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REFINERY AND PETROCHEMICAL

COMPLEX*)

DP/SRV/76/006,

VIET NAM .

Technical report: Preparatory assistance mission .

Prepared for the Government of Viet Nam
by the United Nations Industrial Development Organisation,
executing agency for the United Nations Development Programme

Based on the work of M. El Halfawy, senior interregional adviser,
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O. Delon, UNIDO experts

United Nations Industrial Development Organisation
Vienna

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EXPLANATORY NOTES

References to dollars (\$) are United States dollars. The monetary units in the Socialist Republic of Viet Nam referred to in this report is Viet Nam Dong, the presently valid currency in the Northern Part of the country. The value of the V-N D in relation to the US\$ was V-N D 2.45 = US\$ 1.

References in "tons" are to metric tons.

The following abbreviations of organizations are used in this report :

PETROVIETNAM	-	Vietnam Oil and Gas General Department
BEICIP	-	Bureau d'Etudes Industrielles et de Cooperation de l'Institute Francais du Petrole
UNIDF	-	United Nations Industrial Development Fund
mtpd	-	metric tons per day
mtpy	-	metric tons per year
INTIB	-	Industrial and Technological Information Bank
TCDC	-	Technical Co-operation among Developing Countries

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ABSTRACT

At the request of the Government of the Socialist Republic of Viet Nam a short Preparatory Assistance Mission to Hanoi was undertaken in February 1978 by a team composed of two UNIDO staff members and two UNIDO experts. Following the terms of the UNDP project on Preparatory Assistance (P.A.) the mission was expected to make the necessary preparatory arrangements with the Viet Nam Oil and Gas General Department for formulating a large scale UNDP/UNIDO project on the development of the petroleum refining and petrochemical industry in Viet Nam. The immediate objective of the preparatory assistance was to prepare the terms of reference and scope of work for a techno-economic study, and to draft the project document for UNDP assistance relating to the Government's plan on establishment of an industrial complex for refining of imported and indigenous crude oil and processing of gaseous and liquid hydrocarbons. The final products of the complex will comprise petroleum products, basic petrochemicals and nitrogen fertilizer.

Discussions were held at the abovementioned Government Department, which has been assigned to act as the counterpart organization for the UNDP project. The Department is responsible for implementation of the Government's development projects in the oil and gas sector of the Vietnamese industry. The site for construction of the complex was visited and the counterpart staff was provided with pertinent advice on steps to be taken to make preparatory investigations for assessing the suitability of the site from the technical point of view. The ensuing discussions focussed around infrastructural development and investment to be undertaken by the Government in connexion with the national plan for establishing a new large industrial area comprising all the necessary technical and social facilities as : a deep sea harbour, rail and road connections, process water and cooling water supply, external electric power supply, service centres, and large housing colonies for a large number of future employees of the various industrial plants of the complex.

At conclusion of the mission's work a Memorandum of Understanding was signed with the Oil and Gas Department in presence of the UNDP Resident Representative. The Memorandum identifies aspects of future co-operation on the subject between UNDP/UNIDO and the Oil and Gas General Department. The terms of reference for the UNDP/UNIDO project were drafted and agreed upon and were annexed to the Memorandum.

At the request of the Vietnamese counterpart, members of the mission team held a one-day Seminar for staff of the Department and for invited professionals from research institutes. Brief lectures were given on organization of large scale investment in refineries and petrochemical plants; on general aspects of development of the petrochemical industries; on development of the fertilizer industry on the global scale; on details of crude oil refining operations and technology. A presentation was made on UNIDO operational activities, assistance programmes and industrial development policy.

In addition to the mission's work pertaining to the P.A. project, discussions were held at a meeting organized by the General Department for Chemical Industries with the aim to identify further UNIDO assistance to the chemical industries sector. In presence of representatives of the Chemical Department, the Ministry of Light Industries, the Ministry of Foreign Affairs, PETROVIETNAM and the Engineering Bureau for Chemical Industries, relevant industrial projects and development plans were discussed. UNIDO Interregional Advisers who attended the meeting provided information regarding channels of communication with UNIDO and the ways and means to be considered by Government organizations when requesting financial support from UNDP and technical assistance from UNIDO.

The ongoing preparatory project on establishment of a pilot pesticides plant (DDT) was discussed and recommendations were made to speed up its implementation. The organizations represented at the meeting showed considerable interest in acquiring UNIDO's technical assistance in connexion with Government projects on establishment of a paper mill; construction of a soda ash plant; manufacture of calcium carbide; reconstruction of the

existing fertilizer plants; and development of the phosphate fertilizer industry. Furthermore, it has become evident that in keeping with the Government's priorities allocated to chemical industries, the Engineering and Planning Bureau for Chemical Industries needs urgently to be strengthened. UNIDO training programmes and fellowships as well as supply of equipment required for on-the-job-training have been identified as crucial inputs needed to attain the established goals.

After having concluded its mission to Hanoi, the team worked out the final draft of the project document for submission to and approval by UNDP and the Government, and made preparations for subcontracting of the techno-economic study to a competent consulting firm, following the recommendations of the counterpart organization as stipulated in the Memorandum of Understanding. Because of the urgency and high priority allocated by the Government to the development of the petroleum refining and petrochemical industry it is anticipated that the follow-up UNDP/UNIDO project will start as soon as possible and be concluded in approx. 12 months after approval of the project document. Starting date for project activities has tentatively been scheduled for 1 May 1978.

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SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

1. Technical assistance on development of the petroleum refining, petrochemical and fertilizer industry of the Socialist Republic of Viet Nam (SRV) is of urgent nature. Pursuant to the findings of the UNDP/UNIDO Preparatory Assistance Mission there is justification for undertaking the relevant Techno-economic Study on the subject without delay.
2. In spite of the fact that the extent of local resources of crude oil and natural gas is at present not yet fully explored, the Government's plans relating to the establishment of a large refinery and petrochemical complex should be considered viable and hence recommendable for UNDP/UNIDO involvement and continued co-operation with the Government with respect to organizational and technical matters.
3. Because of the considerable time needed for concluding preparatory work in connexion with the Government's large investment programme and its execution, lack of firm data on indigenous sources of raw materials should not hamper the preparations to be made for construction of the plants. Under the condition that preparatory arrangements will follow the schedule set out in this report, and provided financing from international sources will become available without delay after endorsement of a concrete investment programme, the refinery may be operational in 1983. As exploration for oil and gas is going to be intensified as there are promising indications derived from ongoing work in the field, it may be expected that soon after start-up of the refinery SRV will become self-sufficient in supply of basic petroleum products.
4. Development of the fertilizer industry should be allocated highest priority along with the development of exploitation of local crude oil and gas resources (intensive exploration followed immediately by extensive commercial exploitation). By 1983 the country may need at least two chemical fertilizer plants of the size suggested by the Government for inclusion in the petrochemical development scheme linked with the first Vietnamese petroleum refinery.

While anticipating that agricultural development will gain momentum because of the real and urgent need for SRV to become self-sufficient in food supplies, demand for fertilizer is expected to grow rapidly and may only be hampered by lack of foreign exchange for importing the required quantities.

5. Vietnamese Government organizations appear well staffed with well qualified professionals who had an opportunity to undergo training in a number of developing and developed countries (mainly in Eastern European Socialist Countries). The very complex and specific tasks to be performed in connexion with the comprehensive and very concrete petrochemical development programmes call, however, for upgrading of technical and organizational skills of all those who will be assigned to function as project managers and supervisors in charge. In addition to and in combination with any of the UNDP/UNIDO technical assistance projects there is need for organizing extensive training of personnel. On-the-job-training in project management, fellowships and study tours should be the preferred type of training during the initial phase of assistance. Later, when preparations for start-up of the plants will have to be made, group training through TCDC and other forms of bilateral assistance should be considered as an essential supporting activity which may be organized by UNIDO with the aim to make a strongly pragmatic contribution to the success of the final stage of the Governments Petrochemical Development plan.

