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International Seminar Cum Workshop on  
Petrochemical Technology Transfer and  
Co-operation among Developing Countries  
Pitesti, Romania, 5-10 October 1992

REPORT\*

\* This document has not been edited.

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## I. INTRODUCTION

1. The International Seminar Cum Workshop on Petrochemical Technology Transfer and Co-operation among Developing Countries was held in Pitesti, Romania, from 5 to 10 October 1992. The Seminar was organized by the UNIDO in co-operation with ARPECHIM S.A.-Pitesti - a commercial company set up on the basis of former Petrochemical Complex-Pitesti which started operation in 1966.

2. The Seminar was aimed at providing interested developing countries and other parties with assessed information in the sector of petrochemical industry, thereby facilitating their decision in the future development of this sector and promoting contacts among participants with a view to developing projects for technical co-operation among developing countries.

## II. ORGANIZATION OF THE SEMINAR

### Opening of the Session

The Seminar was attended by 54 specialists from Brazil, China, India, Libyan Arab Jamahiriya, Mexico, Nigeria, Thailand, Turkey and Romania (list of participants attached as Annex I).

The Seminar was officially opened by Mr. Andrei Grigorescu, General Director of ARPECHIM S.A.-Pitesti.

He was followed by Director, Technical Division, Department of Chemical and Petrochemical Industry. Representing the State Secretary he welcomed all participants to Pitesti and stressed the importance of the gathering. He elaborated in detail the history, experience and the development of Romania's petrochemical industry and its role in the national economy. He appreciated UNIDO's effort in bringing foreign participants to Pitesti to promote economic and technical co-operation with Romania.

The meeting was also addressed by the First Vice-Perfect of Arges District. He said that the Seminar sponsored by UNIDO was not only an acknowledgement of Romania's concern for a wide economical and scientific integration, but also an acknowledgement of the fact that Arges District could contribute effectively to the objective of this exercise. In the context of raw material shortages and of the environment problems, the transfer of modern, competitive and non-polluting technologies in the petrochemical industry represents not only a wish but also a necessity. He wished the Seminar a success.

Chief of UNIDO ECDC Section expressed sincere thanks to ARPECHIM S.A. for its generous offer and its substantial contribution to the organization of the meeting. He considered the attendance of high level local officials and the great number of Romanian participants as a manifestation of the importance they had attached to this gathering, aimed at promoting South-South co-operation in the field of petrochemical industry. He elaborated in detail the objectives as well as the meeting arrangements.

### Election of the Bureau

Following the consultations among the participants, Mr. Andrei Grigorescu, General Director of ARPECHIM S.A. was elected Chairman, and Mr. Jirapun Preechawith, from the Office of the Permanent Secretary of Ministry of Thailand, Rapporteur.

### Adoption of the Agenda and Work Programme

The Seminar adopted the following agenda and work programme:

- Opening address by General Director of ARPECHIM S.A.-Pitesti;
- Address by the Representative of the Secretary of State;
- Address by First Vice Perfect on behalf of the Perfect of Arges District;
- Address by Chief of ECDC Section of UNIDO;
- Presentation of UNIDO technical assistance in the petrochemical industry and ECDC/TCDC programme;
- Presentation of UNIDO consultants papers;
- Presentation of foreign national papers by participants;
- Presentation of papers on the petrochemical industry by Romanian experts;
- Field visits to ARPECHIM S.A.-Pitesti, Grulen S.A., Petroleum Research Institute (ICERP), Petroleum Design Institute (IPIP) and Zeolitic Catalyst for Synthesis Institute (ZECASIN);
- Bilateral discussions on co-operation;
- Adoption of draft report and closure of the Seminar.

### Presentation by participants and UNIDO consultants

The UNIDO staff gave a general review of the Petrochemical Industry in the developing countries up to the year 2000 based on UNIDO consultants papers. He also presented information about UNIDO's technical assistance in the field of petrochemical industry and UNIDO programme of economic and technical co-operation among developing countries.

