OCCASION

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

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

RESTRICTED

17201

15 September 1988
ENGLISH

BEIJING SPECIALITY GAS RESEARCH INSTITUTE (BSGRI)

DP/CPR/85/005/11-01 & DP/CPR/85/013/11-51

PEOPLE'S REPUBLIC OF CHINA

Report on the Expert Group Meeting on Chemical Reagents and Speciality Gases*

Vienna, Austria, 16 - 20 May 1988

Prepared for the Government of the People's Republic of China
by the United Nations Industrial Development Organization
acting as executing agency for the United Nations Development Programme

Based on the work of Willard L. Ent
Chief Technical Adviser for UNIDO with BSGRI

Backstopping officer: M. Derrough, Industrial Operations Technology Division

United Nations Industrial Development Organization
Vienna

* This document has been reproduced without formal editing

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued):

ABSTRACT

An expert group meeting was conducted by UNIDO, Chemical Industries Branch on 16-20 May 1988 for Representatives from six countries on the subject of specialty gases and reagent chemicals. Representatives were present from Algeria, Brazil, China, Egypt, Mexico and The Republic of the Phillipines. Recent successes in cooperative technical programs in China for the two disciplines were extensively described in order to stimulate thinking towards similar activities in other (attending) countries.

Each country representative used a UNIDO prepared questionnaire to assist in the preparation of reports by the meeting attendees in attempts to ascertain where similar co-operation projects might be feasible.

A list (by country) of proposed co-operative ventures concludes this report.

INTRODUCTION

An expert group meeting was planned and conducted in Vienna on 16-20 May 1988. The experts were invited by the Chemical Industries Branch of UNIDO.

The major purpose of the meeting was to review with other countries' representatives the activities which the Chemical Industries Branch has been conducting in the Peoples Republic of China in two highly technical industries. These are the Specialty Gas Industry and the Chemical Reagent Industry. Representatives from China were present at the meetings.

Each expert from each country was required to make a presentation on either or both the chemical reagent or specialty gas industry in his country. An agenda and a questionnaire was sent to each participant to assist him in preparing the presentation.

Presentations were also made by senior staff members of UNIDO to assist the participants in understanding the various functions of UNIDO and the types of financial and other assistance available to the countries of the participants.

The final days of the meeting were spent in the preliminary development of potential co-operative relationships and agreements between the participants and between the participants and UNIDO.

This report is divided into sections describing the participants at the meeting and the countries they represent; copies of the agenda, questionnaires, and the individual participant's presentations (as annex items) with,

where appropriate, comments about the individual's reports or documents; copies of documents and comments on the UNIDO staff member presentations; and proposed possible future co-operative relationships of the participants and UNIDO.

EXPERT GROUP MEETING

PARTICIPANTS

ALGERIA:

Mr. AISSAOVI, Abdelaziz
Director of Development
National Industrial Gas Enterprises Engineering
BP 247,
Kouba, Algeria
Telephone: (02) 75 1270

BRAZIL:

Dr. Jose Savio J. HENRIQUE
Technology Development Coordinator
Ministry of Science and Technology
Secretary of Fine Chemicals (SQF)
Ave. W-3 North Q. 515 - Bldg. D
Ed. Imperador - #3 Audar
CEP 7060 - Brasilia - D.F.

- also -

Dr. Sergio Freire de CARVALHAES
Director & Dr. of Science, Chemistry
Grupo Quimica Industrial, LTDA.
Rua Jacuruta, 826
Peuba, Rio de Janeiro

EGYPT:

Mr. Lutfi KHATTAL, Chairman
Dyestuffs and Chemicals Co.
Kafr El Dawar - Egypt
Telephone: 816519 or 4916686

MEXICO:

Mr. Dionisio MENDEZ-MAYORA, Engineer
Asst. Director, Technology Development
Mexican Petrochemical Commission
Patricio Sauz 1609, EDIF, B-5° PISO
Col. Del Valle, 03100 Mexico, D.F.
Telephone: 534-20-81; 554-83-11, Ext. 280

PARTICIPANTS (Continued):

REPUBLIC OF THE PHILLIPINES:

Ms. Gloria D. Santos
Board of Investments
Industry & Investments Bldng.
285 Gil J. Puyat Ave.
Makati, Metro, Manila

PEOPLES REPUBLIC OF CHINA:

Mr. CHEN, Jin Ming
Director
Beijing Specialty Gas Research Institute
Dajiaoting Chaoyang District
Beijing, China
Telephone: 78-2731

Ms. SUN, Jing-Yu
Associate Director
Beijing Institute of Chemical Reagents
Huagong Road, East Suburb
Beijing, China
Telephone: 78-3126

UNIDO PARTICIPANTS:

Ms. A. Tcheknavorian - Asenbauer
Director
Industrial Operations Technology

Mr. Nichola Catipovic
Evaluation Staff
Office of the Director General

Mr. J. A. Kopytowski, SIRA
Chemical Industries Branch
Industrial Operations Department

Dr. M. Derrough
Back Stopping Officer
Chemical Industries Branch

MODERATOR:

Mr. Willard L. Ent, Consultant
P.O. Box 212
Emmaus, PA 18049
USA

DOCUMENT LIST

1. AGENDA FOR THE MEETING: ANNEX A

Because of time constraints, the agenda was prepared only a few weeks before the meeting. Generally the document was followed reasonably well during the full five days of the meeting. The only major changes were the inclusion of the presentations of Ms. Techeknovorian and Mr. Kopytowski from the UNIDO staff. In addition to these changes, more time was devoted to the questionnaire (Annex B) since it greatly aided the participants in understanding each other's countries.

2. QUESTIONNAIRE TO ATTENDEES OF MEETING: ANNEX B

These were sent to the international participants before the meeting in most cases. Some of the participants completed these after arriving at the meeting.

As was pointed out above, considerable time was spent at the meeting in reviewing these for each country. A tremendous amount of information was gleaned by the participants in understanding each other's countries needs and assets. The questionnaire also served to assist the participants in making their presentation anent the specialty gas and reagent chemical industries in their countries.

3. THE TECHNICAL COOPERATION PROJECT: ANNEX C. Presentation made by Mr. Catipovic of the UNIDO Staff.

The presentation was a review of a typical relationship between UNIDO and a country wherein technical assistance was provided. It described the project document, stressing, outputs, inputs, goals,

DOCUMENT LIST (Continued):

activities, use of experts, procurement and all of the other facets of such relationships.

The means of monitoring such projects was also reviewed and extensively described.

4. UNIDO TECHNICAL ASSISTANCE TO INTEGRATED CHEMICAL INDUSTRY DEVELOPMENT. ANNEX D. Presentation made by Mr. Kopytowski, SIRA in the Chemical Industries Branch.