6. Close contacts should be maintained between the various Government organizations mentioned in this report and UNIDO in order to explore possible technical co-operation on a number of topics described in paragraph IX below. It appears obvious that not all of the items which were identified by the mission may be treated with the same priority as the refinery/petrochemical complex. However, preparations for providing assistance, and mobilization of financial resources should actively be pursued in all cases as both the needs for advice and the counterparts capability to make efficient use of the assistance when available, are doubtless the most encouraging factors on which UNIDO's efforts.

may successfully be based.

7. Particular attention be drawn to the need for developing downstream processing of basic petrochemicals in order to develop manufacturing capabilities for plastic products and synthetic fibres, within the country, prior to start-up of local production of petrochemicals at the new complex. In this connexion the Government may decide on formulation of a separate assistance programme for immediate implementation. Advance development of the domestic market should be viewed as a prerequisite to successful putting on stream of the petrochemical plants. Any delay in this respect will have adverse impact on capacity utilization of the petrochemical plants, the products from which may not be exportable in a profitable way during the initial period of their operation if based on imported crude oil as feedstock.

8. Attention be drawn to the enclosed project document setting out the work programme for the consulting firm which will be engaged to conduct the Techno-economic Study. Although advisable to take into account the results of the complete analysis of a representative sample of Vietnamese crude oil, it seems unlikely that such a sample can be obtained within the time limits set by PETROVIETNAM for finalizing the study, the conclusions of which are urgently needed for the Government to go ahead with construction of the refinery. The understanding arrived at so far calls for flexibility in this respect as there may be many ways to arrange for analyzing an appropriate sample of crude at a later stage, when becoming available, in addition to or outside the contract to be signed with the consulting firm.

9. As concerns further UNDP/UNIDO assistance needed for implementing the Government's refinery/petrochemical/ fertilizer project, in particular during the contracting and construction stage, it is being assumed that the scope for follow-up UNIDO projects will be identified in the Techno-economic Study. The Government may then select priority areas and formulate in co-operation with UNIDO the terms of reference for continuation of the assistance programme.

10. There appears to be need for coordination of the refinery project with other UNDP financed technical assistance programmes. Site, soil and marine investigations (e.g. soil bearing tests) required in connexion with the complex may need to be covered by other projects which may require international co-operation in case PETROVIETNAM would face difficulties in conducting the preparatory work for construction of the plants without drawing on foreign expertise.

11. The Government has decided to establish a new industrial area in the northern part of the country, inter alia, because of the need for locating a deep sea harbour in an area protected against typhoons. In this connexion the mission would recommend to form a interministerial committee for co-ordination of infrastructural development which will be common to all the industrial complexes and off-site facilities which are planned for being set-up at the same location. UNIDO may also provide expertise in this particular field, if requested. Because of the considerable capital investment required for establishment of the technical and social infrastructure in the area a master plan will have to be designed on a priority basis in order to avoid future planning constraints.

12. In addition to the basic topic considered by this report i.e. the Techno-economic Study, the mission identified needs for certain training activities to be organized in connexion with the Petrochemical Development Programme. A study tour of Vietnamese staff will need to be organized to acquaint them with recent developments in this field. It appears recommendable to include a staff member of the General Department for Chemical Industries in the team to go on tour, as so far there are no professionals among PETROVIETNAM's staff who have experience in manufacture of fertilizer.

13. Further, it is recommended that co-operation between PETROVIETNAM and the Chemical Department be established in order to facilitate evaluation of the relevant sections of the Techno-economic Study dealing with the fertilizer plant.

14. The need for strengthening of PETROVIETNAM's project team has been considered and agreed upon. The mission recommended to attach two consultants to the team (6 m/m duration) to provide on-the-job-training to the Vietnamese counterpart project personnel and to assist them in evaluating Part I and II of the Techno-economic Study and in preparing for appropriate Government decisions.

15. In connexion with subcontracting of the Study the possibility of attaching one or two representatives of PETROVIETNAM to the Consulting Firm's project working group, should be investigated. At UNIDO's request the sub-contractor may accept this suggestion and provide some support free of charge (office facilities, training materials, instructions etc.) However, it is anticipated that direct costs (travel, subsistence) to be incurred will have to be born by the Government. A pertinent suggestion has been included in the project document (Annex XIII) to facilitate the necessary arrangements if agreed to by the Government.

16. As requested by the Viet Nam Oil and Gas General Department, and the General Department for Chemical Industries, UNIDO should provide the two organizations with relevant general reports on technology,-- sectoral development, and technical matters as well as with any UNIDO publications considered useful for upgrading of technical and managerial skills of their staff. They should also have access to information collected and published by the Industrial Technological Data Bank (INTIB), and should be provided with publications and reports of the UNIDO Negotiations Section/PCD and the International Centre for Industrial Studies (CIS).

I. INTRODUCTION AND BACKGROUND

The UN General Assembly adopted a resolution concerning the reconstruction of Viet Nam (A/RES/32/3 of 13 October 1977) which recommends that Viet Nam be included in the list of the most seriously affected countries. The resolution appeals to Governments of all Member States and to all international economic, financial and social institutions to increase and intensify their efforts and contributions on a bilateral and/or multilateral basis to help the Vietnamese people in the reconstruction of their country. It also urges the Secretary General to continue to encourage further mobilization of resources and efforts from the international community with a view to achieving the social and economic rehabilitation of Viet Nam, and authorizes the Secretary General to utilize the necessary resources for implementing the resolution.

In response, UNIDO has immediately expressed its preparedness to support the UN resolution, through active participation in any pertinent broad based programmes being undertaken by the UN system, for the active contribution to which UNIDO is equipped and is in a position to provide assistance to enhance industrialization of Viet Nam.

Prior to this some initial steps were taken by UNDP and UNIDO. Already in 1976 and early 1977 UNIDO *) and UNDP missions to Viet Nam considered certain projects in priority areas which were identified by the Government. Consequently, urgent action has been requested for the development of the petroleum refining, petrochemical and fertilizer industry.

Reference also be made to the World Bank's exploratory missions in January/February and November 1977 through which a constructive start to the Bank's operative relationship with the unified Socialist Republic of Viet Nam has been made, and pursuant to which it may be expected that UNIDO's pre-investment and techno-economic studies on establishment of industrial plants will be followed by speedy implementation of viable

*) Report of a UNIDO/WHO Mission (UNIDO/IOD/40) Assistance to the Socialist Republic of Viet Nam in establishing a DDT Project (TS/RVN/76/001) by Messrs. Verghese, Head, CHEM/IOD and Van Dijk, WHO. September 1976.

investment projects supported by the World Bank's financing arrangements or through its co-ordinating role in multilateral funding of large scale undertakings. **)

In accordance with the terms of reference of the UNIDO mission this report is mainly intended to summarize the discussions held at the Viet Nam Oil and Gas General Department. In addition to their basic task the UNIDO Interregional Advisers took advantage of the opportunity to meet with staff of other Government organizations in order to advise them on ways and means and the necessary organizational procedures to be followed for acquiring UNIDO's technical assistance. In this connexion the ongoing DDT project VC/SRV/77/033 as well as a number of future project proposals were discussed which are primarily of concern to the Chemical Industries Section/Industrial Operations Division (CHEM/IOD).

