELOPMENT ORGANIZATION



Distr.  
RESTRICTED  
UNIDO/ITD.37  
March 1971  
ENGLISH

REPORT ON EXPLORATORY MISSION ON MARKETING  
AND PRODUCTION OF PETROCHEMICALS IN THE UAR.

(under SIS ID/OA 220 UAR (47) )

22 January - 5 February 1971

A. Dumitrescu  
Fertilisers, Pesticides and Petrochemicals  
Industries Section  
Industrial Technology Division

002696

The views and opinions expressed in this paper are those of the  
author and do not necessarily reflect the views of the Secretariat  
of UNIDO.

14.71-1213

**TABLE OF CONTENTS**

	<b>PAGE NO.</b>
<b>I. INTRODUCTION.</b>	<b>1</b>
<b>II. THE MAIN PROBLEMS REL. TO THE DEVELOPMENT OF A PETROCHEMICAL INDUSTRY IN THE UNITED ARAB REPUBLIC.</b>	<b>2</b>
<b>III. RESULTS AND CONCLUSIONS REACHED DURING THE EXPLORATORY MISSION IN THE UAR.</b>	<b>8</b>
<b>IV. RECOMMENDATIONS ON FURTHER UNIDO TECHNICAL ASSISTANCE FOR DEVELOPING A PETROCHEMICAL INDUSTRY IN THE UAR.</b>	<b>13</b>
<b>V. MISCELLANEOUS PROBLEMS CONCERNING UNIDO ACTIVITY RELATED TO THE UAR.</b>	<b>19</b>
<b>VI. DISCUSSION WITH IDEAS.</b>	<b>20</b>
<b>VII. GENERAL RECOMMENDATIONS FOR IMPLEMENTATION OF THE NEW PROPOSED UAR PROJECTS AS A SPECIAL FUND PROJECT WITH FAG ASSISTANCE TO START WITH.</b>	<b>22</b>

**APPENDICES**

<b>1. Project Data Sheet UAR/BIS 70/1096 (UAR-47).</b>	<b>26</b>
<b>2. List of Persons with whom Discussions were held during Visit to the UAR.</b>	<b>28</b>
<b>3. Job Description (Expert in plastics production and utilization).</b>	<b>29</b>
<b>4. Job Description (Expert in economics of plastics production and utilization).</b>	<b>32</b>
<b>5.1. Terms of Reference for an Export Market Study.</b>	<b>35</b>
<b>5.2. Petrochemical Intermediates and Products which will be produced in the UAR taken into account at the elaboration of the Export Market Study to be exported from the UAR to other Countries as listed in Appendix 5.3.</b>	<b>38</b>

TABLE OF CONTENTS (continued):

	<u>Page No.</u>
5.3. List of Countries and Geographical Areas for which the Export Market Study should be prepared.	40
5.4. Export Market Study. (Form)	41
5.5. Petrochemical Intermediates and Products available for export from those countries which have been studied as possible importers of Petrochemical Intermediates and Products intended to be produced in the UAR after 1975.	44
6. Terms of Reference for a Feasibility Study on the Development of the Petrochemical Industry in the UAR.	45
7.1. Job Description (Expert in petrochemical intermediates and product technologies).	52
7.2. Job Description (Expert in petrochemical intermediates and product technologies). (Industrial Economist)	55
8. Terms of Reference for a Comparative Study on Know-how, Licences, Patents of the Technological Processes used in the Fertilizers and Petrochemical Industries.	58
8.1. Fertilizer Products and Petrochemical Products, Plastics, Synthetic Fibres, Synthetic Rubber and Synthetic Detergents.	64

## I. INTRODUCTION

The visit was undertaken under SIS 70,1096 (UAR-47), (copy of project data sheet is attached as Appendix 1) and was primarily concerned with marketing and production of petrochemicals in the UAR.

However, the opportunity was taken to discuss with Government representatives of the United Arab Republic, (as well as with the representatives of the Industrial Development Centre for Arab States), a number of matters which are within the writer's competence and related to the general activity of the Fertilizers, Pesticides and Petrochemicals Industries Section. All the meetings took place in Cairo. The names of those participating in the discussions are given in Appendix 2. The writer reached Cairo by air late on 22 January 1971 and departed by air on 5 February 1971 from Cairo to Vienna.

The major discussions were held at the General Organisation for Industrialization (GOI) headquarters in Cairo, which is a subsidiary of the UAR Ministry of Industry, Petroleum and Mineral Wealth in charge of the development of the petrochemical industry; their work starts with the preparation of feasibility and market studies, tender specifications and contracting of the plants with foreign companies. After the plants are contracted by GOI then the construction and starting-up of the plants are undertaken by one of the divisions of the Ministry which later on will be also in charge of their further operation.

The opportunity was taken to have discussions at UNDP headquarters in Cairo with Mr. V.P. Pavlicic, Resident Representative, Mr. A.A. Vassiliev, Senior Industrial Development Field Adviser and UNDP Deputy Resident Representative, Mr. T. Saary, UNIDO Programme Officer and Mrs. S. Habib, UNDP Personnel Assistant.

Thanks are due to Mr. T. Sabry and Mrs. S. Habib for their kind co-operation and assistance in making all the arrangements concerning the meetings and travel problems.

**II. THE MAIN PROBLEMS RELATED TO THE DEVELOPMENT OF A PETROCHEMICAL INDUSTRY IN THE UNITED ARAB REPUBLIC**

Apart from the production of nitrogen fertilizer intermediates there is at present no petrochemical industry in the UAR and the domestic demand for these products is met by imports.

Since 1960, the UAR Government has considered the establishment of a petrochemical industry but due to the war, the plans are being reconsidered.

Starting with 1969 together with the proposals for the next Third Five-Year Plan for Social and Economic Development 1971-1975, the UAR Government considered the establishment of petrochemical complexes based on naphtha which is available locally. In order to determine the sizes of the future petrochemical units as well as the local and export demand in petrochemical intermediates and products, GOI undertook a series of market and feasibility studies and for this purpose they used teams of local experts and the studies prepared by different foreign companies.

As a basis for estimating the market forecast for the next ten years (1971-1980), the experts evaluated first of all the actual situation of the plastics and rubber industries as a potential consumer for synthetic resins and synthetic rubber and the imports of the same products during the last years approaching for this purpose the main branches of the UAR National Economy such as agriculture, transportation, the machinery industry, food and light industry, etc.

As a result of this activity, until the first half of 1970, data and information have been collected on the main domestic demand in synthetic resins and synthetic rubbers and its possible trend until 1980, broken down by type of petrochemical product and potential consumers. An attempt has also been made to estimate roughly the export demand of other Arab countries.

Based on the above figures and the availability of raw materials, the sizes of the plants could be established.

In this respect, it was decided that until 1975, two petrochemical complexes should be put into operation consisting of the following units:

Complex "A" located near Alexandria

- i) Feed preparation unit based on 500,000 tons per year of full range of naphtha and producing feedstocks for the production of olefins and aromatics.
- ii) Steam pyrolysis unit to produce 30,000 tons per year of polymer grade propylene using as feedstocks full range naphtha (72-165°C). The unit should be designed and integrated to include the following:
  - (a) Ethane fraction to be recycled and pyrolyzed in adequate furnaces with the aim to increase the ethylene production.
  - (b) C<sub>3</sub> and C<sub>4</sub> cuts to be used partially in the first stage as LPG for domestic and industrial purposes according to a certain given specification.
  - (c) Butadiene Recovery Unit with a capacity of 12,000 tons per year of polymer grade butadiene using the selective solvent extraction process.
  - (d) Hydrogenation and stabilization of by-product gasoline to be suitable as component for motor gasoline.



- (e) Hydrogen rich gas to be used as such for hydrogenation purposes in the unit itself.
  - (f) Tail gas to be used as fuel in the complex.
  - (g) Fuel oil to be used as fuel.
- iii) Low Density Polyethylene Unit with a total capacity of 45,000 tons per year including homogenisation, finishing and colouring facilities. The grades of polyethylene to be produced should be in accordance with the different uses;
  - iv) Vinyl chloride monomer unit with a capacity of 43,000 tons per year.
  - v) Polyvinyl chloride unit designed to produce a total output of 40,000 tons per year of suspension or bulk type PVC. An alternative of including in the plant a line for emulsion type PVC with a capacity of about 5,000 tons per year should be examined. The plant should offer the possibility to be operated in order to produce various grades of PVC in accordance with the requirements of domestic and foreign consumers and should also include the compounding facilities for different types of products.
  - vi) Polybutadiene Rubber Unit with a capacity of 12,000-14,000 tons per year synthetic rubber. The final capacity of this plant should be decided on the maximum possible butadiene to be extracted by the Steam Pyrolysis Unit.
  - vii) Polypropylene Unit with a capacity of 30,000 tons per year.
  - viii) Ethylene Glycol Unit with a capacity of about 10,000 tons per year monoethylene glycol to be used for the production of polyester fibres.

-3-

The plants mentioned in items (i) to (v) should be put on stream during the period 1973-1975 and the rest of them mentioned in items (vi) to (viii), should enter into production after 1975.

Complex "B" located near Cairo

It is planned that this petrochemical complex shall be integrated with one of the now projected refineries at Cairo and its main objectives will be the production of aromatics and aromatic derivatives. The complex will include the following units:

- i) Catalytic Reforming Unit with a capacity of about 300,000 tons per year of naphtha (range 110-145°C) for the production of the maximum possible xylenes mixture,
- ii) Para-Xylene Unit with a capacity of 20,000-25,000 tons per year using isomerisation of xylene mixture and separation by crystallisation of para-xylene.
- iii) Dimethylterephthalate or pure terephthalic acid unit with a capacity of about 25,000-30,000 tons per year DMF,
- iv) Polyester Chips Unit with a capacity of about 25,000-30,000 tons per year chips.