This presentation described a computer model which could be used to assist industrialists in the development of plans in developing an integrated chemical industry. Mr. Henrique, the government representative from Brazil was particularly interested in the potential for its use in his country. Production Distribution Areas (PDA) were defined and it was described how these were utilized with the computer model to relate objectives within the PDA as well as with other PDA's. The development and utilization of network description equation was also explained and in addition how it was integrated into developing data for the PDA.

5. BEIJING SPECIALTY GAS RESEARCH AND DEVELOPMENT CENTER. ANNEX E

This annex contains the notes from Mr. Chen's presentation on a typical technical assistance project and co-operation agreement between PRC & UNDP (UNIDO).

It describes the development of the project document containing all of the typical data, objectives, inputs, outputs, activities, etc. He also described the achievements of the project to date and the continuing goals of the research institute.

DOCUMENT LIST (Continued):

6. BEIJING INSTITUTE OF CHEMICAL REAGENTS: ANNEX F

Like Annex E, this is a description of a project by UNIDO & PRC relating to reagent chemicals. Presentation was by Ms. Sun, Associate Director of the Institute. The report includes a computer print out of typical reagent chemicals which are available from the institute, purities, quantities, etc.

7. QUESTIONNAIRE ANSWERS, BRAZIL: ANNEX G

Since the questionnaire served an integral part of developing data and presentation prepartion by the participants, it was felt that a copy of typical responses should be included in this section. These responses were prepared by Mr. Henrique of Brazil.

8. SPECIALTY AND INDUSTRIAL GAS INDUSTRY IN ALGERIA: ANNEX H

This presentation by Mr. Aissaoui of Algeria is in French. However, it is the only report of a participant at the meeting (other than Mr. Chen of BSGRI) which involves the specialty gas industry. All of the other experts at the meeting had their main interest in fine or reagent chemicals. Therefore, it is included even though it is not in English. The report gives a complete and comprehensive description of the industrial gas industry in Algeria. Many of the specialty gas requirements are presently being imported and feasability studies need to be performed to determine if it would be more appropriate to produce these products in Algeria.

9. DEVELOPMENT OF CHEMICAL REAGENTS (EGYPT): ANNEX J

This outline was used by Mr. Khattal in describing a project which could be developed in Egypt. Mr. Khattal also described the reagent

DOCUMENT LIST (Continued):

and dyestuff chemical company of which he is Chairman and how the UN in the past had assisted in the rehabilitation of the company.

10. SPECIALTY CHEMICALS SUPPLY AND DEMAND FOR MEXICO IN TECHNICAL CO-OPERATION WITH OTHER DEVELOPING COUNTRIES: ANNEX K

This annex shows tables and data presented by Mr. Mendez-Mayora to the other participants. His presentation dealt with specific petrochemical and industrial chemical products, and defined for each whether Mexico wished to sell, buy, enter into a joint venture to develop, tansfer technology on the production of the product or give technical assistance to current producers of the product.

11. PRODUCT CATALOGUE: GRUPO QUIMICA: ANNEX L

This catalogue was used by Dr. Carvalhaes in describing the development of his chemical reagent company in Brazil. Also included is an equivalancy chart relating the Brazilian products to those of other producers of these products throughout the world.

12. CHEMICAL REAGENTS AND INDUSTRIAL GASES IN THE PHILLIPINES: ANNEX M

Ms. Santos distributed this data plus other data on other industries in the Phillipines to the members at the meeting

Other data was also presented to the attendees of the meeting on other industries in the Phillipines. These included Agriculture, Fishing, Forestry, Mining, Textile and Textile Products, Leather Tanning, Basic Chemicals, Pharmaceuticals, Rubber Products, Non-Metalic Minerals, Electronic Products, Electrical Machinery, Shipbuilding, Automotive (Parts) and DFA Based Toilet Soap Manufacture.

PROPOSED CO-OPERATIVE RELATIONSHIPS

As a result of the early presentations in the meeting, particularly those of Mr. Chen and Ms. Sun which described the projects (co-operative relationships) which enabled them to acquire technical assistance in the chemical reagent and specialty gas endeavors; most of the participants developed ideas and proposals for co-operative relationships .

The last portion of the meeting was devoted to developing, expanding and listing these proposals for co-operation. The following is a listing of these interrelationships as they were developed in the meeting. For ease in cataloguing, they are listed by country.

BRAZIL:

A. Proposes to "trade" with Egypt a list of each others products in which they feel they need technical assistance or technical development for their manufacture. When agreement is reached on the product or products in which they need assistance, a project application would be prepared.

B. Agreed to send to the Phillipines a listing of products which are produced in Brazil.

C. Agreed to send to China data on the market situation for reagent chemicals in Brazil. Also agreed to send to China a listing of the primary technologies required in Brazil in the Reagent Chemical Industry.

D. Agreed to send a list of products produced in Brazil to Algeria.

PROPOSED CO-OPERATIVE RELATIONSHIPS (Continued):

ALGERIA:

A. Asked that Beijing Specialty Gas Research Institute (BSGRI) investigate the possibility of supplying technological data on:
   1. Gas Purification
   2. Industrial and Specialty Gas Safety
   3. Advanced Cylinder Filling Techniques
   4. Industrial and Specialty Gas Quality Analysis Procedures

B. Asked that BSGRI supply the names of cylinder manufacturers and compressor manufacturers in China.

C. Request from Egypt that they supply a report on the status of high purity industrial gases in that country. More specifically, what is available and at what purity.

D. Agreed to a comparison of the industrial and specialty gas industry in Algeria and China. Each country will send their 20 year plan in these disciplines to each other.

E. Algeria further requested that a feasability study be conducted to determine the appropriateness of producing rather than importing some of the needed specialty and industrial gas products. The sequence of events proposed was:
   1. Mr. Aissaoui would send a list of the products and their quantities to Mr. Willard Ent.
   2. UNIDO would be petitioned to issue a project document for a feasability study by Mr. Ent with co-operation from the Algerian industrial gas industry.

PROPOSED CO-OPERATIVE RELATIONSHIPS (Continued):

3. If appropriate, a project document would be petitioned from UNIDO on developing the manufacturing capability for the chosen products.

MEXICO:

A. Requested that China and Algeria consider supplying purification technology for industrial and specialty gases used in the electronics industry.

B. Requested a listing from the Phillipines and from China on the major, petrochemical imports.

C. Technical exchanges are sought with all attendees regarding the data presented in the list (see Annex K). This request is particularly for the products listed for pharmaceutical compounds.