II. THE UNDP/UNIDO PROJECT ON PREPARATORY ASSISTANCE

1. Purpose of the mission

In consistency with the above delineated background UNDP has accepted the Government's request for technical assistance relating to a large scale investment project on establishment of a Petroleum Refining and Petrochemical Complex and has decided to dispatch a UNIDO mission for conducting preparatory investigations and identification of the terms of reference for a UNDP/UNIDO project. (Project Document on Preparatory Assistance VIE/76/006/A/01/37 - ref. Annex I)

The UNIDO mission team was composed of :

Mr. M.El Halfawy, UNIDO Senior Interregional Adviser, IOD/DO

Specialist in Petrochemical and Fertilizer Ind.

Mr. S.R. Panfil, UNIDO Interregional Adviser, IOD/DO

Specialist in Fertilizer and Chemical Industries

Mr. C.L. Mercier, UNIDO Expert - Industrial Economist, Expert in Refinery, Petrochemical and Fertilizer Projects

**) UN Mission on the Evaluation of the Need for International Assistance in Reconstruction - The Petroleum Sector - December 1977

Mr. O. Delon, UNIDO (Expert) - Petrochemical Expert

The terms of reference for the consultant's work (job descriptions are attached (Annex II and III)).

2. Work programme of the PA mission

In accordance with the terms of reference of the PA project the mission conducted its work during its two weeks stay at Hanoi, in co-operation with technical staff of the Viet Nam Oil and Gas General Department. After the missions' return to Europe the two UNIDO Experts finalized the technical part of the terms of reference of the UNDP/UNIDO project, and co-operated with the UNIDO Advisers in formulating the project documents as required for submission to UNDP and the Government. All pertinent papers are enclosed in this report (Annexes IV to XI).

The mission team arrived at Hanoi on 30 January 1978. After introductory discussions on 31 January 1978, with the Vietnamese group of counterpart staff a work programme was established and thereafter pursued as shown in the following schedule:

1 February 1978

Presentation of UNIDO's outline of the study to be conducted in two parts.

1 - 2 February 1978

Discussion on the outline of the project and presentation of questionnaires prepared by the UNIDO mission (Annexes VI and XI).
Discussion on relevant basic data requested by UNIDO for preparation of Part I of the Study (Pre-investment Study).
Presentation of UNIDO's view point on the feasibility of the Government's development plan and the investment costs involved.
Discussion on development of production of petrochemicals and on the Vietnamese domestic market potential.
Considerations on the availability of indigenous oil and gas, and the processing of imported crude oil mix.

3 February 1978

Continuation of discussions on the terms of reference for the Study and its time schedule. Discussion on needs for infrastructural development.

Discussions on sampling of crude oil, and making provisions within the project to analyse a preliminary sample and to carry out a full analysis of a representative sample of Vietnamese crude.

Discussion on other topics for inclusion in the terms of reference : e.g. study tour of PETROVIETNAM's staff to refineries, petrochemical and fertilizer plants in developing and developed countries; mission of the consulting firm's staff in connexion with Part I of the Study. Briefing of PETROVIETNAM's staff on UNIDO and UNDP's organizational procedures for project preparation, formulation of requests, financing and implementation of projects.

4 February 1978

Seminar. Presentation of UNIDO's and the experts' experience relating to projects on establishment of petroleum refineries, petrochemical and fertilizer plants. Presentation of recent development in technology and world market trends with respect to raw materials and finished products. Lectures on oil refining and hydrocarbon processing technology.

5 February 1978 - Sunday

6 February 1978

Continuation of discussion on the terms of reference - Part II of the Study (Techno-economic Study). Considerations on the Government's input and on future co-operation between PETROVIETNAM UNDP and UNIDO. Presentation of the draft Memorandum of Understanding by UNIDO and discussion on the draft.

7 February 1978

Official holiday (New Years Day)

8 February 1978

Discussion on location of the plant; handing over of the draft request for supplementary assistance to PETROVIETNAM (UNIDO SIS Project Data Sheet and two Job Descriptions attached to the Memorandum of Understanding. Reference: Annex VII, VIII, IX).

9 - 10 February 1978

Visit to sites preselected by the Government for location of the Refinery and Petrochemical complex. Discussion on relevant topics

relating to site preparation, construction of port facilities, infrastructure, etc.

11 February 1978

Meeting at the General Department for Chemical Industries. Final discussion on the Memorandum of Understanding.

12 February 1978 - Sunday

13 February 1978

Signing of the Memorandum.

Departure of the mission. (Mission did not depart till 14 February because the scheduled flight was delayed by one day)

III. SOME ESSENTIAL DETAILS OF THE TECHNICAL DISCUSSIONS HELD AT
PETROVIETNAM

1. General

The technical discussions mainly concentrated on the identification of issues to be considered by the Techno-economic Study. The terms of reference for the UNDP/UNIDO project prepared by the UNIDO mission were discussed at length and amendments and modifications suggested by the counterpart working group were agreed upon and included in the final text.

For historical and economic reasons there is only limited practical experience in the country in making pre-investment managements for mainly establishing large scale industrial plants. There are some factories under construction in Viet Nam, however, project management is organized and conducted by foreign companies and expatriate staff. As concerns the Refinery and Petrochemical complex the situation tends to be similar, as no representatives from engineering or construction organizations were present at the meetings at PETROVIETNAM. Therefore, a number of peripheral problems had to be explained to the counterpart staff who was dealing with the very complex task for the first time. As the very complex refinery/petrochemical/fertilizer project appears to be an exceptionally difficult case because of lack of technical infrastructure for implementation of the project, it was also necessary to advise PETROVIETNAM on interlinkages between the project and the infrastructural needs which urgently require independent advance action to safeguard timely construction of the complex. Further, financial implications and matters relating to investment cost and profitability of the various plants were discussed.

It was mentioned, inter alia, that the capital investment for the refinery and the fertilizer complex including off-site facilities will amount to approx. 1 billion dollars. This amount, however, will not cover expenses to be incurred in connexion with infrastructural development.

Financing and construction of harbour facilities and infrastructure connected with transportation as well as establishment of the housing colonies needed for the complex will be a huge task which should be undertaken separately on the basis of an integrated development scheme for the whole area embracing also other industrial complexes. As this task is anticipated to go beyond or be outside the responsibilities of the Oil and Gas Department, co-ordination of development plans of other sectoral Government bodies involved will need to be ensured possibly through a Government Act.

As concerns the fertilizer complex, the counterpart team has been advised that under prevailing conditions fertilizer projects are not profitable, per se, if taking into account low world market prices of nitrogen fertilizers for the coming at least 5 to 8 years. Fertilizer prices will continue to be under pressure of considerable overcapacities elsewhere, and are bound to increase only slowly in the near future. Therefore, it cannot be expected that manufacture of urea based on imported crude oil will be rewarding. However, from the point of view of the tremendous local market demand, - the different way of calculating benefits when considering import substitution and savings in foreign currency, - and the likelihood of early discovery of indigeneous sources of crude oil and/or natural gas, there is no doubt that investment in fertilizer plants for supplying the internal market is fully justifiable even with high investment costs and initially high production costs as a result of using naphtha from imported feed stocks of the refinery.

With regard to siting of the complex which, as intended by the Government, will conform with the national development plans, the political goals will have to be weighted against costs of infrastructural development of the new industrial area. In this context it appears obvious that the techno-economic study on the refinery cannot be expected to provide a comprehensive answer to some important cost implications relating to the

overall costs because the share of other industrial complexes in the utilization of the harbour, railways and roads cannot be assessed within the scope of work to be covered by the UNDP/UNIDO project.