Regarding the profile of this last Petrochemical Complex, it seems that GOI is still contemplating the possibility of separating part of the ortho-xylene and to use it for the manufacture of phthalic anhydride which could be together with the ortho alcohols, potential raw materials for establishing a plasticizers production in the UAR.

Another alternative envisaged is to isomerise completely the entire available quantity of xylenes in order to get the maximum amount of para-xylene which could be used for the manufacture of DMF and exported as such.

Recently, based on the yields and material balances of certain reforming-isomerization processes, the possibility of separating the ethylene and benzene from the C<sub>8</sub> aromatic concentrate, which could be used for the manufacture of polystyrene and its copolymers, also appears to be very attractive.

Regarding the manufacture of polyester fibres which in the UAR is co-ordinated by another department (textile industry) there are also two alternatives being contemplated:

- (a) Either to manufacture only DMT in this Complex which could be later sold to the textile industry in order to let them produce the fibres starting with the polycondensation and ending with the spinning process in one of their plants, or
- (b) to include in the Petrochemical Complex the manufacture of DMT and polyester chips, the latter being supplied to the textile industry.

According to the latest decisions of the UAR Government, the Cairo Petrochemical Complex should be put into operation after 1975.

Apart from these two Petrochemical Complexes, the UAR Government is evaluating the construction of a carbon black plant with a total capacity of 10,000 tons per year.

GOI and the Ministry of Industry, Petroleum and Mineral Wealth have already agreed on the sites of the two Petrochemical Complexes (namely near Alexandria and Cairo) and they do not need any particular assistance in this field.

In order to clarify the general technical problems as well as various aspects of the economic efficiency related to a particular process, GOI requested, starting with 1970, preliminary tenders from different consulting firms from the USA, western and Eastern Europe and Japan - covering one or more of the proposed petrochemical plants belonging to both complexes which are still under consideration.

It is the intention of GOI to follow as close as possible a certain time schedule which will enable them to have contracted by December 1971 at least those petrochemical plants belonging to the Alexandria Complex considered as first priority and mentioned on pages 3 and 4 of this report.

In this respect, it is envisaged that by the end of 1971 the technical and economic problems related to the type of processes for the first five plants of the Alexandria Complex should be clarified and then, based on final tenders, the contracts should be signed. Such a time schedule will enable the UAR Government to start construction by 1972 and to have the above mentioned plants commissioned by the end of 1973 and beginning of 1974.

At the same time, following the same procedure, GOI will also consider the rest of the plants belonging to the Alexandria and Cairo Complexes which could be contracted in 1972, after all the problems related to their capacity and economic efficiency have been studied.

**III. RESULTS AND CONCLUSIONS REACHED DURING THE EXPLORATORY MISSION IN THE UAR**

---

In accordance with the duties listed in the attached project data sheet, during the first meeting held at GOI headquarters in Cairo on 7 January 1971 which was also attended by Mr. T. Sabry from the UNDP office, a draft programme was proposed in order to achieve in the given time the goals of this mission.

In this respect, a group of experts was formed including:

- Dr. Mohamed Amin Oraby, Director of Petroleum and Petrochemical Department of GOI:
  - Mr. Salah Dewidar
  - Mr. Mansour Zin El din
- } Experts in the same department.

which was to co-operate with the writer during his stay in the UAR in order to provide him with the information and data needed for evaluating the different aspects of this project.

At the same time an agenda was prepared providing the subsequent steps to be taken in order to reach the appropriate conclusions.

The UAR experts pointed out that taking into consideration the first priority given to the five above mentioned petrochemical plants belonging to the Alexandria Complex, they would like to have the writer's activity concentrated especially on them and only within the available time to discuss also the problems connected with the other plants.

Following this procedure, it was decided that during the first week the writer should be given the opportunity of examining all the data and conclusions reached by the UAR experts on the local and export market demand as well as general information on the technological processes evaluated by the date of his arrival in the U.A.R. In accordance with this decision the writer had the opportunity to meet experts from the plastics and rubber industries, to collect information about the status of the actual situation of these industries and to evaluate roughly the present and future demands of different branches of the UAR National Economy.

Furthermore, the writer also had the opportunity of being informed on different technological processes considered up to now by GOI and those on which information is still lacking.

During the second week, based on the relevant information collected, the writer presented his conclusions and also his recommendations on the subsequent steps needed to be taken by GOI and UNIDO in order to implement them.

Among the conclusions reached, mention should be made of the following:

1) Regarding the synthetic resins, namely domestic demand for plastics and projection for the next ten years (1971-1980)

1.1 Based on the premises taken into account by the UAR experts, it seems that generally speaking, the demand figures by type of synthetic resin, are reasonable and they lead to the idea that at least for the years after 1975, 50 per cent of the future capacity would be used for covering the local demand.

1.2 Certain types of synthetic resins such as high density polyethylene vinyl chloride copolymers and ethylene copolymers which potentially might have an increased demand

in the future have not been evaluated. The reason seems to be the shortage of certain monomers such as the vinyl acetate which will not be produced in the UAR.

1.3 The figure for floor covering products (floor tiles) for 1975, seems to be underestimated according to our knowledge of other developed and developing countries and the UAR construction programme for the next years in this field.

1.4 There is no final information available regarding the possibility of replacing traditional materials such as steel, non-ferrous metals, paper, cardboard, wood, etc. by plastics and which might make its impact on the UAR National Economy and on hard currency expenditures for imports.

1.5 The capacity of actual plastic processing industries is loaded only up to 70-75 per cent and it represents a potential consumer in the future without any important investments.

1.6 There are no figures available regarding the consumption of synthetic resins by grades and by types.

2) Examining the synthetic rubber domestic demand

2.1 Taking into consideration the actual and future development in the tyres and rubber goods industry, it seems that the prospects to absorb locally more than 2,500-3,000 tons of polybutadiene rubber are negligible due to the fact that P.B. Rubber is mostly used only in the tread of the tyre.

2.2 Regarding the structure of the Egyptian Rubber Industry and the relatively high ratio between synthetic and natural rubber (60% : 40%), it would appear interesting to investigate possibilities of using other stereospecific synthetic rubber types besides polybutadiene such as SOLPRENE which have a lower cis content than the last one and could successfully replace the SBR type which is actually imported.

Besides these advantages, the same equipment used to produce polybutadiene could also be used for SOLPRENE production, changing the operation conditions.

3) Regarding the export demand in petrochemical products from the UAR

3.1 As previously stated, about 50 per cent of the future petrochemical plants' capacities is to be exported. This conclusion was reached by GOI based on the economic profitability of certain sizes of plants and general export prospects foreseen in other Arab countries. However, there are no indications either on the quantity or on the grades within each type of synthetic resin and rubber which could be exported.

3.2 Since even in the next ten years after the petrochemical complexes have commenced operation, the UAR will still need to import some quantities of other petrochemical products. The Government would also be interested in knowing, apart from export possibilities to other countries, the quantities and types of products which might be imported on a certain reciprocal basis from these countries. Based on the actual and future demand, under this category there are products such as vinyl acetate monomer, styrene monomer, polystyrene polycarbonates, polyurethanes, etc.



4) Regarding the technologies to be used for the future petrochemical complexes

4.1 Based on the studies prepared by the Egyptian experts as well as the discussions they had with the representatives of different foreign consulting organizations, GOI has already decided what type of process to use for one group of the petrochemical plants belonging to the Alexandria petrochemical complex. For the processes falling within this last category, it seems that no more data and information are needed excepting investment costs, production costs and selling prices.

4.2 For a second group of petrochemical plants, more data and evaluations are needed in order to decide which technologies to use.

Under this category fall the technologies for four petrochemical plants of the Alexandria Complex and those belonging to the Cairo petrochemical complex.

4.3 Regarding the manufacture of vinyl chloride monomer using the oxychlorination process, the writer recommended to have also the quantities of heavy chlorinated by-products evaluated and their possible utilization for manufacture of chlorinated solvents.

4.4 Since the UAR Government should proceed with the signing of contracts for purchasing all the complete petrochemical plants belonging to both complexes by the fourth quarter of 1971, GOI would like to have completed by this date, a feasibility study summarizing all the technical and economic aspects and recommendations on the type of process to be used.

**IV. RECOMMENDATIONS ON FURTHER UNIDO TECHNICAL ASSISTANCE FOR DEVELOPING A PETROCHEMICAL INDUSTRY IN THE UAR**

In accordance with the discussions held with the representatives of the General Organization of Industrialization, and with reference to the above conclusions, the writer suggested the following steps to be taken by GOI and UNIDO in order to assist the UAR Government in implementing its programme for the development of a petrochemical industry.

1) **Expert Team for plastic utilization and production (SIS mission)**

This team composed of a chemical engineer and an industrial economist should investigate new methods of plastics utilization and make recommendations on new investments required to increase the capacity of the plastic industry, the economic efficiency of replacement of traditional materials by plastics, the economic profitability of the new plastic factories and its impact on the development of the UAR national economy by reducing the imports and thereby making foreign currency savings.

In Appendices 3 and 4 the corresponding draft job descriptions are presented, prepared in accordance with the general requirements expressed by the UAR experts.

The expert team should be in the field in June-July 1971 for a period of three months.

The conclusions reached by the expert team would help the UAR Government to finally decide on the internal demand of synthetic resins by types and grades and the development of the plastic industries in the UAR.

2) Export Market Study

During the discussions held with the representatives of GOI, it appeared quite clear that without an estimate on the export prospects from the UAR to other countries, no final decision could be reached on the size of the future petrochemical plants belonging to both complexes.

In this respect, the writer has prepared the terms of reference for an Export Market Study described in Appendices 5.1, 5.2, 5.3, 5.4, and 5.5.