EGYPT:

A. Develop a project document to work jointly with Brazil and or China to develop techniques for the production of certain reagent chemicals in Egypt. See Annex J for the proposed outline of a project document.

CHINA:

A. Both the Reagent Chemicals and the Specialty Gas entities will contact all of the other attendees with listings of the technologies (products) needed in China.

B. The reagent chemical entity will send the projected R&D plan for reagent chemicals development to Grupo Quimica in Brazil. If special fields of study are requested from other attendees, Ms. Sun will

PROPOSED CO-OPERATIVE RELATIONSHIPS (Continued):

direct the requestor to the proper government organization in China.

C. BSGRI requested the names of the major industrial gas companies in each country which was represented at the meeting.

REPUBLIC OF THE PHILLIPINES:

A. Requested receiving technology data on all of the industrial and specialty gas and reagent chemical products available from Mexico, Brazil, Egypt and China. The lists will be reviewed and a "shopping list" prepared and submitted to each country which has the requested product available.

AGENDA

International Symposium on Specialty Gases and Reagent Chemicals

Vienna, Austria

May 16-20, 1988

1/2 Day:

I. INTRODUCTION: (Derrough, Chen, Sun and Ent)

A. UNDP; UNIDO
   Roles and Goals

B. Legal Relationships between UNIDO, UNDP and the Developing Countries
   1. UNIDO Contribution (Derrough)
   2. Developing Country Contribution
      BSGRI (Chen)
      Reagent Chemical (Sun)

C. Country Delegates Meet with UNIDO Staff (Derrough)
   1. Accounting
   2. Administration
   3. Expert Recruitment
   4. Chemical Industries Branch

D. The Project Document
   1. Purpose of the Document
   2. How Prepared and Who
   3. General Layout
      a. Development Objectives
      b. Immediate Objectives
         (1) Specific Aims
      c. Background and Justification
         (1) Current Description of Industry
         (2) Comparisons with Rest of World
         (3) General Desires and Aims
            (a) Specific
      d. Outputs
         (1) List Individually and Specific
      e. Activities
         (1) Specific and Related to Outputs
      f. Inputs ($)
         (1) Related to Outputs and Activities
         (2) Developing Country Government Inputs:
            (a) Staff
            (b) Training

(c) Construction
(d) Equipment
(e) Other
(3) UNDP Inputs
(a) Experts
(b) Training
(c) Purchases - Expendable and Non-expendable

4. Work Plan
5. Institutional Framework
6. Monitoring, Evaluation and Reports
   a. Monitoring (Local and UNDP)
   b. Evaluation (Local and UNDP)
   c. Process Reports
   d. Terminal Reports
7. Tables and Documents
   a. Project Numbering System
   b. Annual Budget Statements
      (1) For Life of Project
   c. UNDP Budget Statements
   d. Equipment Purchases Budget
   e. Experts Budgets
   f. Staffing

1/2 Day:

II. Review of Questionnaires of all Delegates (All Personnel)

A. Determine and Log the Various Needs in the Different Countries (All Personnel).

B. Begin Introduction to Preparation of Project Documents. (Derrough and Ent)

1/2 Day:

III. Government Inputs to BSGRI (Chen and Ent)

A. Staff

B. Training

C. Construction (Buildings and Other)

D. Equipment

E. Other

1/2 Day:

IV. Government Inputs to Chemical Reagent Research Institute. (Sun and Derrough)

A. Staff

B. Training

C. Construction (Buildings and Other)

D. Equipment

E. Other

1/2 Day:

V. UNDP Inputs to BSGRI (Ent and Chen)

A. Experts

B. Training

C. Purchases - Expendable and Nonexpendable

1/2 Day:

VI. UNDP Inputs to Chemical Reagent Research Research Organization (Derrough and Sun)

A. Experts

B. Training

C. Purchases

1/2 Day:

VII. The Tripartide Review System. (Mr. Catipovic and Mr. Derrough)

A. Who Prepares

B. Who Reviews

C. Results of Review

D. Complete Description of Preparation of Documents and Review Procedures

1/2 Day:

VIII. Other Review Systems (Derrough/Ent/Sun/Chen)

A. C.T.A. Reports

B. Directors Reports

C. Back stopping reports

1 Day:

IX. Final Review Period (All Personnel)

A. Respond to All Questions

B. Assist in Preparation and Semi-Finalization of Project Documents for Each Country

C. Wrap-up and Departure.

Annex B
(1)

QUESTIONNAIRE FOR ATTENDEES TO UNIDO SYMPOSIUM ON SPECIALTY GASES AND REAGENT CHEMICALS 16-20 MAY 1988

INTRODUCTION:

This questionnaire has been designed to assist those who are preparing the Symposium to better understand the specialty chemical and specialty gas industries in your country. Questions are generally directed at the various facets of these industries as well as the government organizations who would normally be involved in regulating these industries or its employees and management organizations.

Please respond openly to the questions and feel free to add information if it is felt the additions will be beneficial to the evaluation.

QUESTIONS:

1. Concerning the electronics industry in your country:

   a. Is it a basic manufacturing activity to the level of producing silicon "chips"? Yes or No.

   b. Is its main activity the assembly of finished products or sub-parts from smaller components? Yes or No

   c. Is there a better way to describe the electronics industry in your country. Yes or No. Explain: _____
   _____
   _____

2. Is there a well established heavy metal (iron and steel) industry in your country? Yes or No

   a. If present, does the industry tend to specialize in relatively small volume high quality products? Yes or No

   OR:

   b. If present, does the industry tend to concentrate on the production of high volume (non-specialty) products? Yes or No

   c. If 2, b was answered Yes, does the industry utilize modern basic oxygen processes in its production? Yes or No

3. Concerning the energy production industry in your country, check the fuel sources below which are utilized:

   _____ Oil
   _____ Natural Gas
   _____ Anthracite Coal
   _____ Bituminous Coal
   _____ Hydroelectric
   _____ Nuclear Reactor
   _____ Other

4. If there is a well established chemical industry in your country, check below the facets of that industry which exist:

_____ Petrochemical
_____ Synthetic Fibers and Plastics
_____ Agrichemical (Ammonia and Fertilizer)
_____ Pulp, Paper and Allied Products
_____ Soap, Detergents, Cleaners, Solvents
_____ Basic Inorganic Chemicals (Acids and Bases)
_____ Basic Inorganic Chemicals (Industrial Gases)
_____ Petroleum Refining
_____ Other

5. Is your country self sustaining as far as its agriculture products are concerned? Yes or No

   a. If not, what are the major food-stuff needs which are imported:

   _____
   _____
   _____

   b. If there are major exports of foodstuffs, what are those:

   _____
   _____
   _____

   c. Are there other major imports or exports of agriculture items, (Cotton, Flax, etc.): List as Import or Export.