The foreign participants provided ample information on the current development and policies of their countries in the field of petrochemical industry and explained the scope and nature of the proposals submitted to the meeting (proposals for co-operation offered by China, India and Turkey see Annex II).

The representatives of Romanian Institutions, Enterprises and Companies provided detail information about Romania's capacities and capabilities in the field of Petrochemicals as well as on the nature of co-operation they wanted to initiate with other parties (proposals for co-operation by ARPECHIM S.A. see Annex III).

The papers presented by UNIDO consultants and Romanian experts (see Annex II) and their technical discussions, especially on R&D, contributed greatly to identifying and defining proposals for co-operation. The visits to ARPECHIM S.A., Grulen S.A., and Petroleum Research Institute (ICERP), Petroleum Design Institute (IPIP) and Zeolitic Catalyst for Synthesis Institute (ZECASIN) and the discussions on the spot offered to the participants an opportunity to have a better look on the Romanian petrochemical industry and identify the areas for bilateral co-operation.

### III. RECOMMENDATIONS

The Seminar adopted the following recommendations:

1. The co-operating parties should treat this gathering as a long-run exercise and should provide UNIDO with the outcome of their further contacts towards the implementation of proposals discussed during the meeting. At the request and within the availability of funds UNIDO should initiate some follow-up activities.
2. The contacts made in Pitesti should be continued. Efforts should be made by parties concerned to materialize the proposals discussed during the Seminar and initiate measures leading to concrete bilateral co-operation.
3. UNIDO should continue its support to promoting economic and technical co-operation among developing countries, such as organization of seminars, workshops, technical visit, training, etc.

In this context UNIDO was requested to assist in the establishment of a "Safety Centre for Preventative Equipment Maintenance" for Regional Co-operation among Developing Countries as proposed by ARPECHIM S.A. during the meeting.

### IV. SUMMARY OF PROPOSALS FOR BILATERAL CO-OPERATION

During the bilateral discussions, some 15 proposals were discussed. Some discussions were followed by factory visits, collectively or individually.

A detailed summary of proposals for bilateral co-operation is given in Appendix VI.

The proposals reflect a high degree of active participation of the participants in the Seminar.

The proposals submitted and examined cover such areas as: information exchanges, extension of the existing plants, technological upgrading technology transfer, training of personnel, etc.

Through bilateral discussions potentials for economic and technical co-operation among developing countries in the petrochemical industry were identified. The participants considered that their participation and the contacts made during the Seminar were very positive and useful, particularly for the future mutually advantageous technical co-operation.

### V. CLOSING OF THE SEMINAR

The Seminar was closed on October 10, 1992.

The Seminar adopted the draft report and expressed its high appreciation for the hospitality and the excellent arrangements made by the host institutions for the conduct of the Seminar. It particularly expressed its very hearty thanks to ARPECHIM S.A. and its staff.

The Chairman underlined the success of the Seminar and warmly thanked all the participants for their contribution. He emphasized the importance of the follow-up phase and expressed his conviction that through joint efforts a bilateral co-operation could be materialized for mutual benefit.

He also thanked UNIDO for its contribution towards the organization of the seminar and its catalytic role to play in the future.

Chief of UNIDO ECDC Section stated that the existence of a mutual understanding for co-operation contributed remarkably to the success of the meeting. He thanked the Romanian Institutes and Companies and the participants for their participation and positive contribution towards the attainment of the positive results. He referred to the importance of the follow-ups and the necessary contacts and actions from the co-operating partners to materialize co-operation proposals.

The representative of Turkey, speaking on behalf of the foreign participants, thanked ARPECHIM S.A. and its staff for the warm hospitality extended to the participants and for the excellent arrangements made for the Seminar. He placed on record the positive results and invited all participants to maintain their contacts and worked for the implementation of a bilateral co-operation.

The Chairman announced the closure of the Seminar Cum Workshop.