In approaching this problem, we tried to consider all the relevant elements which could eventually help the UAR Government in reaching a conclusion on the export projections for the next ten years, or more exactly the next five years after both complexes have been put on stream, namely between 1975 and 1980, such as the geographical areas involved, the foreign competition, the new investments envisaged in the same field by the importing countries under consideration, quality and selling price trends in the future, etc.

Knowing that sometimes an importing country might import different grades of a similar polymer, e.g. PVC or polyethylene, in the mentioned terms of reference the emphasis was mainly on the importance of different grades of synthetic resins and rubbers. It was also considered desirable that at the time the investigations for determining the export possibilities are being carried out, to evaluate in each country the petrochemical products which are going to be produced over and above the domestic demand and which could be exchanged on a compensatory or reciprocal basis, against the petrochemical products imported from the UAR.

It was considered necessary that the study be completed following the form described in Appendix 5.4 which should be undertaken by the contractor for each considered potential importing country and within each country (as described in Appendix 5.3), should have the above mentioned form completed for each product, namely grade as described in Appendix 5.4.

The petrochemical products and intermediates which could be considered, for importation by the UAR on a compensatory or reciprocal basis, are listed in Appendix 5.5.

Taking into consideration that the conclusions of this study have to be known by GOI at least by the end of this year, it was suggested to have this study commissioned to a consulting firm conforming as close as possible to the following time schedule requirements:

- (a) UNIDO (Fertilizers, Pesticides and Petrochemicals Industries Section and TEPCO) investigation in order to get in touch with different consulting firms suitable to undertake the study - February to April 1971.
- (b) List with the suitable consulting firms submitted by UNIDO to the UAR Government - April to May 1971.
- (c) Company(ies) selected by the UAR Government and contract awarded by UNIDO - May 1971.
- (d) Execution of the Export Market Study and study submitted to the UAR Government and UNIDO - June to November 1971.
- (e) Final comments of the UAR Government and UNIDO on the study - November to December 1971.

3) Feasibility Study for the Petrochemical Complexes

As previously stated, in order to meet the requirements of having the contracts for purchasing the petrochemical plants belonging to both complexes signed by the end of this year, GOI needs a feasibility study.

Apart from similar studies, this one has to answer in particular the various problems which were not already solved by the investigations carried out until now by the UMI experts as follows:

3.1 Investment costs and economic efficiency of all petrochemical plants.

3.2 Recommendations on the most suitable technological processes for only part of the petrochemical units, assuming that for three plants GOI has already decided in principle on what type of process to use.

3.3 Recommendations on the alternative to include in the polyolefins and PVC plants a homogenisation and colouring section.

3.4 Evaluation and suggestions on the utilisation of heavy chlorinated by-products obtained from the manufacture of vinyl chloride through the oxychlorination process.

In accordance with GOI's wishes mentioned above, and the writer's suggestions to this point, at the end of our discussions the terms of reference were submitted as presented in Appendix 6 of this report.

In order to meet GOI's demand to have the investment costs for all petrochemical plants as soon as possible, the study has to be submitted in two phases: The first phase being submitted within the first three months after the contract was awarded and the second phase, after six months.

GOI representatives emphasized the necessity to consider for selection of the contractor for this study, the companies listed in the letter sent on 12 October 1970 by Mr. V.P. Pavicic, Resident Representative in the UAR to Mr. A. Manock, Chief of the Section for Africa, Technical Co-operation Division, namely:

- (a) Scandiconsult, Sweden.
- (b) Inam Progetti, Italy.
- (c) TNO, Holland and/or TEBHIN, Holland.
- (d) Petrochemical Consultants Ltd., Austria.
- (e) Kennedy Denkin Consulting Engineers, U.K.
- (f) Badger Ltd., U.K.

One company, namely BEICEP (IFP), France, which originally was on the above mentioned list, was excluded because GOI already got in touch with them directly.

The time schedule of this study has to follow the schedule listed for the Export Market Study.

#### 4) UNIDO assistance for tender evaluation

Since GOI needs to have, apart from the opinion of its experts, an impartial opinion on the selection of the most suitable contractor(s), the writer suggested taking into account the assistance UNIDO could provide for such an activity.

The proposal was accepted and it was suggested to have during the fourth quarter of 1971 a UNIDO team of two experts (one chemical engineer and one industrial economist) in Cairo who,

based on the received tenders, should evaluate them from the technical and economic point of view and should make proposals on the most suitable contractor(s).

The job descriptions drafted for these two posts are presented in the Appendices 7 and 8.

5) UNIDO assistance during the construction and start-up of petrochemical complexes

Knowing the willingness of the UAR Government to proceed further with the implementation of both petrochemical complexes during the forthcoming years after 1971, the writer suggested the idea, and GOI accepted in principle, to have UNIDO technical assistance during the construction of the petrochemical plants until they will be commissioned.

Resulting from the above mentioned discussions, the best ways to achieve the proposed objectives might be the following ones:

5.1 A UNIDO SIS mission composed of a group of two experts could help the corresponding Egyptian Authority during the engineering work for both complexes. Among the duties of such a mission would be the co-ordination between the UAR engineering organization and the corresponding foreign supplying companies in order to meet the terms provided in the contract's time schedule.

5.2 A UNIDO expert who could assist the UAR Government, at the level of a Field Advisor, during the construction of the plants, in order to supervise and co-ordinate all activities of foreign and local equipment suppliers, erection personnel and the engineering organization.

5.3 A UNIDO expert team which could assist the corresponding UAR Authority during the start-up period.

Since all these projects are dependent on the fulfilment of the first mentioned projects, it was decided to approach them step by step and the relevant UAR Government official requests should be received after the first half of 1971.

6) Discussions at the UNDP Office, Cairo

After the discussions with GOI and the Ministry for Industry, Petroleum and Mineral Wealth were finalized, on 4 February 1971, the writer accompanied by Dr. M.A. Oraby, Mr. S. Dewidar and Mr. M. Min Eldim paid a visit to Mr. A.A. Vassiliev. The meeting was attended by Mr. T. Sabry, Programming Officer in charge of UNIDO projects.

During this meeting, the writer presented the work accomplished and the conclusions reached during his mission in the UAR on this occasion.

It was agreed that due to the short time and first priority given by the UAR Government to these projects, GOI should make all necessary arrangements in order to submit the official requests to the Resident Representative's office as soon as possible.

V. MISCELLANEOUS PROBLEMS CONCERNING UNIDO ACTIVITY RELATED TO THE UAR

1) The Ministry for Industry, Petroleum and Mineral Wealth expressed its willingness to being informed on the status of the UNIDO Export Group Meeting on Future Trends in, and Competition between Natural and Synthetic Rubber and in being invited to attend any further meetings related to this subject.

2) The writer considers that among the UAR experts, there are many having much experience in the petrochemical industry who could successfully undertake UNIDO projects mostly in Arab countries where the arabic language is often required.



In this respect, suggestions were made to the Personnel Office of UNDP headquarters in Cairo.

**VI. DISCUSSION WITH THE INDUSTRIAL DEVELOPMENT CENTRE FOR ARAB STATES (IDCAS)**

Knowing the interest of this organisation in UNIDO activities as well as its recent application for UNIDO assistance concerning the establishment of a petrochemical research institute, between 1 and 5 February 1971 the writer had discussions with the IDCAS representatives.

From IDCAS, the meetings were attended by Mr. A.H. Montas, Acting Chief of the Metallurgical and Engineering Industries Section and Dr. A.K. Hilm, expert in petrochemical industries.

UNIDO assistance was discussed for implementing the recommendations of the Fertilisers and Petrochemical Symposium which took place in Kuwait between 18 and 19 January 1971.

1) In accordance with the above mentioned recommendations, IDCAS should take the necessary effective steps to execute the establishment of an Arab Petrochemical Company which will have the purpose of promoting in all Arab countries the development and marketing of the petrochemical products.

Mr. A.H. Montas mentioned that it is the intention of IDCAS to collect all opinions of the interested Arab countries regarding the organisation of this company by the end of April 1971 and then to convene a meeting with the participation of representatives of each Arab country and one UNIDO staff member.

In this connection, an official invitation will be sent to UNIDO by the beginning of March 1971.

2) Another recommendation of the Kuwait Symposium was related to the establishment of a specialized Arab Institute for petrochemicals having as main objectives all activities from the planning stage to the execution, improving of technological processes and training of personnel.

Since the official request should come from an Arab country which would agree to have such an Institute (Syria and Libya are under consideration) after a decision has been taken on its location, UNIDO would be approached.

3) The Symposium recommended that IDCAS should undertake a study for establishing markets concerning the present and future consumption of petrochemical products within the Arab countries. The writer was informed that IDCAS has capabilities to undertake in principle this study. For this purpose, IDCAS is going to study the available experience existing in each Arab country, including the UAR in order to avoid parallel and unnecessary work. However, IDCAS is still considering using UNIDO assistance at a later stage when all the required information has already been gathered and arranged in a suitable form for reaching a conclusion.

4) The last recommendation provides that IDCAS in co-operation with UNIDO undertakes an analytical, comparative study for licences, patents and industries property rights related to the technological processes for manufacture of petrochemical products.

In this connection, the writer was informed that it is desirable to include also in the above mentioned study the main fertilizers and pesticides intermediates.

Having been requested to suggest the next steps to be taken, the writer drafted the Terms of Reference for a comparative study which are presented in Appendices 8 and 8.1 of this report. However, it seems that there are reduced chances to have included in such a study, accurate figures for know-how and licence fees, unless direct negotiation would start with the process owners.

Due to the short time available, it was not possible to discuss in detail with the IDCAS representatives the above terms of reference but it was established that by the beginning of March 1971, an official request will be sent to UNIDO.