2. Long term UNDP/UNIDO assistance

The feeling of the UNIDO mission is that long term UNDP/UNIDO technical assistance to Viet Nam is indispensable for a number of reasons. There are numerous problems to be solved in connexion with the Government's development plan within the framework of which the refinery complex is only one element. Even if after successful conclusion of the Techno-economic Study implementation of the respective investment projects will be organised through management consultancy services which might be subcontracted in connexion with plant supply contracts, the Government will need further assistance in up- and down-stream integration of the complex with other industries. This will particularly be the case with petrochemical industries, plastic processing etc. chemical plants which will have to be established during the second phase of the plan or are presently considered as second priority in the Government's industrial development plan. Although it was considered feasible to cover all the UN expert services required for successful setting-up of the refinery/petrochemical/fertiliser complex, by one multi-stage UNDP project, the scope of work and the number of alternatives to be investigated during its initial stage would render the project unintelligible particularly with regard to the work programme for its contracting and construction/start-up stage. For that reason it was agreed with PETROVIETNAM to confine the project document to the initial planning stages i.e., to the Preinvestment and Techno-economic Study.

However, it is understood that the Government organizations involved may request guidance relating to specific issues, immediately after conclusion of the initial stage of the UNDP project, in order to strengthen their capability to cope with organisational matters for making arrangements with financing institutions and for competent co-operation with project management consultants during the precontract phase (discussions with bidders, contract negotiations etc.)

In accordance with UNIDO's experience investment projects of complex nature as the one under consideration, when left in hands of inexperienced people had led quite frequently to decisions which have entailed costly and sometimes unremediable lay-out of plants. Projects suffered through all their technical life-time from not carefully thought over plant locations, improper selection of processes and equipment suppliers. Unreasonable savings made by rejecting consultancy services when undertaking large scale investment for the first time in a developing country proved to be of great disadvantage to the owner companies or the national economy in the long run. This has been the case in a number of developing countries which embarked on huge development plans without ^{having} conducted adequate project preparations and pre-investment investigations, or which have chosen unsuitable sites, or have acceded to unfavourable contract terms. To avoid all this in case of the Vietnamese extensive development plan, which in general is based on a sound and viable concept, it is obvious that further international assistance is indispensable for attaining the goals in shortest possible time and at lowest cost.

The enclosed draft project document envisages, therefore, that formulation of UNDP/UNIDO follow-up projects and identification of correlated assistance programmes will be made at the conclusion of the Techno-economic Study.

3. Other inherent problems

In addition to the projects envisaged for implementation by UNIDO, the representatives of the Oil and Gas Department requested technical assistance in soil testing at the selected site for erection of the complex, and were seeking advice concerning construction of a jetty and crude oil/petroleum products shipping terminal. The UNIDO team advised that this was outside the terms of reference of UNIDO activities. The Oil and Gas General Department has been informed that assistance projects financed from UNDP sources of funds do not provide means for purchase of all the equipment needed for conducting the soil tests unless through an assistance project assurance is given that such equipment is needed for on-the-job-training of operators as well as for strengthening the opera-

tional activities of an existing organization in the sector responsible for civil engineering construction works and erection of buildings in general. Thus equipment supplied for some specific works will become available to many industrial projects undertaken by the Government.

However, the Resident Representative informed the representative of the Oil and Gas Department that provisions are being made by UNDP to assist the Government through a broad based project covering all aspects of planning and design relating to civil engineering and construction works of all kinds, including reconstruction of buildings, factories and structures damaged during the war. Training of engineers upgrading of skills and most likely also soil and site investigations may be included in the assistance programme and perhaps some ways could be found to provide the assistance needed for soil investigations for the complex. The UNIDO mission advised PETROVIETNAM in this connexion to keep track of developments regarding other relevant UNDP financed projects through which certain urgent problems connected with the establishment of the refinery complex, could be solved in co-operation with other ministries and Government organizations. For that reason it was found highly recommendable for PETROVIETNAM to coordinate their technical and organizational tasks and efforts with other Government bodies at a higher level or through establishment of a interministerial committee for implementation of the refinery/petrochemical project.

As regards the Government's development programme relating to petrochemical industries the UNIDO mission expressed doubts whether establishment of some of the process plants should be treated as a matter of high priority in view of the apparently still very limited internal demand for basic petrochemicals. The investment programme for the refinery and fertilizer complexes which doubtless will have to be allocated highest priority, is so large that the timing of establishment of petrochemical plants should be subordinated according to physical facilities available for implementation of the whole development programme.

As manufacture of basic petrochemicals for export can hardly be expected to be profitable if based on imported crude oil, as is the case with the world fertilizer industry, capital investment in advance of

development of the local market for petrochemicals may not be justifiable. During the period between now and start-up of the refinery the market should be developed for plastic processing and synthetic fibre industries. Deferred programming of investment in basic petrochemical plant, by up to 3 years, in relation to the refinery may provide a reasonable solution of the issue.

However, it is expected that the problems involved will to some extent be quantified in the Pre-investment Study and then, subject to evaluation by the Government, a decision may be made regarding the scope of detailed studies on the subject to be considered for inclusion in the work programme of Part II of the Study. Further, it may become necessary to identify separate assistance programmes for the development of downstream processing units in the Light Industries Sector, to solve problems during the intermediate period, under the assumption that market development will be based on local processing of imported basic petrochemicals.

4. The project document and terms of reference for the Techno-economic Study

The project document (Annex XIII) has been prepared by UNIDO in co-operation with the UNIDO experts, strictly following the terms of reference (Annex V) which were worked out and agreed upon with PETRO-VIETNAM during the mission. As suggested by UNDP the project time schedule was slightly modified to allocate more time for the Government to evaluate the pre-investment study (Part I) and to make decisions needed for conducting Part II of the Study (Techno-economic Study) as outlined in the terms of reference. From the technical point of view there was no need to introduce any other changes. The terms of reference reflect the difficult situation caused by lack of a great deal of basic data for the two parts of the Study, and make provisions for the eventuality that neither quality nor quantity of the indigenous crude oil will definitely be known before concluding the pre-investment study. As anticipated by the Government initial operations of the petroleum refinery may have to be based on imported crude within certain limits of composition and from sources going to be specified by the Study. It is further anticipated, however, that any data on local raw materials likely to become available in time before the final decision on implementation of the

investment project is taken, will have to be taken into account by PETROVIETNAM even after conclusion of the Study in order to appropriately equip the refinery for processing of indigeneous feedstock.

The project budget is based on a detailed cost estimate which specifies man/months of expert services of different grades and the respective rates, travel expenses and other costs to be incurred by the consulting firm and UNIDO. The costs were assessed with a reasonable degree of accuracy, and therefore, the budget may be regarded as medium level approximation, under the condition that the contract with the consulting firm will be signed in due course, however, not later than by end April this year.

5. Basic data for the Study

The UNIDO mission team prepared two questionnaires after having learned that during the mission and at the discussions held at PETROVIETNAM it would not be possible to collect immediately the information needed for the Study. In particular, data on crude oil, statistics relating to petroleum products, petrochemicals and fertilizer, development trends, distribution systems, pricing policies etc., were not available at PETROVIETNAM or non-existing. For that reason the terms of reference for the Study make provisions in connexion with subcontracting of the Study, for dispatching a group of specialists of the Consulting Firm who will investigate into the inherent problems and make their own assessment of the most important basic input data needed for the Study.

The questionnaire (Annex VI) concerning the refinery and petrochemical complex, covers also some topics relating to fertilizer as: consumption and production statistics, distribution and marketing of fertilizer, availability of phosphatic raw materials. The questionnaire has been attached to the Memorandum of Understanding.

After having reconsidered at UNIDO HQ the scope of work to be done the mission arrived at the conclusion that because of the uncertainty about location factors and site data, it appeared necessary to formulate some more questions. A supplementary questionnaire has, therefore, been prepared (Annex X) and will be dispatched to PETROVIETNAM prior to arrival of the Consulting Firm's working team.