## ANNEX I.

## LIST OF PARTICIPANTS

Participants from Invited Countries:Brazil

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 Mr. Gheorghe Ciuca, PETROBRAZI  
 Mr. Ioan Varga, PETROBRAZI  
 Mr. Gregor Simion, PETROBRAZI  
 Mr. Constantin Tatu, PETROTEL  
 Mr. Ilie Mina, PETROTEL  
 Mr. Sotir Baliu, ICERP PLOIESTI  
 Mr. Adrian Nastasi, ICERP PLOIESTI  
 Mr. Ion Zgiiia, IPIP PLOIESTI  
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 Mr. Stirimin Stefan  
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 Mr. Aristide Ionita, RAFO ONESTI  
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 Mr. Aradoae Ion, MELANA SAVINESTI  
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 Mr. Ladislau Csomontany, ZECASIN BUC.  
 Mr. Ion Diaconescu, IPECHIM BUC.  
 Mr. Mihai Ionescu, ICECHIM BUC.  
 Mr. Cornel Todereanu, IPROCHIM  
 Mr. Nicolae Decu, IPROCHIM  
 Mr. Dragus Constantin, IPROCHIM  
 Mr. Ion Bota, IPROCHIM  
 Ms. Maria Teodorescu, IPROCHIM  
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 Gh. Ivanus, PETRODESIGN  
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 Mr. N. Olteanu, DANUBIANA  
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 Mr. Octavian Negru, UNIDO/Romania Joint Centre  
 Mr. Constantin Divan, ROLAST PITESTI

Mr. Mircea Cimpeanu, ROLAST PITESTI  
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Participants from UNIDO

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Mr. M. Derrough, IO/T/CHEM

## ANNEX II.

PROPOSALS FOR CO-OPERATION OFFERED  
BY CHINA, INDIA AND TURKEY

China Petrochemical Corporation (SINOPEC) can offer co-operation in the following fields:

1. Petrochemical technology:
  - a) Oil refining technology including FCC residual catalytic cracking, etc.;
  - b) Chemical technology including ethylene plant, SBS Plant, etc.;
  - c) Catalyst: FCC catalyst, catalyst for ethylene oxide;
  - d) Plastic processing: LLDPE weather-proof masterbatch ABS/PVC plastic alloy, etc.;
2. Feasibility study and design of the complex.
3. Consultation on market investment and technology of petrochemical industry;
4. Constructions of the plant and export services.

India Petrochemicals Corporation Limited (IPCL) can render services to other countries in the following fields:

1. Technical assistance for the erection and commissioning of naphtha/gas cracker, downstream units (LDPE, LLDPE, PP, LAB, etc.);
2. Training of operation and maintenance personnel;
3. Supply of trained man-power and management experts for petrochemical plants;
4. Corrosion and inspection services;
5. Co-operation and inspection services;
6. IPCL has got most up-to-date sophisticated plant control systems like DCS, PLC system. Training in this area will be very useful to other countries;
7. Marketing services;
8. Polymer application services.

Turkey PETKIM YARIMCA KOMPLESİ can offer the following R&D topics for possible co-operation:

1. Coke formation on naphtha cracker furnace tubes;
2. Comparison of various naphthas from coke formation point of view by laboratory tests;
3. Reduction of coke formation by various additives;

4. Selective hydrogenation of C2 and C3 streams of naphtha cracker units;
5. Kinetic modelling of such reactions;
6. Reactor design and control strategy of such selective hydrogenation units to optimize ethylene and propylene yields;
7. Catalyst preparation/production from laboratory scale to production;
8. Model predictive control of continuous flow stirred tank reactors to produce SBR latex;
9. Surface coating of PVC reactor for crust free productions.