   _____
   _____
   _____

6. Would you describe your country as being more agrarian than industrialized? Yes or No

   a. If yes, list the major staple crops (corn, wheat, rice, etc.)

   _____
   _____
   _____

   b. If yes, list the major specialty crops (dates, fruits, coffee, etc.):

   _____
   _____
   _____

7. Other than the agrarian activities, how would you describe the level of education of the persons employed in industry:

Type Employee	Education Level*				
	Less than Secondary School	Completed Secondary School	2 Yr. College Degree	4 Yr. College Degree	Advanced Degree
1. Factory Laborer	____	____	____	____	____
2. Factory Foreman	____	____	____	____	____
3. Maintenance Employee	____	____	____	____	____
4. Maintenance Supervisor	____	____	____	____	____
5. Accounting Personnel	____	____	____	____	____
6. Laboratory Technician	____	____	____	____	____
7. Laboratory Scientists	____	____	____	____	____
8. Laoratory Supervisors	____	____	____	____	____
9. Stenographic & Secretarial	____	____	____	____	____
10. Factory Manager	____	____	____	____	____
11. Company Owner (Manager)	____	____	____	____	____

* Check more than one level, if appropriate.

8. Is the health-care industry well advanced in your country? Yes or No

   a. Is health-care in modern hospitals available to all citizens? Yes or No

   b. Are well trained physicians available to all citizens? Yes or No

   c. If 8, a and 8, b are not answered yes, is the reason financial or lack of facilities and trained personnel:

      _____ Financial
      _____ Facilities
      _____ Trained Personnel

9. Are industrial and government laboratories involved in analyses for process control and quality control; or for governmental monitoring activities equipped with modern analytical equipment? Check below if equipment listed would be found in typical analytical laboratories:

      _____ Gas Chromatography (Vapor Phase)
      _____ Liquid Chromatography
      _____ Infrared Spectrophotometry
      _____ Mass Spectrometer
      _____ Atomic Absorption
      _____ Thermal Conductivity
      _____ N.M.R.

10. Are there national standards organizations or other regulatory organizations extant in your country relating to:

   a. Weights and measures (similar to USA's National Bureau of Standards) Yes or No

Annex B
(4)

b. The establishment of hazardous goods or chemical shipping regulations and the specifying of shipping containers (similar to USA's Department of Transportation) Yes or No

c. The protection of workers in the workplace (similar to the USA's Occupational Safety and Health Administration). Yes or No

d. The protection of air, water, and land from chemical or other hazardous waste spills (similar to USA's Environmentl Protection Agency). Yes or No

11. Please add any other comments about the specialty gas, industrial gas or reagent chemical industries in your country:

COMMENT_____

_____

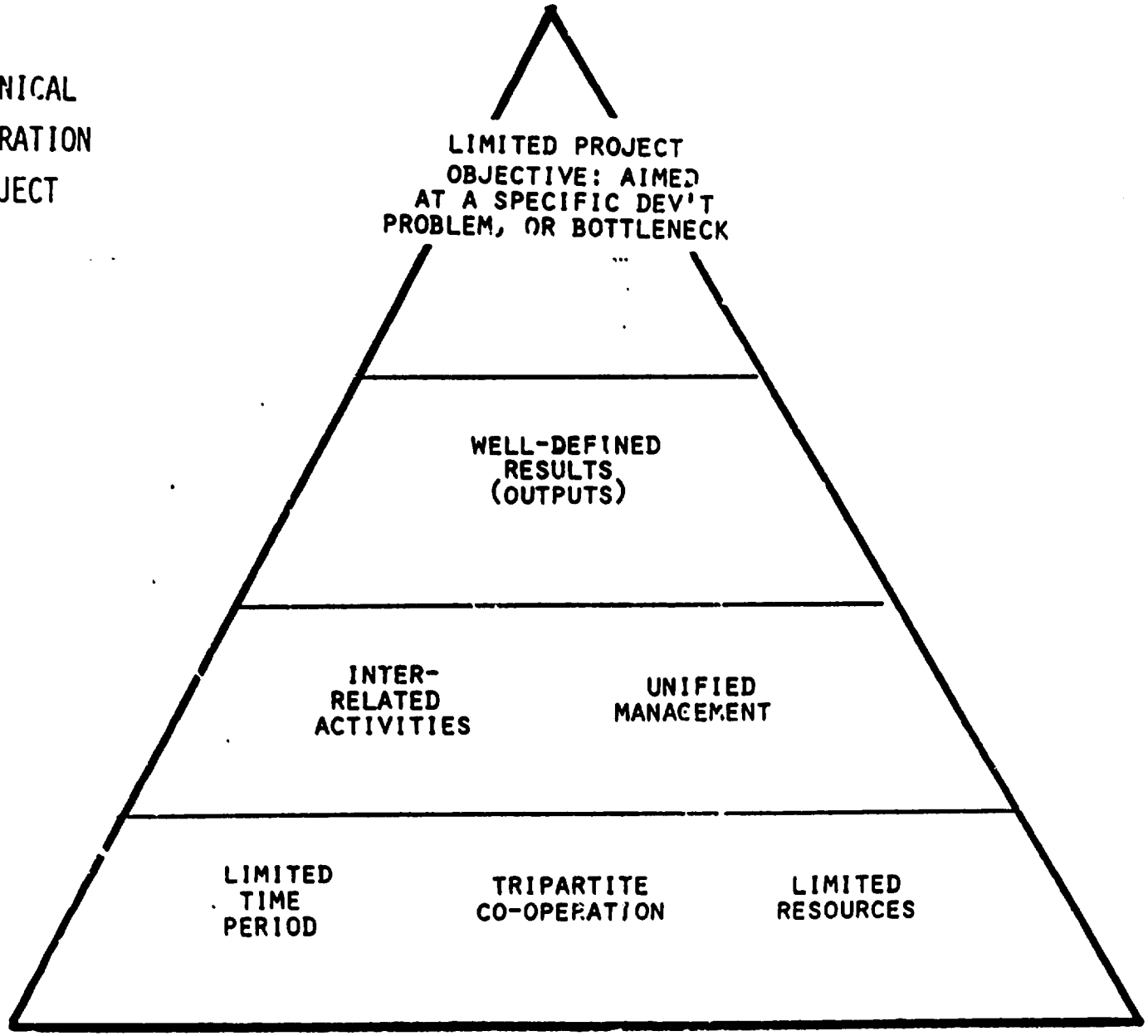
_____

_____

_____

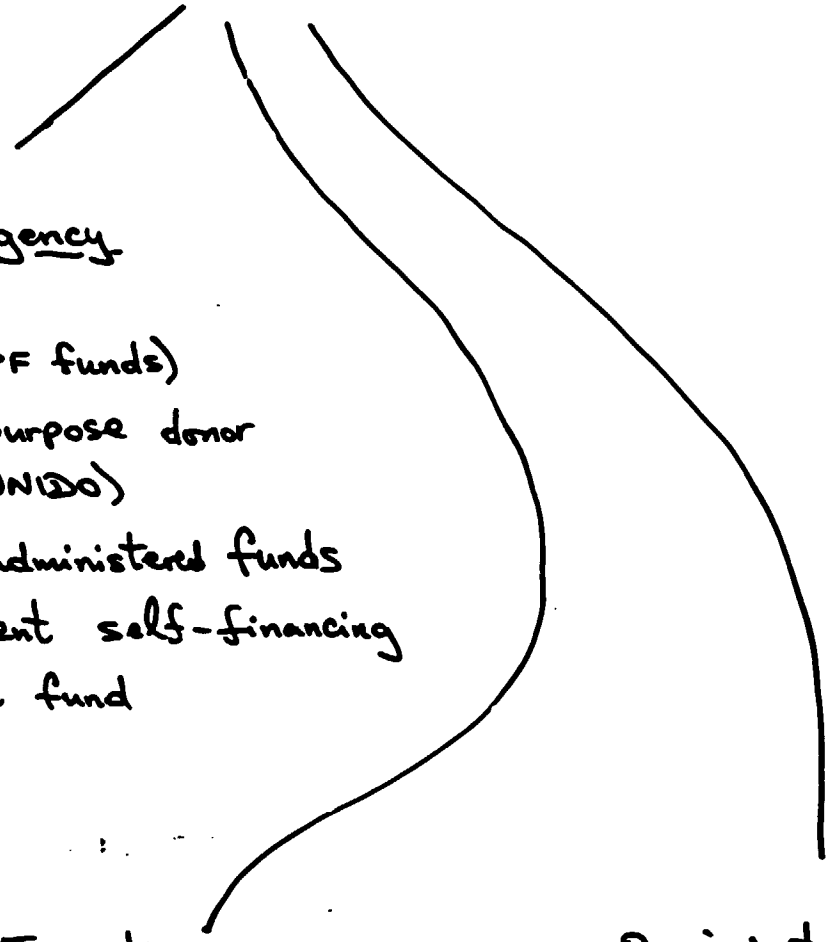
Annex C
(1)

TECHNICAL CO-OPERATION PROJECT



Annex C
(c)

TRIPARTITE CO-OPERATION



Financing agency

- UNDP (IPF funds)
- Special purpose donor (through UNIDO)
- UNIDO-administered funds
- Government self-financing or trust fund

Executing agency
UNIDO

Recipient Govt/agenc

ACTORS:

Backstopping officer - project manager at HQ

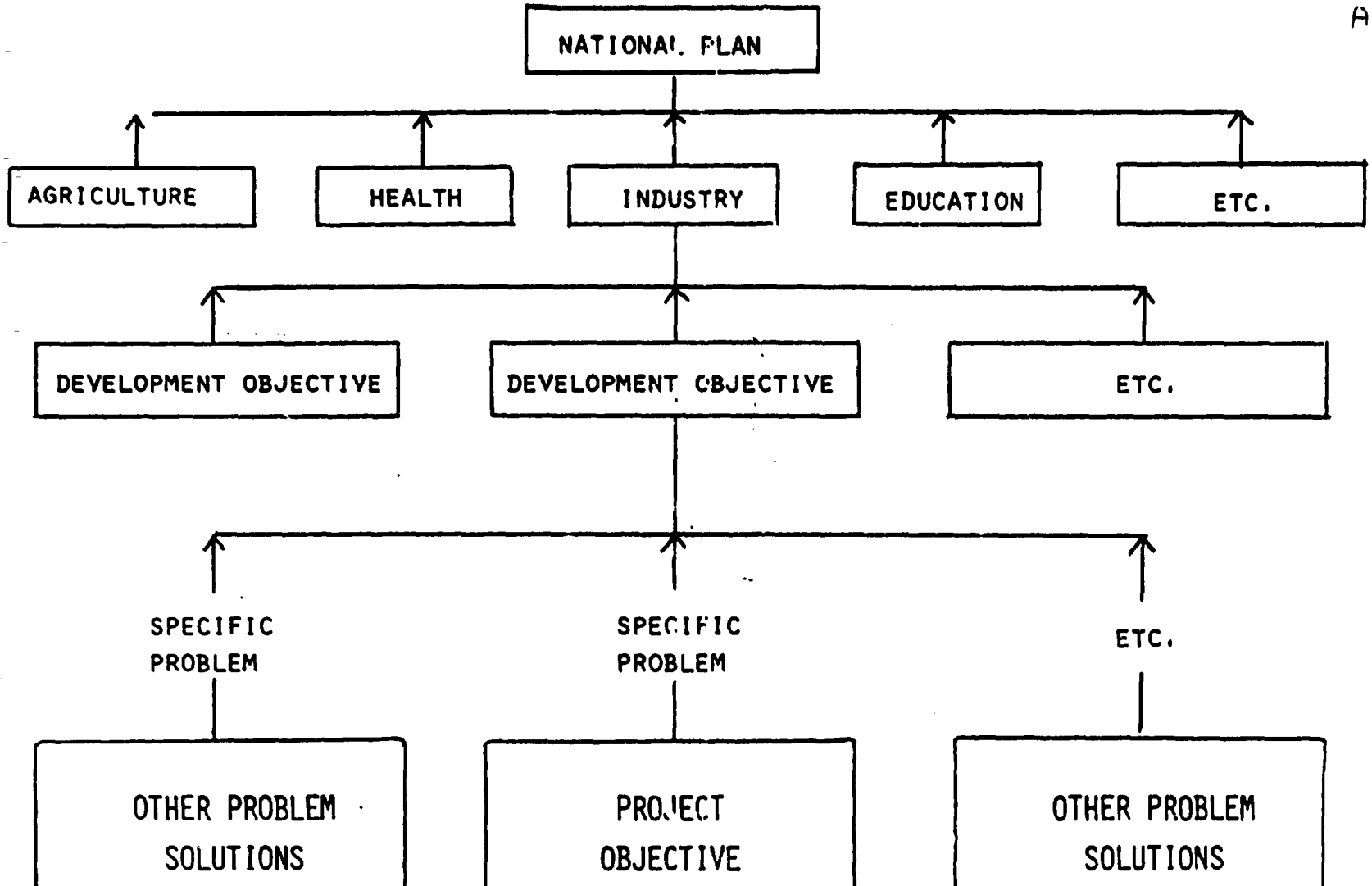
Chief Technical Adviser/ Intern. Team Leader

various experts

National Project Co-Ordinator/ Director

national project staff

Annex C
(3)