The questionnaire on the fertilizer industry (Annex XI) covers topics regarding development of the fertilizer industry of Viet Nam in broader terms. The questionnaire does not confine itself to the establishment of the ammonia/urea complex in conjunction with the refinery. The Vietnamese counterpart group decided to send the questionnaire to the General Department for Chemical Industries because there are no specialists at the Oil and Gas Department who could answer most of the questions. Although there is no doubt about the necessity of establishing a fertilizer complex for manufacture 500 000 mtpy urea the mission was of the opinion that a broader view on fertilizer development is needed to make correct decisions on plant size and its location as well as on the raw materials to be used. Furthermore, it is expected to use the information for making recommendations on future expansion of fertilizer production at the refinery or elsewhere in the country. Questions concerning raw materials are overlapping with some questions in the petrochemical questionnaire and may not be answered by the General Department for Chemical Industries. Some questions relating to agricultural development may have to be answered by the Ministry of Agriculture or by organizations who have conducted relevant studies on the subjects. As was found out later, there is no FAO fertilizer development programme for the country and it may be difficult to obtain a precise answer to questions about the soil, agricultural land area, cropping patterns, extension services and the choice of various types of fertilizer. If so, the questionnaire is expected to provide some guidance to the Government with respect to studies needed for establishing a consistent long term fertilizer development policy. In this particular field, UNIDO is willing to participate in the respective assistance programmes, possibly in co-operation with FAO, with the aim to establish an integrated fertilizer development scheme covering both agricultural and industrial aspects.

IV. DESCRIPTION OF THE LOCATION OF THE COMPLEX

1. GEOGRAPHICAL SITUATION OF THE ZONE AND GENERAL TOPOGRAPHY

The zone chosen for the complex is situated 209 km to the South of Hanoi in the TINH GIA district of the Province of Thanh Hoa, to the south of QUA BANG River. Site No.1 is located 4 km from National Road No. 1. It is surrounded by several hills, including one of 150 metres to the south and another one of 180 metres to the west. The average altitude is 4.5 metres above sea level and is not subject to flooding, according to the statistics.

The area available is about 800 hectares split into two by a hill oriented north-south.

The ground is mixed with sand. First estimates of the soil show a layer of 1 metre of sand followed by a layer of 8 metres of clay.

The present crops are rice and potatoes, but part of the surface does not seem to be cultivated. The site is protected from violent south-easterly monsoon winds by the hills to the south.

Site no. 2 is situated on the other side of the southern hills. The main advantage is its proximity to the sea, but the disadvantage is the possibility of whirlwinds and the necessity of diverting a small stream which flows through the area. Site 2 is also less protected from the winds than Site no.1.

2. TRANSPORT AND DIFFERENT MEANS OF ACCESS

2.1. ROADS

Site no. 1 is 4 km from National Road no. 1. There is a small unasphalted road which connects Road no. 1 to the DAO-NGHI-SON peninsula and which is situated to the south of the site. Access to the site is also possible by another small unasphalted road coming from the north which crosses the QUA BANG river mouth by a newly constructed earth dam.

National Road no. 1 crosses the whole country and connects HANOI to HO CHI MINH City. In the TINH GIA district, the road is 6 metres wide and two cars can pass easily. It is sometimes flooded during several hours in the rainy season. Between HANOI and TINH GIA, travel is less easy, because part of the road has been bombed. All the bridges have been bombed several times and a number of them will have to be entirely rebuilt; for instance, between HANOI and the sites there are about ten bridges which are difficult to cross, the maximum load for several of them being 8 tons.

In some places the road is wide and renovation work is in progress, but in other places, the road is steeply cambered and also very narrow; widening the road will require a lot of work, since the road crosses rice fields.

2.2. RAILWAYS

The railway connects HANOI to HO CHI MINH City. It is a narrow gauge single track 1m 10 wide. It is planned to widen the track to 1m 40 by 1980. The nearest station in the area is KHOA TKUONG station, 6 kms away. It is a very small station with too little space available; it would be necessary to build a marshalling yard 2 km towards the south where there is more space available. The track is not liable to flooding because it is on a higher level than the road.

The track which will link the site to the station will cross Road no. 1 and a swampy area.

2.3. WATER TRANSPORT

Transport by river seems very difficult; the depth and flow of the rivers are not sufficient. However, a small canal

connects the QUA BANG river to the YEN river and is used by small junks but it will be used mainly to supply fresh water to the different complexes.

The only waterway which will be used is the sea. At present there is no available harbour. The construction of a deep water harbour is planned, located between the peninsula and the coast, partly on the salt marsh; it will be situated about 6 km from Site no. 1. The salt marshes presently cover a surface of 200 hectares; they have been created partly on a surface recovered from the sea, after the erection of the two dams, the first one in the north and the other one in the south, which connect the peninsula to the coast. Before these were built, the depth of the sea inlet between the island and the coast was supposedly ten metres.

The 1/50,000 U.S. Army map of the TINH XUYEN area gives several indications as to depths after construction of the dams; for instance, the six fathoms line, i.e. 11 metres, passes 600 metres from the northern cape of the peninsula and between 3 and 3.500 km from the coast.

The construction of an artificial deep water harbour will require major digging and dredging works. It should be pointed out that the peninsula is oriented north-south; it is formed by high cliffs of 100 metres to 160 metres, and is 4 km in length and 500 to 1,000 metres in width. The peninsula thus offers good natural protection against the strong monsoon winds from the south-east.

3. CLIMATIC INFORMATION

The area is not liable to flooding. The prevailing winds are north-east during the October to January period and south-east during the April to October period; during September and October, winds can reach a speed of 120 km/hour.

In July and August there are very hot earth winds. No series of average temperatures and hygrometric data were supplied. However, there is a new weather station in the TINH GIA district.

4. GENERAL SERVICES

4.1. ELECTRICITY

There is no electricity available on the site. A power plant will have to be constructed to supply the requirements of the complex and the housing area in the industrial zone.

A high voltage overhead power line of 220 kv will be erected after 1980 and will pass 4 km from the site, to which it will be connected.

4.2. WATER SUPPLIES

Two rivers could supply the cooling water and process water required by the complexes : firstly, the QUA BANG River, the mouth of which is about 6 km to the north; and secondly the YEN River, the mouth of which is about 20 km to the north of the site and which is connected to the QUA BANG River by the THAN Canal.

The waters of the two rivers are presently salt but important construction works have already been undertaken at the QUA BANG River mouth :

- 1) A dam to prevent the sea from flowing up the river, built between April and December 1977.
- 2) An artificial storage area into which the waters of the QUA BANG River and the THAN Canal flow.
- 3) A flood dam built in 1977 which enables water from the artificial storage area to be poured into the sea.

The Vietnamese engineers foresee a period of 3 years before the water becomes salt-free. The same works are planned on the YEN River in order to transform the salt waters from the THAN Canal into fresh water.

The average quantity of water available for the complex is expected to be 1m³/s for the QUA BANG River and 4 to 6m³/s for the two rivers.

The artificial storage area built at the QUA BANG River mouth will be used in priority for the water requirements of the complex.

Another dam project is planned on the YEN River, 15 km upstream, to store fresh water.

V. SUPPLY OF PETROLEUM RAW MATERIALS AND SHIPPING OF PRODUCTS

1. The position regarding future oil and gas production possibilities in Viet Nam, described in the Annex XIV of this report can be summed up as follows :
 - 1.1. The offshore areas located in the South of the Mekong delta are the most promising petroleum areas
 - 1.2. The onshore areas located in the North appear to be somewhat limited, although some results have been reported in the Hanoi zone (South and North-East) from where the sample supplied by PETROVIETNAM was collected.

2. The refinery could thus be supplied with crude (5 to 6 million tons/year) from the following sources :
 - 2.1. Crude from the Hanoi zone (constituting a small part of the total, as production potential seems limited)
 - 2.2. Crude from the offshore areas in the South of Viet Nam (a major part of the total, as production here looks promising)
 - 2.3. Imported crude (a major part of the total during early years of operation, given that offshore production is not expected to be significant before 1982-83).