V. GENERAL RECOMMENDATIONS FOR IMPLEMENTATION OF THE NEW PROPOSED UAR PROJECTS AS A SPECIAL FUND PROJECT WITH PAO ASSISTANCE TO START WITH

Apart from the previous proposals made in this report, namely to consider each individual project as a T.A. or SIS project, since all of them are contributing to the development of the basic petrochemical industry in the UAR, they might also be considered as components of a larger UNDP/UNIDO Special Fund Project having the same objectives.

Although the last suggested projects could not be completely defined during the visit in the UAR, we could envisage for this alternative the following approach:

- 1) Project title: Assistance for developing the UAR petrochemical industry.
  
- 2) Main components of the S.F. Project and UNDP/UNIDO contribution:
  - 2.1 Expert team for plastics  
Utilisation and production.  
Date and Duration requested:  
After 1 May 1971 (3 months)  
Experts and Costs:
    - a) One Chemical Engineer  
(3 man months) US\$ 6,000.-
    - b) One Industrial Economist  
(3 man months) US\$ 6,000.-

Total expert costs: US\$12,000.-

    - c) UNIDO overhead costs: US\$ 1,700.-

Total costs: US\$ 13,700.-

**2.2 Export Market Study**

**Date requested:** June-November 1971 (6 months)

**Experts and Costs:**

a) Two Market Analysts	US\$ 48,000.-	
b) One Chemical Engineer	US\$ 24,000.-	
c) One Industrial Economist	<u>US\$ 24,000.-</u>	
Total expert costs:	US\$ 96,000.-	
UNIDO Overhead costs:	<u>US\$ 14,000.-</u>	
Total costs:	US\$	110,000.-

**2.3 Feasibility Study for the Petrochemical Complexes**

**Date requested:** June-November 1971 (6 months)

**Experts and Costs:**

a) Two Chemical Engineers	US\$ 48,000.-	
b) Two Industrial Economists	<u>US\$ 48,000.-</u>	
Total Expert Costs:	US\$ 96,000.-	
c) UNIDO Overhead costs:	<u>US\$ 14,000.-</u>	
Total costs:	US\$	110,000.-

**2.4 Assistance for Tender Evaluation**

**Date requested:** December 1971 (3 months)

**Experts and costs:**

a) One Chemical Engineer	US\$ 6,000.-	
b) One Industrial Economist	<u>US\$ 6,000.-</u>	
Total Expert costs:	US\$ 12,000.-	
c) UNIDO Overhead costs:	<u>US\$ 1,700.-</u>	
Total costs:	US\$	13,700.-

2.5 Assistance during the construction of the petrochemical complex

Date requested: 1971-1974

Items and Costs

a) One Chemical Engineer for engineering work (8 man months)	US	32,000.-	
b) One Chemical Engineer for construction and erection work supervision (18 man months)	US	72,000.-	
Total expert costs:	US	104,000.-	
c) U.I.D. Overhead costs	US	15,000.-	
Total costs:	US		119,000.-

2.6 Assistance during the start-up of the petrochemical complex

Date requested: 1974

Items and Costs

a) Two Chemical Engineers (6 man months)	US	24,000.-	
b) U.I.D. Overhead costs	US	3,400.-	
Total costs:	US		27,400.-

2.7 Expendable

a) Ten U.I. experts for one th (5 man months)	US	37,000.-	
b) Travel expenses	US	10,000.-	
Total expert costs:	US	37,000.-	
c) U.I.D. Overhead costs	US	5,200.-	
Total costs:	US		42,200.-

2.8 Equipment for plastic and synthetic rubber evaluation laboratory

a) equipment costs:	US	100,000.-	
b) U.I.D. overhead costs:	US	14,000.-	
Total costs:	US		114,000.-

GROSS TOTAL: US 250,000.-

Since the first four projects are regarded by the UAR Government as a main priority being closely related to its decision to start the investments for both Petrochemical Complexes already in 1972, and since the UNDP Governing Council approval cannot be received sooner than January 1972, we would suggest at this stage to handle them as SIS or PAG projects.

In this category enter the above mentioned projects listed in items 2.1, 2.2, 2.3, and 2.4 summing up a total amount of US\$247,000.- which should be implemented by the end of 1971.

The rest, consisting of four projects, listed in items 2.5, 2.6, 2.7, and 2.8, having a total value of US\$302,600, could be considered as components of a "Mini" Special Fund Project and the Plan of Operation has to be submitted by June 1971 in order to have it approved by the UNDP Governing Council by January 1972.

UNIDO suggests that the UAR Government should submit such a Special Fund project to UNDP indicating the Government's contribution in counterpart services, secretarial assistance, transport, travel and office equipment costs, which may add up to about US\$100,000 (in UAR currency).

Appendix 1

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNITED NATIONS DEVELOPMENT ORGANIZATION

Special Industrial Services

Project Data Sheet

1. Reference No.: UAR/SIS 70,1096 (UAR-47) Country: UAR  
Project title: Exploratory Mission - Marketing and Production  
of Petrochemicals in the UAR.

Date formal request received: 28 October 1970.

Government Department submitting request: Ministry of Foreign  
Affairs.

Purpose of the Project: To study and evaluate the extent of  
data available in the UAR on the present and projected domestic  
demand for major petrochemical products, and to finalize the terms  
of reference of the subsequent feasibility study.

2. Description of the Project: The project will consist of a  
preliminary mission to carry out the following:

- a) Study and evaluate the extent and nature of the available  
data on the present and future market demand for the major  
petrochemical intermediates and products in the UAR and  
neighbouring countries.
- b) Finalize the terms of reference for the subsequent  
feasibility study on the marketing and production of  
petrochemicals in the UAR.

3. Background information: Apart from the production of nitrogen  
fertilizer intermediates there is at present no petrochemical  
industry in the UAR and the domestic demand for these products is  
met by imports.

The Government of the UMR is therefore, considering establishment of a petrochemical complex based on steam cracking of naphtha, which is available locally. As the result of a market study recently completed by the Government and based on projections of domestic market requirements up to 1980, it is planned to establish a petrochemical complex consisting of a number of units for feed preparation and production of major types of petrochemicals. The complex will be located in the Alexandria region.

The object of the subject exploratory mission is to evaluate the extent of the available data on present and projected domestic market requirements for the petrochemical products envisaged and to finalize the terms of reference of the feasibility study proposed to be carried out subsequently.

4. Project components, duration and estimated costs:

<u>Field of activity</u>	<u>Duration</u>	<u>Cost</u>
Chemical engineer with experience in the petrochemical field	2 weeks	US\$1,500.-

5. Request approved:

(Signed H.E. Ward)  
by UNIDO

Date: 11-11-70



Appendix 2

LIST OF PERSONS WITH WHOM DISCUSSIONS WERE HELD DURING VISIT  
TO THE UAR

United Nations Development Programme Office in Cairo:

Mr. V.P. Favicic	Resident Representative.
Mr. A.A. Vassiliev	Deputy Resident Representative/ Senior Industrial Development Field Adviser.
Mr. T. Sabry	Programme Officer, UNDP Programming Office.
Mrs. S. Habib	Personnel Assistant, Personnel Office.

General Organization for Industrialization (GOI)

Dr. Mohamed Amin Oraby	Director of Petroleum and Petrochemical Department, GOI.
Mr. S. Dewiedar	Expert in Petroleum and Petrochemical Department, GOI.
Mr. H. Ein Eldin	Expert in Petroleum and Petrochemical Department, GOI.
Mr. M.F. Filcry	Expert in Petroleum and Petrochemical Department, GOI.
Mr. Y.M. Youssef	Head of Chemical Department, GOI.
Mr. M.S. Bodour	Expert in Chemical Department, GOI.

Ministry of Industry, Petroleum and Mineral Wealth (MIPMW)

Mr. Y. Mohamed	Director of Chemical Department, MIPMW.
Mr. F. El-Fikry	Production Manager in Rubber Factory.
Mr. H. Barghout	Manager of National Plastics Company (El Giza Factory).

Industrial Development Centre for Arab States (IDCAS)

Mr. A.H. Montaz	Acting Chief of Metallurgical and Engineering Industries, IDCAS.
Dr. A.K. Hilmi	Expert in Petrochemical Industry, IDCAS.

Appendix 3

REQUEST FROM THE GOVERNMENT OF THE UNITED ARAB REPUBLIC FOR SPECIAL INDUSTRIAL SERVICES

JOB DESCRIPTION

UAR-

**Post title:** Expert in plastic production and utilization.

**Duration:** Three months with possibility of extension.

**Date required:** As soon as possible after 1 May 1971.

**Duty station:** Cairo with travel to Alexandria and other parts of the country as required.

**Purpose of the Project:** The Government of the UAR intends to make a qualitative and quantitative evaluation on increasing the utilization of plastics in all the main fields of the National Economy and to evaluate its impact on the manufacture of synthetic resins and the new investments in the plastic industry during the next ten years. The conclusions and recommendations of the expert will be used for determining the expansion policy in the plastic industry and the production scheme of the new Alexandria Petrochemical Complex regarding the types and grades of synthetic resins to be produced. The expert will be one of a UNIDO team of two experts, the other being an Industrial Economist.

**Duties:** The expert will be assigned to work in close co-operation with the General Organization for Industrialization (GOI), a subsidiary of the Ministry for Industry, Petroleum and Mineral Wealth of the UAR and will have the following duties:

- a) Evaluation of the thermoplastics consumption in the USSR by types and grades of synthetic resins needed by the main sectors of the National Economy such as agriculture, construction, food and light industry, transportation, machine building industry, etc.
- b) Based on the above mentioned figures as well as on the estimated development of the National Economy during the next ten years (until 1950) the expert will make recommendations and estimates in tonnage by products and grades for new utilizations of plastics in all fields of activity.
- c) Evaluation of the existing producing capacities and their possibility to increase the plastic output by loading the actual equipment up to 100 per cent.
- d) Proposals for new investments during the next ten years in the plastic industry in order to meet the demand mentioned in (b).
- e) The total demand of synthetic resins by type and grade, plasticizers and other auxiliary materials needed for the development mentioned in (b) and (d).