## ANNEX III.

PROPOSALS FOR CO-OPERATION BY ARPECHIM S.A.  
WITH OTHER DEVELOPING COUNTRIES

ARPECHIM S.A. can offer:

1. Technical assistance for the erection and commissioning of the process units for refineries and petrochemistry: modern refinery and petrochemical processes, steam crackers, HDPE, LDPE, ethylene oxide and glycols, acrylonitrile, toluene, hydrodialkylation;
2. Training of the operating and maintenance (instrument, electrical, mechanical) personnel;
3. Technical assistance for various services: unloading and loading of E.D. catalyst as well as column packings;
4. Consulting services for the analyses and selection of the best offers for crude oil processing and petrochemistry;
5. Licences for:
  - production of polymeric compounds with neutron stream suppression
  - production of bioactive nyrilamines (biocides) used for the adjustment of the microorganisms contents of the cooling waters
  - manufacture of polymeric compounds with organic and mineral fillers
  - homopolymeric polystyrene with low molecular weight within the range of Mw 10,000 to 80,000
  - catalyst recovery from the dimethylterphthalate manufacturing process
6. Co-operation for the development of the following processes:
  - Superactive catalyst for HDPE based on titan on magnesia oxide support
  - Dye pastes for plastics (manufacture and colouring procedure)
7. ARPECHIM S.A. Pitesti has developed its own technology for the production of LDPE in autoclave reactor in order to increase the plant's productivity and to improve the quality of the product. Also with a minimum modification of the existing plant we can produce ethylene vinyl acetate copolymers. In this field ARPECHIM S.A. has more than 30 registered patents.

ARPECHIM S.A. Pitesti is interested in:

1. Exchange of experience in the field of production of polymerizing glefins (ethylene, propylene), HDPE and fluid bed cata-catalytic cracking; exchange of experience in the field of petrochemical plant equipment reliability improvement.
2. Offers for some new and efficient technology with lower energy consumption for the treatment of the waste water contaminated with cyanides from the acrylonitrile units.

## ANNEX IV

## LIST OF PAPERS

- I. Presented by UNIDO consultants
  1. "Petrochemical Industry by the Year 2000 with Special Emphases on the Developing Countries", by Mr. J.A. Kopytowski (M.Sc.Ph.D).
  2. "Technology Development and Selection of Appropriate Technology for Petrochemical Plant Erection", by Professor Dr. Gh. Ivanus.
  
- II. Presented by representatives of invited countries
  3. "CENPEB support to Brazilian Petrochemical Companies", by Mr. Wagner Carvalho Coelho, Petrobras, Brazil.
  4. "General Company for Chemical Industries (GCCl)", by Mr. Ali Ardawi and Mr. Mohamed Msalem, Libya.
  5. "The Role of Chemical Engineering in Development of Petrochemical Industry in China (SINOPEC)", by Mr. Ou Can-Qi, China.
  6. "Some New Technologies Developed by SINOPEC", by Mr. Ou Can-Qi, China.
  7. "Petrochemical Industry in Turkey, Petkim", by Mr. H. Ozturk.
  8. "The Petrochemical Industry in Thailand", by Mr. J. Preechavith, Samuthprakan Provincial Industrial Office, Thailand.
  9. "Outlook for the Mexican Petrochemical Industry", by Mr. J. Barroso Castillo, Mexico.
  10. "Indian Efforts and Capabilities in the Field of Petrochemicals, IPC-Baruda", by Mr. Nani Gopal Roy, India.
  11. "Brief Overview of the Nigerian Petrochemical Industry, Project Elme Petrochemicals Co. Ltd.-Port Harcourt, Nigeria", by Mr. E.I. Oahimin Akhimien.
  
- III. Presented by Romanian Experts
  12. "Short Presentation on S.C. ARPECHIM S.A. Pitesti", by Mr. Andrei Grigorescu, General Director.
  13. "Cyclo-olefins Polymerisation by Ring Opening", by Mr. Prof. M. Dimonie.
  14. "Trends in Using of Elastomers for High Performance Tyres", by Mr. N. Decu.
  15. "Progress in Plastic Production Technology", by Mr. A. Variu.
  16. "New Trends in Fibres Industry", by Mr. I. Sirbu.
  17. "New Route for Olefins and Aromatics", by Mr. Gr. Pop.
  18. "Romanian Petroleum Processing Industry, Tradition and Innovation", by Mr. A. Nastasi.
  19. "The Predictive Maintenance Programme Conditioning Safety", by Mr. D. Vlaheli.
  20. "Philosophy of Technological Security", by Mr. A. Pavel.