PROJECTS: ELEMENTS IN THE NATIONAL DEVELOPMENT PROGRAM

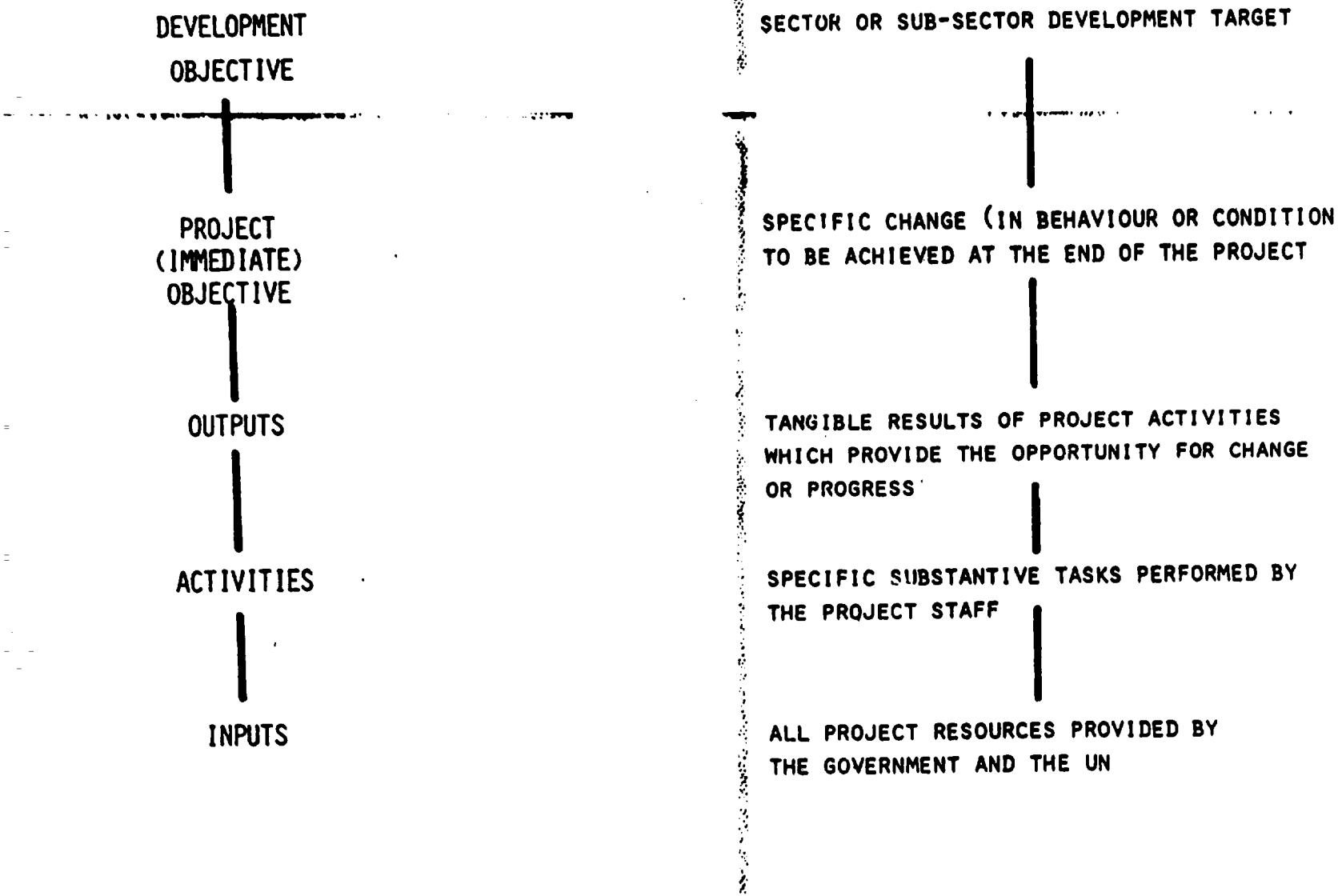
ANNEX C (II)

TECHNICAL CO-OPERATION PROJECT CYCLE

- IDENTIFICATION
- DESIGN / FORMULATION
- APPRAISAL
- APPROVAL
- IMPLEMENTATION (EXECUTION)
  incl. monitoring
  reporting
  review
- EVALUATION
- TERMINATION AND FOLLOW-UP

Annex C
(5)

ELEMENTS OF PROJECT DESIGN



Annex C
(6)

SIMPLIFIED LOGIC FOR A DIRECT SUPPORT PROJECT:

THEN....

THEN.... IF...

THEN.... IF...

THEN.... IF...

IF...

DEVELOPMENT OBJECTIVE

INCREASED AVAILABILITY OF DRUGS TO RURAL POPULATION

(THE PROBLEM ADDRESSED IS THE LOW PRODUCTIVITY OF THE STATE PHARMACEUTICAL COMPANY RESULTING IN SEVERE SHORTAGES)

PROJECT (IMMEDIATE) OBJECTIVE

INCREASED PRODUCTION BY THE STATE PHARMACEUTICAL COMPANY

OUTPUTS

- RECONDITIONED EQUIPMENT
- PREVENTIVE MAINTENANCE SYSTEM DEVELOPED AND INSTALLED
- IMPROVED PRODUCTION SCHEDULES

ACTIVITIES

- MAKE SURVEY OF MACHINERY, IDENTIFY SPARE PARTS NEEDED, SUPERVISE RECONDITIONING
- DEVELOP PREVENTIVE MAINTENANCE PROCEDURES, ETC.

INPUTS

- MACHINERY ENGINEERS, PRODUCTION PLANNING EXPERT, PREVENTIVE MAINTENANCE EXPERT
- FUNDS FOR SPARE PARTS (GOV'T CONTRIBUTION)

HOW?