**Qualifications:**

Chemical Engineer with extensive experience in processing and utilization of thermoplastics.

Language: English

Background Information: The proposals for the Third Five-Year Plan of the United Arab Republic provides that in 1975 a Petrochemical Complex should be put into operation near Alexandria. Among the main production units within this Complex would be a low density polyethylene plant and possibly a high density polyethylene plant, a PVC plant (suspension and possible bulk PVC type and V.C. comonomers) and a polypropylene plant. The production of polystyrene and plasticizers is also contemplated to be developed on another site. The UAR has already a plastic industry concentrated in Cairo and Alexandria which is operating a number of factories belonging to the State Sector and many workshops belonging to the Private Sector, all having accumulated vast experience in processing different types of synthetic resins through injection moulding, extrusion, blow moulding, spreading, etc. The SIS project will help the UAR Government to take the subsequent steps needed for developing the development of the plastics industry with the synthetic resin production.

Appendix 4

**REQUEST FROM THE GOVERNMENT OF THE UNITED ARAB REPUBLIC FOR SPECIAL INDUSTRIAL SERVICES**

---

**JOB DESCRIPTION**  
**UAR-**

**Post title:** Expert in economics of plastic production and utilization.

**Duration:** Three months with possibilities of extension.

**Date required:** As soon as possible after 1 May 1971.

**Duty station:** Cairo with travel to Alexandria and other parts of the country as required.

**Purpose of the Project:** The Government of the UAR is interested in having an economic evaluation on the efficiency of increasing the utilization of plastic by 1980 and its impact on the UAR's National Economy. The conclusions reached by the expert will be used for taking decisions on the new investments to be implemented in the plastic industry and for preparation of detailed tender specifications and engineering detailed works.

**Duties:** The expert will be one of a UNIDO team of two experts, the other being a Chemical Engineer. He will be assigned to work in co-operation with the General Organisation for Industrialization (GOI), a subsidiary authority of the UAR Ministry for Industry, Petroleum, and Mineral Wealth and will have the following duties:

(a) Evaluate in terms of economic efficiency the future demand of plastics and synthetic resins (by types and grades) and its impact on the reduction of imports of synthetic resins and plastics during the next ten years.

(b) Evaluate the economic efficiency by replacing the traditional materials such as glass, cardboard, paper, wood, jute, metals, etc. by plastics and make corresponding recommendations.

(c) Evaluate the investment costs for the new plastics factories provided to be implemented between 1972-1980, as well as the economic influences on production costs assuming that the actual factories could be loaded up to 100 per cent of their original capacities. In accordance with the recommendations made by the chemical engineer for the actual factories, the supplementary investments have to be evaluated.

(d) Evaluate the production costs of the new units and the selling prices (for domestic and export market) by group of plastics goods.

**Qualifications:**

Industrial Economist with an academic degree and extensive experience in plastics production and utilisation.

**Language:**

English

**Background Information:** The Proposals for the Third Five-Year Plan of the United Arab Republic provides that in 1975 a Petrochemical Complex should be put into operation near Alexandria. Among the main production units within this Complex would be a low density polyethylene plant and possibly a high density polyethylene plant, a PVC plant, (suspension and possible bulk PVC type and V.C. co-monomers) and a polypropylene plant. The production of polystyrene and plasticizers is also contemplated to be developed on another site. The UAR has already a plastics industry concentrated in Cairo and Alexandria which is operating a number of factories belonging to the State Sector and many workshops belonging to the Private Sector, all having accumulated vast experience in processing different types of synthetic resins through injection moulding, extrusion, blow moulding, spreading, etc. The SIS project will help the UAR Government to take the subsequent steps needed for developing the domestic demand and correlate the development of the plastics industry with the synthetic resin production.

TERMS OF REFERENCE  
FOR AN EXPORT MARKET STUDY

I. GENERAL BACKGROUND INFORMATION

The proposals for the Third Five-Year Plan of the United Arab Republic provides that by 1975 two Petrochemical Complexes should be put into operation.

The first one which will be located close to Alexandria will produce high and low density polyethylene, PVC (polypropylene, butadiene, synthetic rubber (polybutadiene and styrene-butadiene rubber with a low cis content) ) and ethylene glycols (mono-, di- and tri).

The second Petrochemical Complex will be located close to Cairo and will produce benzene, toluene, ortho-, meta- and para-xylene, DMT and polyester chips.

At the same time, the plastics industry in the UAR will be developed by putting into operation new units and by diversifying the actual production.

The Petrochemical Complex and the plastics industry, will have available for export as from 1975, increased quantities of petrochemical intermediates and products as well as plastic goods.

II. OBJECTIVES OF THE EXPORT MARKET STUDY

- 1) The Contractor is required, based on the products and groups of products listed in Appendix 5.2, to make proposals on the possibilities of exporting them during the years 1971-1980 to the countries mentioned in Appendix 5.3.



2) The study should be prepared following as close as possible the information required by the form shown in Appendix 5.4.

Using Appendix 5.4 as a guide, the contractor should collect the required information (for each country and within each country), related to each grade of products listed in Appendix 5.2 under Chapter II (synthetic resins) and Chapter III (synthetic rubbers). For the rest of the products listed in Appendix 5.2 (Chapters I, IV and V), the contractor should also complete the form mentioned in Appendix 5.4, taking into consideration only those qualities and grades which are normally sold on the international market. In any case, the contractor is required to complete for each product a form as described in Appendix 5.4.

3) The conclusions and the recommendations of the study should be based on the information contained in the form described in Appendix 5.4 and they should give an orientation on the quantities of products (by grades), the year(s) when they could be exported and the potential importing countries.

4) In case the required data is not available by countries, Appendix 5.4 could be completed for geographical areas. In any case, the contractor should indicate the sources (official surveys issued by different authorities in the countries, statistical bulletins, etc.) which have provided the relevant information.

5) In order to investigate a possible exchange of petrochemical products on a compensative basis, subject to the latter being established through negotiations by the foreign trade authorities of the U.M. and the interested countries, apart from the above mentioned information the contractor is required to investigate in each country or geographical area the availability in the next ten years of the petrochemical products listed in Appendix 5.5.

Appendix 3.1  
SIA.1

**III. GENERAL**

- 1) The study should be submitted six months after UNIDO's notification of contract award, in five copies in English to UNIDO and five copies in English to the General Organization for Industrialization.
- 2) UNIDO shall submit its comments on the study within thirty days of its receipt. The General Organization for Industrialization shall submit its comments on the study through UNIDO thirty days after its receipt.
- 3) The contractor shall take into account the comments made by UNIDO and the General Organization for Industrialization in preparing the final report which shall be submitted within the following thirty days to UNIDO and the General Organization for Industrialization in twenty copies in English.

SECRET

PERSONNEL INFORMATION AND PRODUCTS WHICH WILL BE PROVIDED  
BY THE U.S. AIR FORCE TO THE U.S. AIR FORCE  
OF THE AIR FORCE SHALL BE TO BE REPORTED TO THE AIR  
... ..

**1. PERSONNEL INFORMATION AND PRODUCTS WHICH WILL BE PROVIDED**

1. Station
2. Supply
3. Navy, Air and Army, Army, Army
4. AF
5. AF and Air Force
6. AF
7. AF
8. AF
9. AF
10. AF (by product of station production)

**2. PERSONNEL INFORMATION AND PRODUCTS WHICH WILL BE PROVIDED**

1. AF (supply) - by grade
2. AF (supply) - by grade
3. AF (supply) - by grade
4. Low density polyethylene - by grade
5. High density polyethylene - by grade
6. Polyethylene - by grade
7. Water tank of polyethylene with carbon tank

**3. PERSONNEL INFORMATION AND PRODUCTS WHICH WILL BE PROVIDED**

1. AF - by grade
2. Polyethylene tank - by grade

Appendix 3-3  
[Redacted]

**27. PLASTIC GOODS (BY TYPE AND BY TYPE OF MATERIAL)**

1. Film
2. Heavy duty units
3. Pipes and tubes
4. Injection molded goods
5. Extruded products
6. Architectural leather
7. Structural profiles
8. Sheet and fabrics

**28. LEATHER GOODS (BY TYPE AND BY TYPE OF MATERIAL)**

1. Types by size and type (SA, custom, heavy)
2. Industrial leather goods
3. Miscellaneous leather goods

SECRET

**LIST OF COUNTRIES  
AND GEOGRAPHICAL AREAS FOR WHICH THE REPORT  
MAY BE OF INTEREST TO THE UNITED STATES**

1. All countries in Africa
2. The Arab countries, Turkey and other Middle East countries
3. European Mediterranean countries (Spain, France, Italy, Yugoslavia and Greece)
4. Pakistan, Afghanistan, India and Ceylon
5. Southeast Asia.

Appendix 5.4

MARKET STUDY

Code No.: ....

**Product:** ....

**Grade:** As defined by one or two technical characteristics and by trade marks of similar grades existing on the world market.

**Country or geographical area:** ....

	Units	1971	1972	etc.	1980
<b>1. DEMAND</b>					
1.1 Total Product Demand	tons/yr.	..	..	..	..
1.2 Total Grade Demand	tons/yr.	..	..	..	..
<b>2. PRODUCTION</b>					
2.1 Total output of product	tons/yr.	..	..	..	..
2.2 Total output of the considered grade	tons/yr.	..	..	..	..
<b>3. TRADE</b>					
3.1 Total import of considered grade by exporting countries	tons/yr.	..	..	..	..
3.1.1 Country - A	tons/yr.	..	..	..	..
3.1.2 Country - B	tons/yr.	..	..	..	..
.....					
..... etc.					
<b>4. UTILIZATION</b>					
4.1 Quantities of grade ... used for production of ...	tons/yr.	..	..	..	..
4.2 Quantities of grade ... used for production of ...	tons/yr.	..	..	..	..
.....					
..... etc.					
<b>5. ACTUAL SELLING PRICES AND SELLING CONDITIONS AND FUTURE TRENDS BASED ON ACTUAL IMPORTS</b>					
5.1 Country ...	tons/yr.	..	..	..	..
5.2 Country ...	tons/yr.	..	..	..	..
.....					
..... etc.					