ANNEX IV

PROPOSALS  
FOR BILATERAL CO-OPERATION

ROMANIAN PARTNER	SUBJECT DISCUSSED	POTENTIAL CO-OPERATING PARTNER	AGREED MEASURES AND FOLLOW-UP REQUIRED
1. ARPECHIM SA PITESTI  Mr. V. Croitoru Mr. F. Florea	1. FCC Unit and DCC Unit Updating  2. Deep Catalytic Cracking Unit DCC	SINOPEC CHINA Mr. Ou Can-Qi	1. For FCC Unit, Romanian partner is interested in an offer for a batch of catalyst (1200 t/y); an offer for cyclones and turbo-expander system. Chinese side agreed to provide some catalyst characteristics to Romanian side. For cyclones and turbo-expander system, the Chinese side will study the possibility of transferring such technology and will answer the Romanian side.  2. For the deep catalyst cracking (DCC), the Romanian side is interested in:  - catalyst - technology for revamping the existing FCC Unit.  The Chinese side agreed to send some written suggestions.



PROPOSALS FOR BILATERAL CO-OPERATION (CONT.)

ROMANIAN PARTNER	SUBJECT DISCUSSED	POTENTIAL CO-OPERATING PARTNER	AGREED MEASURES AND FOLLOW-UP REQUIRED
2. ARPECHIM SA PITESTI  Mr. I. Cojocaru Mr. P. Pop Mr. C. Moga	Caustic wash of cracked gas    Ethylene purification for HOPE use (with superactive catalyst)	Petrobras/Brasil Mr. W.G. Coelho	Romanian side is interested in some information about caustic wash of cracked gas. Petrobras agrees to send the information available from SW steam cracker.  The Romanian side is interested in some information about purification of ethylene in order to be used in HOPE plants with super active catalyst. Petrobras agrees to send some information as required.
3. ICECHIM BUCURESTI Chemical Research Institute  Mr. I. Sirbu	Exchange of technical information and experience	Petrobras/Brasil Mr. W.C. Coelho	Seminar for polymer chemistry between Romania and Brazil. First half 1994 in Romania. Second half of 1994 in Brazil.
4. ARPECHIM SA PITESTI  Mr. P. Obloja Mr. A. Variu	Personnel training for processes and maintenance	Libya, Abukammash	Libyan partner will send an inquiry: - subject of training - number of persons to be trained and the training duration.

PROPOSALS FOR BILATERAL CO-OPERATION (CONT.)

ROMANIAN PARTNER	SUBJECT DISCUSSED	POTENTIAL CO-OPERATING PARTNER	AGREED MEASURES AND FOLLOW-UP REQUIRED
5. OLTCHIM RM. VILCEA PETRODESIGN  Mr. Gh. Ivanus	Vinyl chloride monomer manufacturing in fixed bed system (UHDE). Problems: - low yield - furnace cocking	Libya, Abukammash	Diagnosis study on local technology, technical assistance, personnel training
6. ICECHIM BUCURESTI PETRODESIGN  Mr. Gh. Ivanus	Creation of a research and development institute in chemistry and petro-chemistry in Libya	Libya, Heavy Industry Light Industry	Preparation of a tender specification by Romanian partners based on the inquiry sent by the Libyan Party.
7. OLTCHIM RM. VILCEA	Poly vinylchloride manufacturing (P.V.C. Halls) Problems to be solved: - scaling - agitation - development	Libya, Abukammash	Libyan partner will send an inquiry to Rimmku Vilcea.
8. ARPECHIM S.A. PITESTI  Mr. I. Cojhocar Mr. M. Georgescu	Catalyst for selective hydrogenation of C3 cut	Petkim, Yarimca Kompleks-Turkey  Mr. H. Ozturk	Petkim asked for some information about selective hydrogenation of C3 cut. ARPECHIM SA. agrees to send such information to Petkim. Petkim will make some catalyst screening in the lab. A co-operation in this area will be possible in the future.