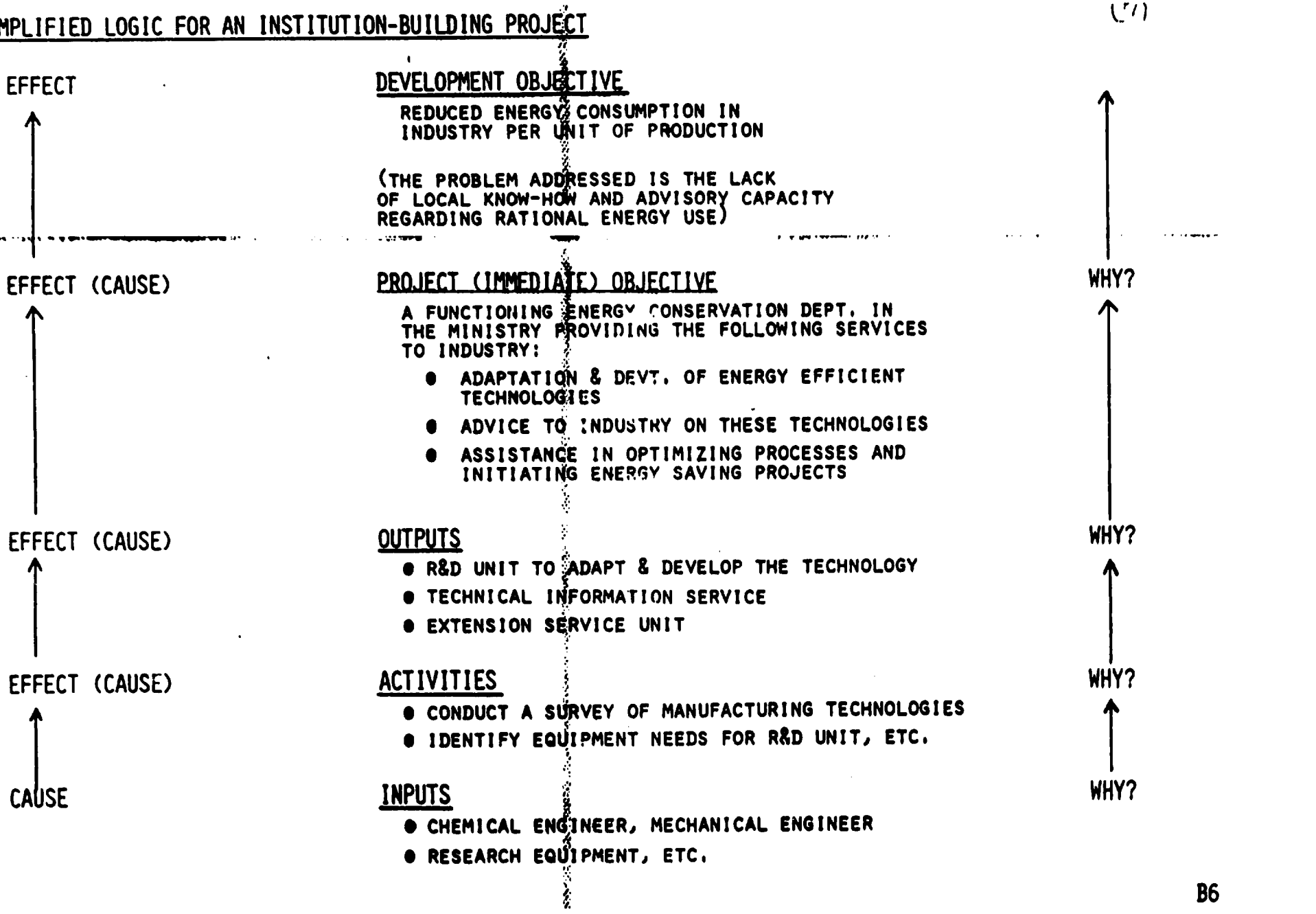
HOW?

HOW?

HOW?

Annex C
(7)

SIMPLIFIED LOGIC FOR AN INSTITUTION-BUILDING PROJECT



PROJECTS CAN BE DISTINGUISHED BY THEIR MODE OF ASSISTANCE OR "FUNCTION"

PROJECT FUNCTION	TYPE OF OUTPUT
INSTITUTION BUILDING	CAPACITY/CAPABILITY
DIRECT SUPPORT	PRODUCT OR SERVICE (EEASIBILITY STUDY, FIVE-YEAR PLAN, TROUBLESHOOTING SERVICES, ETC.)
DIRECT TRAINING	SKILLS/KNOWLEDGE
EXPERIMENTAL	RESEARCH RESULTS, DATA
PILOT	OPERATIONAL INFORMATION FROM A PILOT PLANT (TECHNICAL OR ECONOMIC DATA)

Annex C
(7)

MONITORING

CONTINUOUS OVERSIGHT OF:
- INPUT DELIVERY
- IMPLEMENTATION OF ACTIVITIES (FULFILLMENT OF WORK PLAN)
- OUTPUT PRODUCTION

BY:
- PROJECT STAFF
- BACKSTOPPING OFFICER
- SIDFA/JPD
- LOCAL UNDP OFFICE

Annex C
(10)

1985												1986				1987			
1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	1	2	3	4

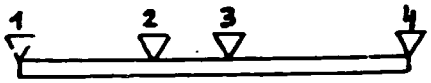
OUTPUT NO.1

LABORATORY TO PROVIDE BASIC TESTING AND ANALYSIS SERVICES

ACTIVITIES

A. CONSTRUCTION OF LABORATORY

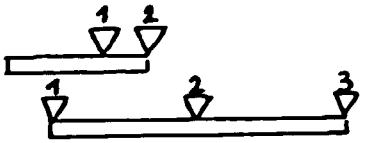
B. EQUIPPING OF LAB.



C. TRAINING OF STAFF

D. UPDATED INDUSTRIAL DEMAND SURVEY

E. SERVICE TO INDUSTRY



OUTPUT NO.2

ACTIVITIES

A.

B.

Annex J (iii)

∇ = MILESTONE (PRE-ESTABLISHED EVENT SELECTED BY MANAGEMENT FOR MONITORING PURPOSES)

A.1 - SURVEY OF SITE COMPLETED

A.2 - FRAME COMPLETED

A.3 - INTERIOR COMPLETED

B.1 - LAB EQUIPMENT ORDERED

B.2 - INTERIOR ALTERATIONS COMPLETED

B.3 - EQUIPMENT INSTALLED

B.4 - FINAL TEST COMPLETED

C.1 - TRAINING IN THIRD COUNTRY COMPLETED

C.2 - TESTING AND ANALYTICAL PROCEDURES LEARNED ON-THE-JOB

C.3 - FINAL TEST GIVEN ON SKILLS AND KNOWLEDGE

D.1 - QUESTIONNAIRES PREPARED

Annex C
(1/2)

TRIPARTITE REVIEW

WHAT IS IT?

A DECISION-MAKING MECHANISM (PROCESS)

WHAT IS IT TO BE USED FOR?

- PERIODIC REVIEW OF PROGRESS
- EXAMINATION OF EXTERNAL FACTORS
- PROBLEM SOLVING

WHEN IS IT DONE?

AT LEAST ONCE PER YEAR FOR PROJECTS OVER $400,000 AND AS REQUIRED FOR SMALLER PROJECTS

WHAT IS IT CONCERNED WITH?