Appendix 5.5

**PETROCHEMICAL INTERMEDIATES AND PRODUCTS AVAILABLE FOR EXPORT FROM  
THOSE COUNTRIES WHICH HAVE BEEN STUDIED AS POSSIBLE IMPORTERS OF  
PETROCHEMICAL INTERMEDIATES AND PRODUCTS INTENDED TO BE PRODUCED  
IN THE UAR AFTER 1975.**

---

**I. General Petrochemical Intermediates and Products**

1. Styrene monomer
2. Caprolactam monomer
3. Intermediates for polyurethanes production
4. Bisphenol A
5. Plasticizers
6. Oxo Alcohols
7. Acrylonitrile

**II. Synthetic Resins**

1. Polystyrene
2. Methyl Polymethacrylate
3. Polycarbonate
4. Polyurethanes
5. Cellulose acetate
6. Polyester resins
7. Copolymers ABS and AS

**III. Synthetic Rubbers**

1. Polyisoprene
2. Butyl rubber
3. Ethylene-propylene rubber
4. Nitrile rubber
5. Synthetic latexes

Any other petrochemical products which will be available during the next ten years.

NOTE: For each of the above mentioned products, the contractor should indicate its estimates on the available quantities and the years when they could finally be exported.

TERMS OF REFERENCE  
FOR A FEASIBILITY STUDY ON THE DEVELOPMENT OF THE  
PETROCHEMICAL INDUSTRY IN THE

UAR

I. GENERAL BACKGROUND INFORMATION

Apart from the production of nitrogen fertilizers there is at present no major petrochemical industry in the UAR and the domestic demand for these products is met by imports.

In accordance with the proposals for the Third Five-Year Plan two petrochemical complexes are under consideration for being built and put on stream by 1975. The first complex located close to Alexandria will use as raw material naphtha and will produce PVC, polyethylene, polypropylene, ethylene glycols and synthetic rubber.

The second petrochemical complex will be located close to Cairo and will produce based on the naphtha reforming and isomerization benzene, toluene, ortho-, meta- and para-xylene, BHT and polyester chips for the production of polyester fibres.

The production of both petrochemical complexes is destined to satisfy the increasing demand of the UAR and to be exported to other countries.

Up to 1971, the General Organization for Industrialization, a subsidiary of the UAR Ministry for Industry, Petroleum and Mineral Wealth, has already considered different technological processes for part of the petrochemical plants belonging to both complexes and in this respect, some preliminary studies have been prepared. Based on these, GOI has already decided on the technologies to be used for some of the petrochemical plants. For the rest of the petrochemical production units, the technological processes are still under consideration.

Appendix 6  
Page 2

The production capacities of all petrochemical units have been established by SOI, taking into consideration some preliminary data on local demand and possible export demand projections.

At present, following the studies and evaluations made by SOI, the situation is as follows:

1. Alexandria Petrochemical Complex

1) Petrochemical production units having already established the type of technological process.

<u>No.</u>	<u>Petrochemical Plant</u>	<u>Capacity</u>	<u>Type of process</u>
1.1	Olefins plant.	50,000 tons/yr. ethylene. 16,000-18,400 tons/yr. propylene.	Steam reforming (severe cracking of naphtha).
1.2	Low density polyethylene plant.	2 production lines with a total capacity of 45,000 tons/yr.	Tubular process.
1.3	Styrene extraction.	11,500 tons/yr. styrene.	EF solvent extraction.

2) Petrochemical Production Units with technological processes under consideration

2.1	Vinyl chloride monomer plant.	42,000-43,000 tons/yr. V.C. monomer.	Cryohydrolysis.
2.2	PVC plant.	40,000 tons/yr. PVC.	Suspension or bulk polymerization process.

<u>No.</u>	<u>Petrochemical Plant</u>	<u>Capacity</u>	<u>Type of process</u>
2.3	High density poly-ethylene plant.	20,000 tons/yr.	** .....
2.4	Polypropylene plant.	30,000 tons/yr.	.....
2.5	Ethylene Oxide and ethylene glycol plant.	10,000 tons/yr. ethylene glycols.	.....
2.6	Synthetic rubber plant.	12,000-14,000 tons/yr.	*High cis poly-butadiene rubber or Solprene type with a low cis content.

\* These processes have been in principle evaluated without selection of a particular licence or know-how.

\*\* It is expected by increasing the capacity of the olefins plant to fulfil the requirements of this unit.

B. Cairo Petrochemical Complex

<u>No.</u>	<u>Petrochemical Plant</u>	<u>Capacity</u>	<u>Type of process</u>
2.7	Naphtha reforming plant.	300,000 tons/yr. through-put of heavy naphtha.	No process has been considered until now.
2.8	Isomerisation and xylenes separation and purification plant.	25,000 tons/yr. para-xylene and corresponding quantity of meta-xylene.	" " " "
2.9	IMP or purified terephthalic acid plant from para-xylene.	Adequate capacity to produce 25,000 tons/yr. polyester chips.	" " " "

**II. SCOPE OF THE FEASIBILITY STUDY**

For both the petrochemical complexes, the contractor is required to submit a feasibility study including the following information:

1) For the petrochemical plants belonging to the Alexandria Petrochemical Complex having already selected technological ~~PROCESS~~

1.1 Estimation of the investment costs (battery limits)  
- total investment cost and broken down by the following categories in foreign currency (US\$) and local currency (Egyptian pounds).

**In Foreign Currency (US\$)**

- 1.1.1 Total materials and equipment;
- 1.1.2 Freight and Marine Insurance;
- 1.1.3 Supervision, erection and start-up;
- 1.1.4 Procurement;
- 1.1.5 Engineering;
- 1.1.6 Know-how;
- 1.1.7 License fees;
- 1.1.8 Spare parts for two years operation;
- 1.1.9 Initial filling with solvents and catalysts, if any, and separate cost for chemicals, solvents and catalysts for six months operation.

In local currency (L.S.)

1.1.10 Civil Engineering Works.

1.1.11 Erection Works.

1.1.12 Material and utilities requirements for start-up for three months operation.

1.2 Estimation of production costs and recommendations on the selling prices for the local market in order to have a pay-out period of five years and assuming an selling prices for export the international prices, and 50 per cent of the total production would be exported.

2) ~~For the petrochemical plants belonging to Alexandria and other petrochemical complexes for which the technological processes have not been selected, the contractor is required to submit the following information:~~

2.1 Selection of the process based on a techno-economic comparison of the leading processes used in the world.

2.2 Raw materials and utilities, specific consumptions and their quality requirements.

2.3 Estimate of the investment costs (battery limits) as required by item (1.1) above.

2.4 Estimate of production costs and recommendations on selling prices for local market and export as required by item (1.2).

2.5 For the polyethylene, PVC and polypropylene plants, the contractor is required to estimate the investment costs needed in order to provide each of those three plants with a homogenization, compounding and colouring section. The percentage of total production to be homogenized and coloured should be estimated by the contractor according to the practice of similar projects.

- 2.1 Recommendations on the utilization of heavy chlorinated by-products obtained during the manufacture of vinyl chloride monomer by the oxychlorination process as well as on the utilization of the other by-products which would be obtained by the other petrochemical plants.
- 2) The contractor is required to include in the feasibility study the following information regarding both petrochemical ~~plants~~:

---
- 2.1 Estimation of the utilities and facilities needed for each of the two complexes outside battery limits of process units and inside the battery limit of complexes.
- 2.2 Man-power requirements qualification and suggested training programs.
- 2) After the contract has been awarded, OIL will provide the contractor with all information related to the technical specifications and local prices of the raw materials and utilities available in the U.R.
- 2) All costs listed in the contractor's study should be expressed in US dollars, mentioning if needed, the rate of exchange for other currencies. The metric system of measures and weights will be used throughout the study.

**2.3. GENERAL PERSONNEL SERVICES**

- 1) The contractor's team leader should be available in Vienna, Vienna, for technical discussions within a maximum of seven days from the receipt of the signed contract by the contractor.
- 2) The contractor's personnel should be in the field for working within ten days after conclusion of discussions in Vienna as per clause 2.3-1.

**Annex 6**  
**Annex 6**

- 3) During the execution of work under the contract, the contractor shall submit to UNDO and OIL short monthly progress reports in three copies in English providing information on the work performed.
- 4) The contractor should submit three months after UNDO's notification of the contract award, the FIRST part of the feasibility study (Phase I) containing the information listed in Chapter II para. 1.1 - and Chapter III para. 1.) (investment costs) in five copies in English to UNDO and five copies in English to OIL.
- 5) The contractor should submit the rest of the feasibility study (Phase II), six months after UNDO's notification of contract award in five copies in English to UNDO and five copies in English to OIL.
- 6) One month after receiving each Phase (I and II) UNDO and OIL will send through UNDO their comments on the received studies.
- 7) The contractor shall take into account the comments made by UNDO and OIL in preparing the final report, which shall be submitted within the following thirty days after Phase II has been submitted, in ten copies in English to UNDO and ten copies to OIL.



SECRET

SECRET AND NOT TO BE DISCLOSED TO THE PUBLIC  
... ..