PROPOSALS FOR BILATERAL CO-OPERATION (CONT.)

ROMANIAN PARTNER	SUBJECT DISCUSSED	POTENTIAL CO-OPERATING PARTNER	AGREED MEASURES AND FOLLOW-UP REQUIRED
<p>9. PETROLEUM DESIGN INSTITUTE (IPIP) PETROLEUM RESEARCH INSTITUTE (ICERP SA) Mr. A. Nastasi Mr. V. Oragomirescu</p>	<p>Co-operation on research of isomerization of m-xylene on catalyst. Catalyst for dehydrogenation of parafins, absorbants or molecular sieves</p>	<p>Petkim, Yarimca Komplex-Turkey Mr. H. Ozturk</p>	<p>Exchange of visits to set-up co-operation activities programme. The first meeting was held in Ploiesti on October 8, 1992 by Mr. H. Ozturk at ICERP and IPIP.</p>
<p>10. PETROLEUM DESIGN INSTITUTE (IPIP) &amp; PETROLEUM RESEARCH INSTITUTE (ICERP) Mr. V. Deagomirescu Mr. A. Nastasi</p>	<p>Mutual information on the parties' capabilities and co-operation possibilities - valorification of delayed coking gasoline - hydroisomarization of middle petroleum cuts - hydrodesulphurization of residues and heavy products</p>	<p>Commission Petroquima Mexicana Mr. J.B. Castillo</p>	<p>ICERP/IPIP introduced their activities. Mexican Oil &amp; Petrochemical Institutions are interested in co-operation with Romanian partners for developing engineering activities in third countries as well as in Mexico. They will further contact on this subject.</p>
<p>11. ARPECHIM SA PITESTI Mr. D. Vlaheli</p>	<p>Creation in ARPECHIM SA Pitesti of a Safety Centre for Refinery, Petrochemical and Chemical Industry, with assistance of UNIDO for training experts from the developing countries.</p>	<p>Request addressed to UNIDO at plenary session</p>	<p>UNIDO was requested to analyse this proposal based on a project document to be submitted by ARPECHIM and to send an expert to evaluate the project at Pitesti, for final decision during early 1993.</p>

PROPOSALS FOR BILATERAL CO-OPERATION (CONT.)

ROMANIAN PARTNER	SUBJECT DISCUSSED	POTENTIAL CO-OPERATING PARTNER	AGREED MEASURES AND FOLLOW-UP REQUIRED
12. ARPECHIM SA PITESTI Mr. A. Variu	Production LDPE co-polymers i.e. EVA.	Petkim, Yarimca Komplex, Turkey Mr. H. Ozturk	It was agreed that depending on PETKIM decision to produce co-polymer after doing market research, ARPECHIM will be contacted and asked to provide detail information.
13. ICECHIM CCMP Mr. I. Diaconescu	Engineering plastics: - polycarbonate - polyphenylene sulphide - polyphenylene oxice - polyurethane, including raw materials	SINOPEC CHINA Mr. Ou. Can-Qi	- Exchange of specialists - Exchange of information - Joint R/D Programme
14. ZECASIN Romania	Biotechnology and effluent treatment by microbial process.	IPCL Mr. N.G. Roy	Zecasin will further communicate with IPCL.
15. ARPECHIM SA Mr. Georgescu	Alkylation of benzene and/or toluene	PETKIM, Turkey Mr. H. Ozturk	Petkim is interested in the alkylation reaction-process-developed by ARPECHIM and PETRO-DESIGN. They will send to Petkim the results of their pilot-plant studies.