3. The need to import crude will no doubt diminish as offshore crude from the South begins to be produced in sufficient quantity. It must be remembered, however, that the characteristics of this Vietnamese crude - according to published information - are apparently very similar to those of low sulphur Indonesian crudes, thus making it unsuited to the Vietnamese market where gasoline and middle distillates are in greatest demand.
4. In view of this, it may be economical to export part of local crude to Japan, for instance, and continue to import at least part of the refinery feedstock choosing crudes better suited to the local market and requiring less costly refining plant.
5. The refining scheme should be sufficiently flexible, therefore, to allow North and South Vietnamese crude and imported crude to be processed.
6. In addition, infrastructure will have to be planned to accommodate tankers (100,000 tons) bringing crude from South Vietnam or imported crude, and this will involve :
 - a) either crude oil terminal facilities (sea line and buoy, to be constructed off the refinery site in the area where depth is at least if not more than 20 metres (close to Hon Me Island)
 - b) or deep water harbour facilities close to the Bien Son Island
7. Harbour facilities for dispatch by sea will also require to be planned, to handle petroleum products from the refinery to be shipped by 5 to 10,000 ton tankers to consumer areas, and solids such as urea and petrochemicals from the petrochemical plant, which will be transported by 2,000-5,000 ton coasters or 200-300 ton barges.

8. Finally, the following will also be necessary :

- . a crude pipeline to bring crude from fields round Hanoi to the refinery (if oil production from these fields is sufficient to warrant the necessary investment)
- . an end-product pipeline network linking the refinery to Hanoi (white products and heavy fuel oil if necessary).

9. Road and rail transport being limited, maximum emphasis must be given to the development of sea transport, including harbour and marine facilities, tankers, coasters and barges.

At the same time, delivery, storage and distribution facilities will have to be set up close to consumer areas to handle end products from the refinery and petrochemical complex.

VI. DETAILED CRUDE OIL ANALYSIS

Assuming that it is possible to check that the sample collected is in fact representative of the crude, it is recommended that crudes likely to be used as refinery feedstock be subjected to detailed analysis.

Approximately 400 litres of crude are required for this operation. If lubricating oils are also to be produced from crude, 600 litres will be needed for the analysis.

Laboratory operations and tests forming a typical analysis are listed at the end of this paragraph.

The number of tests and their complexity may vary considerably depending on the crude characteristics and the various constituent cuts, as well as the objective i.e. production of conventional petroleum derivatives such as gasoline, kerosene, jet fuel, gas oil and fuel oil, or of products with special characteristics such as lube oils, asphalts, etc...

The time required for the analysis will thus vary accordingly; 3 months for conventional analysis and 5 to 6 months if lube oil production is to be included.

The cost of this work will similarly vary, from 100,000 to 150,000 French francs for conventional analysis and 200,000 to 250,000 French francs if lubes are to be covered by the analysis.

CRUDE OIL ANALYSIS

1. Crude Oil characteristics

specific gravity
RVP
pour point
viscosity
water content
sulphur content
mercaptan content
H₂S content
total salinity
chloride content
asphalt content
K_{UOP}
light hydrocarbons content
etc ...

2. True boiling point distillation

preparation of fractions
characteristics of fractions (weight and volume balance,
sp. gr., K_{UOP}, etc ...)
distillation curves

3. Gasoline properties (preach wide cut)

specific gravity, ASTM distillation, RON clear and
ethylated sulphur content, mercaptan content, H₂S
content, chromatographic analysis, PONA analysis,
copper corrosion

4. Kerosine

sp. gr., calor, freezing point, flash point, aniline
point, aromatic content, smoke point, ASTM distillation,
sulphur and mercaptan content

5. Gas oil

sp. gr., ASTM distillation, flash point, cloud point, pour point, viscosity, aniline point, diesel index, cetane number, sulphur content, copper corrosion, nitrogen content.

6. Vacuum distillate

sp. gr., viscosity, conradson carbon residue, sulphur content, nickel, vanadium content, nitrogen content, pour point, flash point.

7. Residue

sp. gr., pour point, viscosity, sulphur content, nitrogen content, conradson carbon residue, flash point, vanadium content, asphaltenes.

VII. CRUDE OIL ANALYSIS

(based on the sample supplied by PETROVIETNAM during the UNIDO Assistance Mission in February 1978).

1. The crude sample (5 litres approximately) taken from fields in the Hanoi area and brought by UNIDO representatives was analysed in the Institut Français du Pétrole laboratories.
2. The sample was found to be homogeneous. After heating and decantation, however, it was found to contain 62 % water.
3. The quantity of crude obtained being small - about 1.5 litres - it was possible to carry out only a summary examination of its properties, which were found to be as follows :

d_{4}^{15} : 0.900

pour point : 42°C

viscosity at 50°C : 13.9 centistokes

sulphur % weight : 0.18

4. The sample was fractionated under atmospheric pressure followed by vacuum distillation, and most of the light components were found to be absent.

5. On the basis of these results it was felt that the crude sample obtained from Hanoi could not in any way be taken as representative of future crude, and PETROVIETNAM were at once alerted to cancel dispatch of two 200 litre barrels requested during the preparatory mission to Hanoi.
6. It would seem that the sample was collected without stabilisation facilities having been placed over the well head. PETROVIETNAM were thus urgently requested to check the representativeness of the sample and the method of collection, and forward details of conditions during sample collection, such as : sample temperature, Reid vapour pressure, crude gravity, etc... so that the anomalies could be accounted for and analysed.
7. The analysis should be completed by 20th March 1978, and the analysis report should be available by the end of that month.
8. Laboratory expenses in this connection are estimated to be approximately 15,000 Francs.

VIII. THE MEMORANDUM OF UNDERSTANDING

The Memorandum, which is attached to this report as Annex IV, was drafted by the UNIDO mission, and discussed with the counterpart working team. The text was slightly modified and agreed upon after having been cleared by higher ranking officials of the Department who did not take part in the work of the group.

The contents of the Memorandum are reflecting the agreements reached on :

- the terms of reference for the Study, and the suggested time schedule (Annex V of this report),
- the work plan covering a fact-finding mission of staff of the consulting firm, the pre-feasibility Study (Part I) and the Techno-economic Study (Part II),
- the study tour of engineers of PETROVIETNAM,
- the request for supplementary assistance to PETROVIETNAM under SIS (Annex VII to IX of this report),
- the selection of BEICIP as Consulting Firm, for conducting the study,
- the Questionnaires, (Annex VI and XI),
- the Government contribution to the UNDP/UNIDO project,
- and a statement of anticipation that the study will be followed by further UNDP assisted projects.

The understanding was that the project document for the Study will not include terms of reference and related matters for follow-up work, called "second phase of the project". It was agreed that UNIDO follow-up work will have to be based on separate project documents to be prepared in pursuance of conclusions and recommendations made by Part II of the Study, and will have to take into consideration the priorities established by the Government after having taken decisions on implementation of a defined investment plan for the complex.

The Memorandum also stresses the importance of identification of the crude oil availability and its quality (composition). The need for making a detailed analyses of the indigeneous crude oil in connexion with the project and specifically for improving conclusions to be made by the Study has been emphasized.