ANALYSIS

**Fact 1961.** Report is a technical and statistical analysis of the present situation.

**Significance.** This report will provide a basis for action.

**Date required.** A copy is possible after 1 November 1970.

**Why written.** Under this report is intended to provide other parts of the report is required.

**Purpose of the Report.** In Government of the U.S. is interested in having a comprehensive evaluation of technical progress for the international plane industry in the technology. Following this report and the future international situation. The conclusions reached by the report by analyzing comprehensively the different technical will help the Government in making decisions on the next steps for the international plane.

**Notes:** The report will be one of a series of reports, the other being in statistical documents. It will be required to work in cooperation with the General Administration for International Affairs (GIA) a subsidiary institution of the U.S. Ministry of Industry, Production and Commerce. It will have the following content:

Appendix 7.1  
RFP No. ....

- a) Evaluate each tender in terms of technical advantages compared with the best known technologies used in the world for the manufacture of similar products.
- b) Rank the competitiveness of the tenders received for each petrochemical plant making recommendations as to the most suitable process to the U.A.R. conditions and requirements.
- c) Propose to OIG to ask for additional information if needed from the consulting companies, which could be relevant for taking a final decision on the contractor(s).
- d) Assist the Industrial Economist in evaluating the economics of each tender, pointing out those technical aspects which reflect a higher economic efficiency.

**Qualifications:**

Chemical Engineer with extensive experience in design and engineering works related to new petrochemical processes, tender evaluation and petrochemical plant operation.

**Language:**

English

**Background Information:**

The proposals for the Third Five-Year Plan of the United Arab Republic provides that in 1975 a petrochemical complex should be put into operation near Alexandria and another one near Gizeh. Among the main petrochemical plants included in the two complexes would be the following production units:

- i) Olefins plant with a capacity of 80,000 tons/yr. ethylene and 36,000 tons/yr. propylene.
- ii) Low density polyethylene plant with a capacity of 45,000 tons/yr.
- iii) High density polyethylene plant with a capacity of 20,000 tons/yr.
- iv) Vinyl chloride monomer plant with a capacity of 43,000 tons/yr. (oxychlorination process).
- v) PVC plant (suspension or bulk process) with a capacity of 40,000 tons/yr.
- vi) Polypropylene plant with a capacity of 30,000 tons/yr.
- vii) Ethylene oxide and ethylene glycol with a capacity of 10,000 tons/yr. mono-ethylene glycol.
- viii) Butadiene recovery and purification unit - total capacity 11,500 tons/yr. (IMF process).
- ix) Naptha reforming plant - total through-put 300,000 tons/yr. heavy naptha.
- x) Isomerization and para-xylene separation and purification unit - total capacity 25,000-30,000 tons/yr.
- xi) IMF or pure terephthalic acid plant capacity 25,000 tons/yr. IMF.

For the above mentioned plants, tenders would be submitted which have to be evaluated by the UNIBO expert(s).

Appendix 7.2

REQUEST FROM THE GOVERNMENT OF THE UNITED ARAB  
REPUBLIC FOR SPECIAL INDUSTRIAL SERVICES

JOB DESCRIPTION

UAR-

- Post title:** Expert in petrochemical intermediates and product technologies.
- Duration:** Three months with possibility of extension.
- Date required:** As soon as possible after 1 November 1971.
- Duty station:** Cairo, with travel to Alexandria and other parts of the country as required.
- Purpose of the Project:** The Government of the UAR is interested in having a techno-economic evaluation of tenders received for the petrochemical plants belonging to the Alexandria Petrochemical Complex and the Cairo Petrochemical Complex. The conclusions reached by the expert by studying comparatively the different tenders will help the UAR Government in taking a decision on the contractor(s) for the above mentioned plants.
- Duties:** The expert will be one of a UNIDO team of two experts, the other being a Chemical Engineer. He will be assigned to work in co-operation with the General Organization for Industrialization (GOI), a subsidiary of the Ministry for Industry, Petroleum and Mineral Wealth and will have the following duties:
- a) Evaluate comparatively the tenders received for each petrochemical plant from the point of view of economic efficiency and make corresponding recommendations on the most suitable tenders.

b) Co-operate with the Chemical Engineer in defining how the different technical aspects are reflected in the economic efficiency of tenders.

**Qualifications:**

Industrial Economist with an academic degree and extensive practical experience in the economic evaluation of petrochemical projects.

**Language:**

English.

**Background Information:** The proposals for the Third Five-Year Plan of the United Arab Republic provides that in 1975 a petrochemical complex should be put into operation near Alexandria and another one near Cairo. Among the main petrochemical plants included in the two complexes would be the following production units:

- i) Olefins plant with a capacity of 80,000 tons/yr. ethylene and 36,000 tons/yr. propylene.
- ii) Low density polyethylene plant with a capacity of 45,000 tons/yr.
- iii) High density polyethylene plant with a capacity of 20,000 tons/yr.
- iv) Vinyl chloride monomer plant with a capacity of 43,000 tons/yr. (oxy-chlorination process.).
- v) PVC plant (suspension or bulk process) with a capacity of 40,000 tons/yr.

- vi) Polypropylene plant with a capacity of 30,000 tons/yr.
- vii) Ethylene oxide and ethylene glycol with a capacity of 10,000 tons/yr. mono-ethylene glycol.
- viii) Butadiene recovery and purification unit - total capacity 11,500 tons/yr. (DMF process).
- ix) Naphtha reforming plant - total through-put 300,000 tons/yr. heavy naphtha.
- x) Isomerization and para-xylene separation and purification unit - total capacity 25,000-30,000 tons/yr.
- xi) DMF or pure terephthalic acid plant capacity 25,000 tons, yr. DMF.

For the above mentioned plants, tenders would be submitted which have to be evaluated by the UNIDO expert(s).

TERMS OF REFERENCE  
FOR A COMPARATIVE STUDY ON KNOW-HOW, LICENCES,  
PATENTS OF THE TECHNOLOGICAL PROCESSES  
USED IN THE FERTILIZERS AND PETROCHEMICAL INDUSTRIES

I. GENERAL BACKGROUND INFORMATION

During the last years some of the Arab countries were contemplating developing a fertilizers and/or petrochemical industry based on local natural resources like natural gases and petroleum.

Since it is necessary that these industries be established on a sound economical basis, all Arab countries are interested in having information on performances of different know-how and licences used on a world scale for the manufacture of various petrochemical intermediates and products, and on their technical and economic efficiency in the specific conditions existing in each of these countries.

In this respect, the last Symposium on the Fertilizers and Petrochemicals Industries in Arab Countries (Kuwait, 18-19 January 1971) made recommendations that the Industrial Development Centre for Arab States (IDCAS) in co-operation with UNIDO should undertake an analytical comparative study on licences, patents and industrial property rights related to the technological processes for the manufacture of various fertilizers, fertilizer intermediates, petrochemical intermediates and products intended for production during the forthcoming years, in the Arab countries.

appendix 8  
Table 1...

II. ~~CONFIDENTIAL~~ INFORMATION

The contractor is required to take into consideration the products and information listed in Appendix 7.1 to submit a comparative study on the actual status of the licensee, know-how and property rights related to the technological processes for manufacturing each of the above mentioned information and products including the following information:

1) ~~CONFIDENTIAL~~ INFORMATION.

- 1.1 Process description including flow sheets and general operation conditions such as temperature, pressure, etc.
- 1.2 Raw materials quality requirements.
- 1.3 Specific description of raw materials utilization.
- 1.4 Significant figures related to the yields, conversions, etc. for one major step of the process involved.
- 1.5 Type and nature of the catalysts involved in one or more steps of the process.
- 1.6 By-products (quantity, quality and utilization).
- 1.7 Special requirements regarding the air and water pollution problems related to the process, if any.
- 1.8 Hazards (if any).
- 1.9 Key equipment, if any, with critical components and special requirements for operation.



2) Main Economic Information

2.1 The minimal economic size of the plant mentioning the number of process lines and their characteristics. (in tons/day and/or tons, yr.)

2.2 Investment costs (latterly limits) in US\$ for the minimal economic size broken down by the following categories:

2.2.1 Total materials and equipment

2.2.2 Supervision, erection and start-up

2.2.3 Procurement

2.2.4 Engineering, know-how and licence fees, if possible, broken down by each individual item.

2.3 Similar figures to those mentioned on (2.2) for the most economic size with the indication on the capacity. (in US\$)

2.4 General information on production costs based on standard conditions (USA or Europe) broken down by main elements. Relations between size of the plant and costs (in US\$) and/or other relevant elements connected with the process.

2.5 Selling prices and their trends (in US\$/ton).

2.6 Some significant economic indexes of economic efficiency (return on the investments, cash flow discount, pay-out time etc.).

2.7 Description of a few plants using the above process. Company, location, capacity, etc.

2.8 Non-power requirements by category (per shift and total).

3) General information related to the Know-How and License

1.1 License and know-how owners. (names of companies and number of patents involved).

1.2 Names of consulting or engineering companies entitled to use the above licenses.

1.3 Validity of license, know-how and patents involved. (years or the last year)

1.4 Special conditions requested by the license owner in the case of commercial arrangements concluded with a licensee.

1.5 Restrictions imposed by the license owner granting its license.

Remarks:

(a) The contractor is supposed to collect the above information, as far as they are either ready to be disclosed or based on his own experience. However, it is expected that the contractor will approach the main licensors in order to get some of the general requested data, as far as this would be possible and acceptable to the licensors.

(b) For each product or intermediate listed in the Appendix B.1, the contractor is requested to complete the above mentioned information, repeating it as many times as processes are considered for that particular intermediate or product.

(c) In principle, the contractor is requested to consider all processes already implemented on a commercial scale. However, if for any one of them, not enough information is available, the contractor should present in the study only those processes for which he has succeeded to collect information.

(d) After all manufacturing processes of a certain intermediate or product have been presented, the contractor should summarize in a brief report the main advantages and disadvantages of any of them, pointing out what local conditions should be fulfilled in order to take the highest benefit any of them could provide (e.g. selling price of a certain raw material or/and utility below a certain level, qualified personnel, maintenance problems, etc.).