The suggested study tour of Vietnamese technical staff to refineries, petrochemical plants and fertilizer complexes in developed and developing countries could not be accommodated in the project document for the Study (Annex XIII). During the discussions at PETROVIETNAM, prior to signing the Memorandum of Understanding, it has become evident that upgrading of professional knowledge of Vietnamese specialists who will be assigned to co-operate with UNIDO and will be entrusted with various supervisory functions through all phases of the Government's investment projects, is a prerequisite for efficient implementation of the whole plan. Some problems arose later when financial implications of the issue were considered. UNIDO is going to make the necessary arrangements to follow-up on the Government's request, possibly by preparing a separate project document for financing of the study tour from sources yet to be identified. The mission is convinced of the soundness of the project, and suggests, therefore, as a recommendation of this report that the matter be pursued accordingly. The Oil and Gas Department should be kept informed on the results of UNIDO's endeavours regarding organizational arrangements being made (detailed terms of reference, work programme, time schedule and financing) for formulating the proposed supplementary project and making possible its early implementation as expected by PETROVIETNAM.

The terms of reference for the UNIDO SIS project which were agreed upon and included in the Memorandum (Annex VII, VIII and IX of this report) will be processed in due course in accordance with UNIDO's internal standard procedures. In this connexion PETROVIETNAM has been advised at the discussions that a separate request for the SIS project will have to be made and channeled through the Ministry of Foreign Affairs, and the UNDP Resident Representative's Office at Hanoi, to UNIDO. This should be done as soon as possible so as to ensure timely implementation of the project. In the meantime the mission will prepare the formal project document to avoid delay in processing of the Government's request.

IX. REPORT ON THE MEETING HELD AT THE GENERAL DEPARTMENT FOR
CHEMICAL INDUSTRIES

At the request of the UNIDO mission a meeting was held on 11 February 1978 at the General Department for Chemical Industries. The primary purpose of the meeting was to discuss organizational matters relating to the ongoing UNIDO project on establishment of a DDT pilot plant in Viet Nam, and to provide officials at the ministerial level with information on UNIDO's operational activities and the procedures to be followed for acquiring technical assistance.

The meeting was attended by staff of the General Department for the Chemical Industry headed by the Chief of Division for External Relations, the Director of the Engineering and Planning Bureau for Chemical Industries a representative of the Ministry of Light Industries, one member of the Petrochemical group of the Oil and Gas Department, and a representative of the Ministry of Foreign Affairs.

The UNIDO Advisers were briefed on the functions of the General Department for Chemical Industries which, as is the case with the General Department for Oil and Gas is performing ministerial functions and is reporting directly to the Government, however, it is not headed by a minister and is not controlled by another ministry.

At present there are only few chemical factories in the country manufacturing some basic chemicals, batteries, oxygen, and agricultural chemicals as fertilizer, and possibly pesticides and insecticides. The General Department is planning for rapid development of this branch of industry because of the growing demand for chemicals. The discussions were introduced by a presentation of the Department work and future plans.

The integration of the chemical industries existing in the Northern and Southern Part of the country seems not yet completed. Mention was made of existing fertilizer manufacturing facilities in the Northern part : a SSP plant of 180 000 mtpy and a urea plant of Chinese origin of approx. 100 000 mtpy capacity. Both plants were heavily damaged during the war and still are not fully operational. It seems premature to judge what role the Department for Chemical Industries will play in the development of the naphta and/or gas based nitrogen fertilizer production, the first phase

of which will be covered by the Techno-economic Study on the refinery and petrochemical complex of the Oil and Gas Department. The development plans of the Chemical Department include, inter alia, a soda ash project (capacity 100 - 150 000 mtpy) and a calcium carbide factory (80 - 120 000mtpy) including facilities for acetylene generation and bottling.

As concerns the DDT project the UNIDO mission was advised that the responsibility for preparatory arrangements rests still with the Ministry of Health. However, in future the project will be included in the investment programme of the Chemical Department. The UNIDO mission learned that the report of the UNIDO financed Vietnamese mission to India was mailed to UNIDO by end January.

The UNIDO Advisers informed the counterparts at this opportunity that immediate action on part of the Government is needed to ensure effective continuation of the preparatory assistance project. They stressed also that an official Government request is needed for UNIDO to make the travel arrangements for two Indian experts and Mr. K. Szabo, UNIDO Industrial Development Officer, who is backstopping the project, to come to Viet Nam in order to finalize the preparatory investigations and to draft the project document. Further, in accordance with UNIDO's preliminary consultations, mention was made of the possibility of obtaining financial support from the Government of India for establishment of the pilot plant, up to 50% of its investment cost. The balance might then be financed jointly by UNDP and UNIDO provided the preparatory mission will successfully be conducted without delay.

It appeared necessary to brief participants of the meeting on standard organizational procedures and channels of communication to be observed prior to project formulation and approval by UNDP and UNIDO. The representative of the Chemical Department promised to co-ordinate the work on the project with the Ministry of Health according to the mission's advice.

Considerable interest for UNIDO's assistance was shown regarding the following issues :

1. Strengthening of the Engineering and Planning (Design) Organization of the Chemical Industry. In particular, on-the-job training of engineers supported by supply of modern equipment for draftsmen and designers in

connexion with the training is badly needed. Technical literature, periodicals, catalogues of machinery and equipment for chemical plants are lacking and hence are required to upgrade the Organization's potential for conducting pre-investment design and detailed engineering of plants. Training abroad and fellowships would also be necessary.

2. Pre-investment studies are needed for the abovementioned soda ash plant and the calcium carbide plant (chemical industries) and for a craft-packaging paper mill of 30 - 50 000 mtpy capacity based on pine wood (light industries).

3. An expert is needed to put into operation existing machines for plastic coating of paper. The machines are of Japanese origin and cannot be used because factory staff lacks experience in operating and repairing this equipment. Some spare parts and missing items will also be needed.

4. Assistance is urgently required for reconstruction of the existing fertilizer plants which are partly damaged. As well, expertise is needed for improving phosphate rock mining and beneficiation. An inherent critical problem seems to be lack of financial means for purchase of replacement equipment.

In connexion with the planned development of the petrochemical industry the UNIDO mission advised the representative of the Ministry of Light Industries to consider advance development of plastics processing prior to establishment of the respective basic petrochemical manufacturing units envisaged within the framework of the project which is going to be implemented by PETROVIETNAM. The discussion focussed on the appropriate sequence of steps to be taken to develop a petrochemical industry and how to avoid hampering of off-take of large quantities of product after start-up of the petrochemical plants, what is bound to happen if downstream processing would only inadequately be prepared and/or the absorptive capacity of the local market would be too small to make the chain of operations from raw materials to finished products profitable right from the beginning.

The UNIDO mission reiterated that UNIDO is prepared and willing to provide any assistance needed by the Vietnamese Government in connexion with the topics discussed at the meeting. Examples were given to show how UNIDO can assist in organizing bilateral aid for financing of technical assistance programmes, in addition to UNDP and UNIDO funds, and in arranging training programmes in co-operation with other developing and developed countries.

The mission further advised that in case UNIDO's help may be needed for project formulation, the Government should approach UNIDO through the UNDP Resident Representative's Office at Hanoi and submit the required official request.

X. MEETINGS WITH THE UNDP RESIDENT REPRESENTATIVE

During its mission the UNIDO team met several times with Mr. Englund, UNDP Resident Representative in Viet Nam and discussed with him relevant items of the scope of work of the PA project, the terms of reference of the Techno-economic Study, its cost and time schedule. Technical and organizational matters of the mission and suggestions regarding follow-up work were also considered.

Mr. Englund was briefed on the mission's point of view on the full extent of the UNDP assistance needed for the Government to implement its huge investment plan. The mission expressed its opinion on the viability of the plan and the anticipated assistance requirements. Because of the complexity of the task it was understood that after conclusion of the Techno-economic Study the Government may wish to request further UNDP/UNIDO assistance, however, follow-up work pursuant to the Study may not be confined to the Oil and Gas Department. The mission emphasized that there is justification for establishment of a consistent assistance programme covering all aspects of investment project preparation and implementation for the Chemical and Light Industries. The cost of the total programme of a duration of not less than 5 years has been estimated by the mission to be in the order of magnitude of approx. US\$ 4 million. Many problems will have to be solved by the Government with help of external expertise, sometimes on a case to case basis.

The mission mentioned that, in particular, during the precontracting and contracting stage as well as during construction and start-up of the various plants which form part of the complex, transfer of experience might most fruitfully be conducted. Because of the far-reaching decisions on investment to be made by the Government highly specialized advice and on-the-job-training of high level Government officials ^{would} be the most appropriate and effective form of assistance to be financed from inter-

national sources. Pursuant to the preferential treatment of Viet Nam, advocated by the UN General Assembly, it may be expected that technically sound and viable industrial projects which prove also financially feasible under prevailing conditions will adequately be supported by the international financing institutions. However, thorough investigations and relevant in depth studies will have to be conducted to provide full justification for the considerable capital investment requirements. For the time being the various Government organizations seem not adequately equipped to deal with problems requiring extensive knowledge of internationally accepted procedures and contacts. Unbiased advice rendered by UN Agencies is therefore recommendable and will prove most helpful in this field.

The Resident Representative expressed his best intentions to support the UNIDO assistance programmes which will be suggested and formulated as a result of the discussions held during the mission and will thereafter favourably be responded to by the Government. He provided also an optimistic view on the possibilities of establishing good co-operation with the Government, as well as between the Government Organizations and UN Agencies

XI. ACKNOWLEDGEMENTS

The mission wishes to express their appreciation to the staff of the Government counterpart working party of the Viet Nam Oil and Gas General Department and to the Ministry of Foreign Affairs for their kind co-operation and the assistance rendered that made the mission's stay a pleasant one and its work fruitful. The mission is also grateful for the valuable contribution of all persons met to the mutual understanding of problems regarding industrial development of Viet Nam. Thanks are also due to Mr. Englund, UNDP Resident Representative at Hanoi for his active participation in the working arrangements of the mission team and for his support to UNIDO's suggestions concerning follow-up work and future tripartite co-operation between UNDP, UNIDO and the Government of Viet Nam. Acknowledgement is also due to UNDP Headquarters staff who pursued the Government's request and prepared fertile grounds for the mission's work and for future close cooperation between the Government and UNIDO.

XII. LIST OF PERSONS MET DURING THE MISSION TO VIET NAM

Mr. Vu Bot	Chief of the Vietnamese counterpart group of PETROVIETNAM, Director of the Department for New Projects
Mr. Bi Van Tu'	Deputy Chief
Mr. Le Quang Vinh	Refinery and Petrochemical Engineer (PETROVIETNAM)
Mr. Ngo Duong Hung	" " " "
Mr. Dinh Nhu Nhat	" " " "
Ms. Ngo Nguyet Tue	" " " "
Ms. Nguyen Phuong Hai	" " " "
Mr. Vo Lien	Director of the Engineering Bureau for Chemical Industries
Mr. Doan Minh Trieu	Section Chief for Foreign Relations of the General Department for Chemical Industries
Mr. Hai	Representative of the Ministry of Foreign Affairs
Mr. Vu Ngoc Ky	Chemical Engineer of the General Department for Chemical Industries
Mr. Pham Minh Duc	" " " "
Mr. Tan	Engineer, Representative of the Ministry of Light Industries
Mr. K. Englund	UNDP Resident Representative

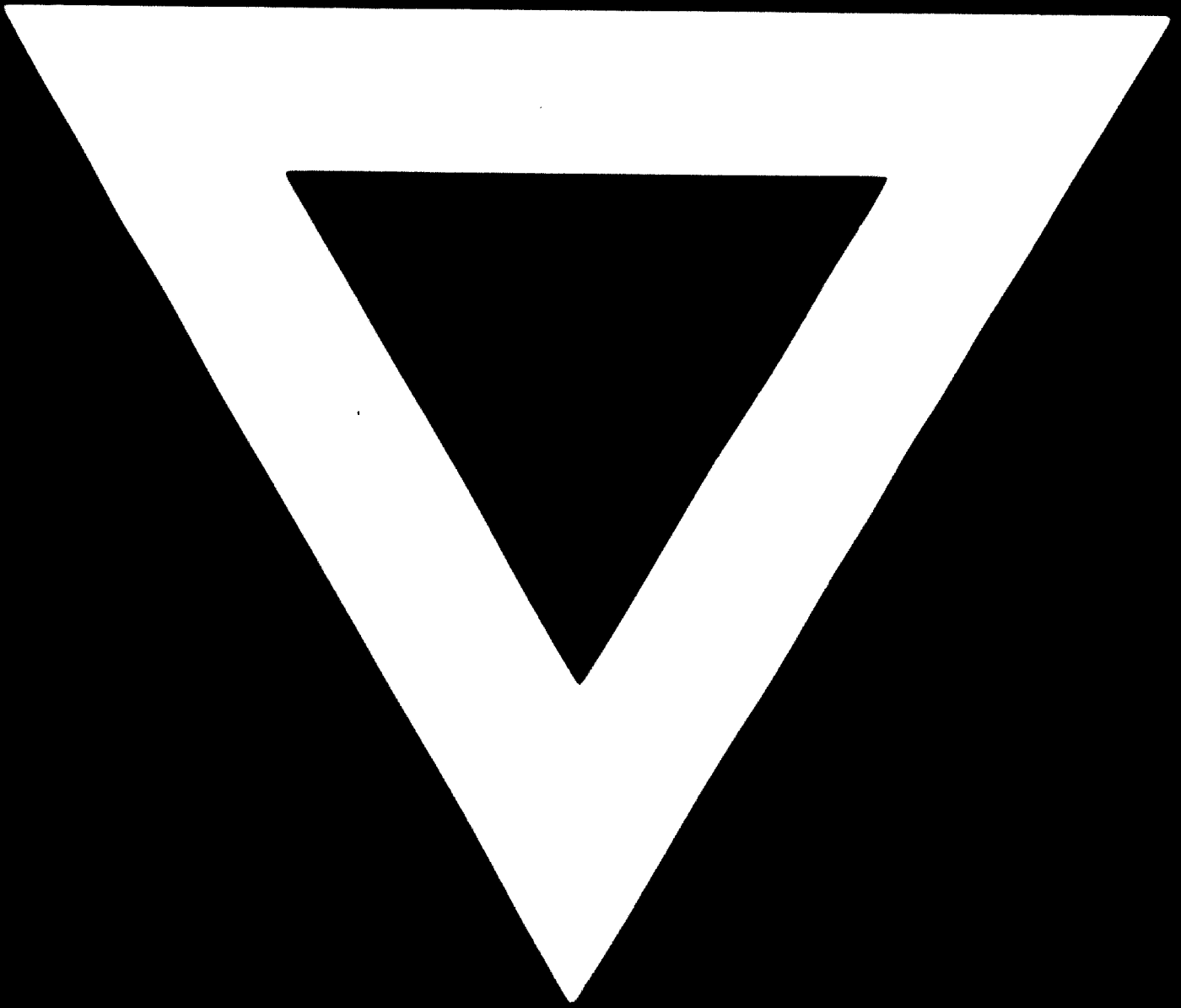
XIII. LIST OF ANNEXES *)

- ANNEX I. Request for Preparatory Assistance from the Government of Viet Nam.
- ANNEX II. Job description of an expert.
- ANNEX III. Job description of an expert.
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- ANNEX V. Terms of reference for the Techno-economic Study (in French)
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- ANNEX XIII. Vietnamese crude oil : supply background data and crude oil analysis information.

*) The Annexes listed below which form an integral part of this report are available at UNIDO - IOD/CHEM on request. For organizational reasons the complete set of Annexes has been reproduced in a limited number of copies.



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