(e) All costs listed in the contractor's study should be expressed in US dollars, mentioning if needed, the rate of exchange for other currencies. The metric system of measures and weights will be used throughout the whole study.

### III. GENERAL PROGRAMME SCHEDULE

- 1) The contractor's team leader should be available in UNIDO, Vienna, for technical discussions within a maximum of seven days from the receipt of the signed contract by the contractor.
- 2) The contractor's personnel should be in the field for briefing by IDAS, ten days after conclusion of discussions in Vienna.
- 3) The contractor should submit five months after UNIDO's notification of the contract award the cooperative study in five copies in English to UNIDO and five copies in English to IDAS.

Appendix B  
Page 6

- 4) One month after receiving the comparative study, UNIDO and IDCAS will send through UNIDO their comments on the received study.
- 5) The contractor shall take into account the comments made by UNIDO and IDCAS in preparing the final report which shall be submitted within the following thirty days, after the date the comparative study has been first submitted, in ten copies in English to UNIDO and ten copies in English to IDCAS.

1000000

**PHOSPHORUS**

- 1) Ammonia
- 2) Urea
- 3) Di-ammonium phosphate
- 4) Ammonium nitrate
- 5) Single super phosphate
- 6) Triple super phosphate
- 7) Triple super phosphate
- 8) Super phosphate
- 9) Phosphorus

- 10) Potassium chloride
- 11) Potassium sulphate

- 12) Compound Fertilizers 12-12-12  
or any other formula

**PHOSPHORUS**

- 13) Dicalcium
- 14) Tricalcium
- 15) Tetradecan
- 16) Dodecane
- 17) Hexadecane
- 18) 12 or 14
- 19) Caproic acid
- 20) 12
- 21) Myristic
- 22) Arachidic

Appendix B.1  
B.1.1

**Section**

- 1) Polyethylene
- 2) PVC
- 3) Polystyrene
- 4) Polycarbonate

**Section B.1.1**

- 1) Polyethylene
- 2) Polystyrene
- 3) Polycarbonate

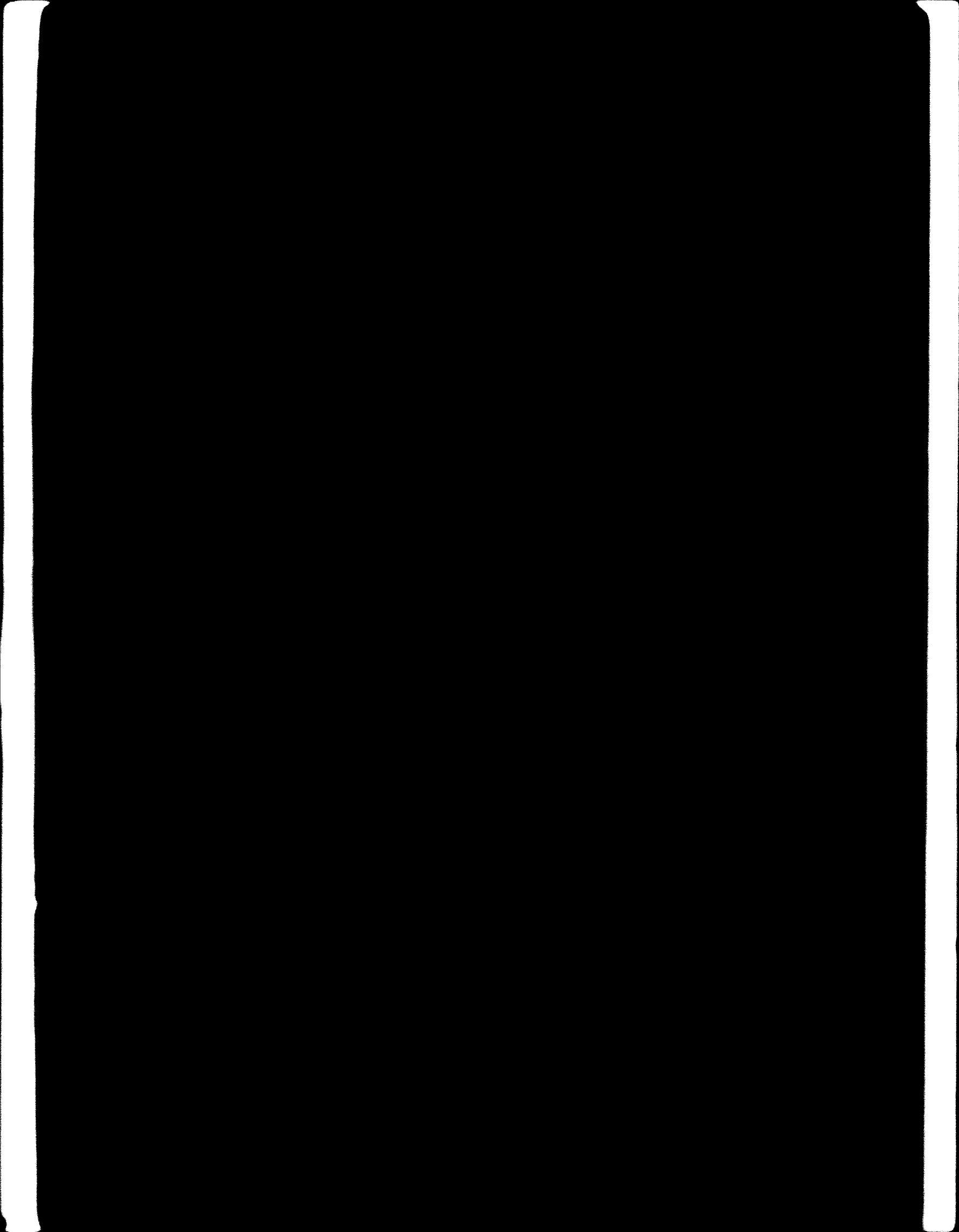
**Section B.1.2**

- 1) PVC
- 2) Polycarbonate

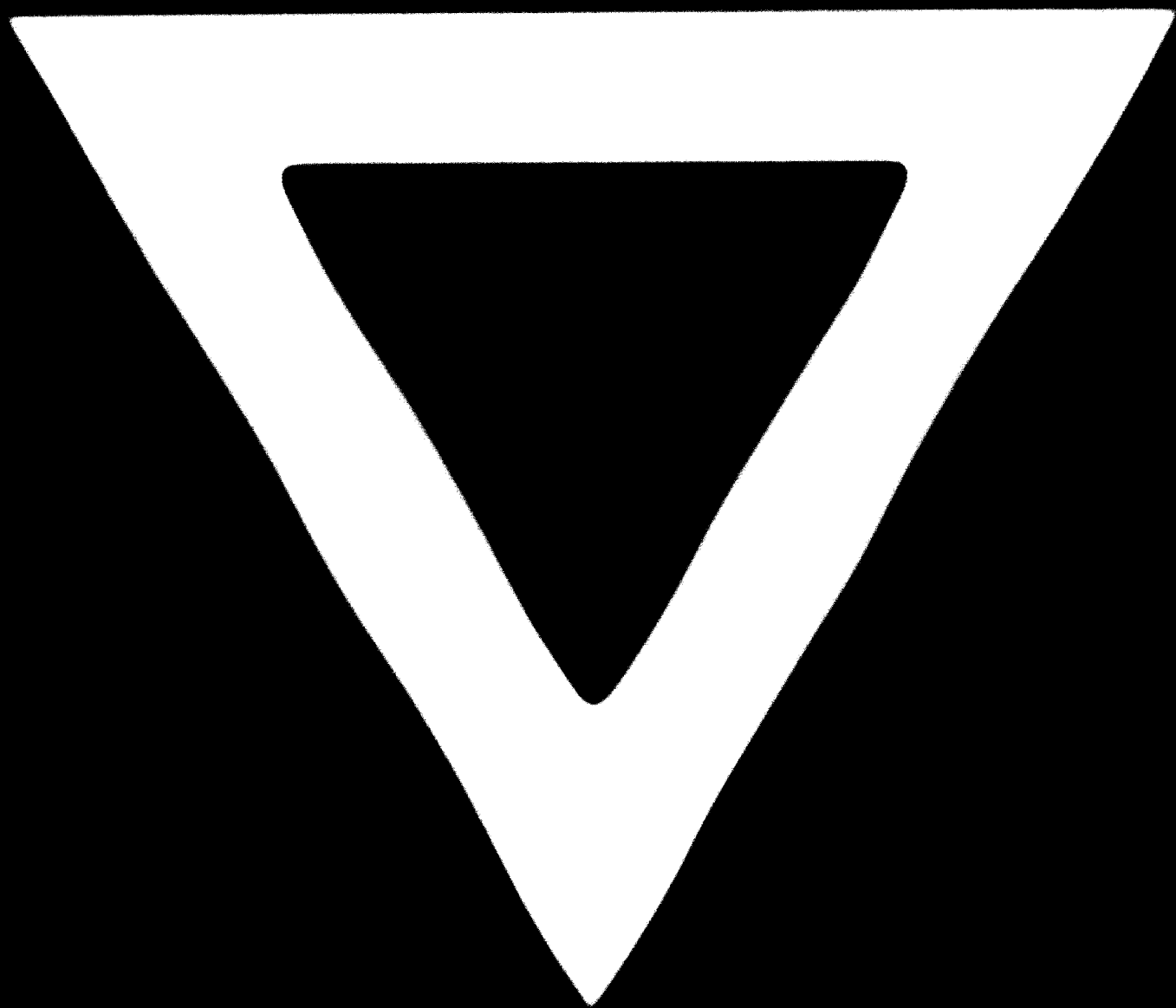
**Section B.1.3**

(B.1.3.1)





C - 827



82.06.25