- IMPLEMENTATION OF ACTIVITIES
- PRODUCTION OF OUTPUTS
- ACHIEVEMENT OF PROJECT OBJECTIVE

WHO CONDUCTS IT?

- UNIDO, UNDP AND GOVERNMENT REPRESENTATIVES, INCLUDING OPERATIONAL-LEVEL STAFF
- UNIDO HEADQUARTERS STAFF (IF NECESSARY)
- TARGET GROUP REPRESENTATIVES (DESIRABLE)

Annex C
(12)

TRIPARTITE REVIEW

- ANY OF THREE PARTIES CAN TAKE THE INITIATIVE FOR SCHEDULING
- ALL PARTIES HAVE TO BE INFORMED IN ADVANCE
- FORMAL AGENDA IS REQUIRED:

  A. PROJECT CONCEPT AND DESIGN
  B. PROJECT ACTIVITIES (PROGRESS IN WORK PROGRAMME)
  C. PRODUCTION OF OUTPUTS
  D. PROSPECTS OF ACHIEVING PROJECT OBJECTIVES
  E. UTILIZATION OF PROJECT RESULTS
  F. MONITORING OF CRITICAL ASSUMPTIONS
  G. WORKPLAN TILL NEXT TPR
  H. CONCLUSIONS, DECISIONS AND RECOMMENDATIONS

- NECESSARY INPUT: UNDP/UNIDO PROJECT PERFORMANCE EVALUATION REPORT (PPER)
- REPORT OF TPR TO BE MADE BY RESREP's OFFICE, INCLUDING RECOMMENDATION REGARDING IN-DEPTH EVALUATION

EVALUATION

AN ASSESSMENT OF PROJECT PERFORMANCE...

- ORIENTED PRIMARILY TOWARD EFFECTIVENESS (P.O.) AND IMPACT (D.O.)
- SYSTEMATIC AND OBJECTIVE
- AIMED AT PROJECT IMPROVEMENT (FEEDBACK)
- TO BE USED AS A LEARNING, ACTION-ORIENTED MANAGEMENT TOOL
- NOT MONITORING, REVIEW, INSPECTION, OR AUDIT

EVALUATION

SELF-EVALUATION

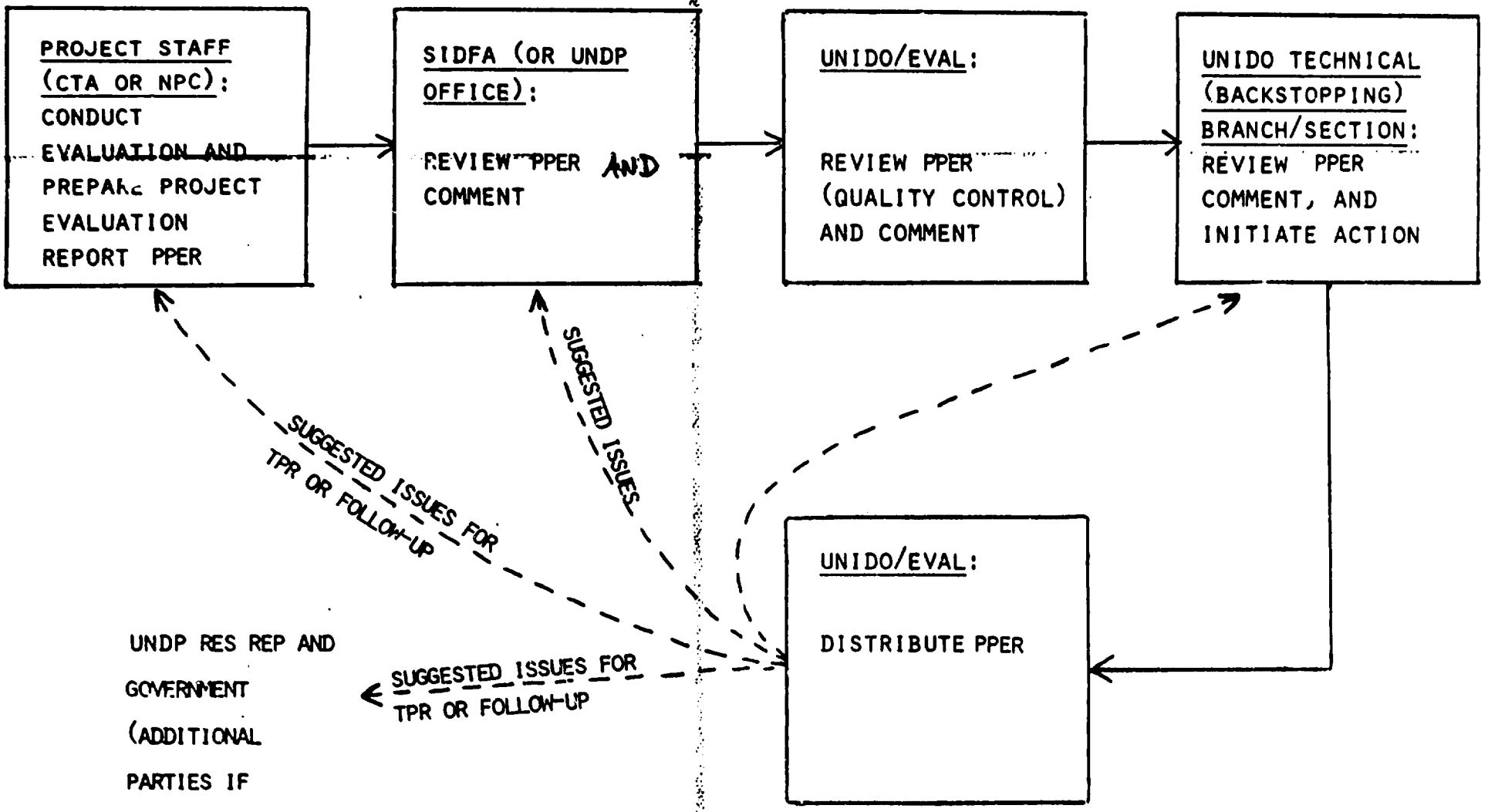
- INTERNAL
- PERFORMED BY STAFF INVOLVED IN OR CLOSEST TO PROJECT MANAGEMENT
- REGULAR
- OUTPUT-ORIENTED
- SIMPLIFIED
- STRUCTURED

IN-DEPTH EVALUATION

- TRIPARTITE
- PERFORMED BY SPECIALIZED STAFF NOT DIRECTLY INVOLVED IN PROJECT
- AT KEY DECISION POINT, AT END OR EX-POST
- OBJECTIVE-ORIENTED
- MORE SOPHISTICATED
- MORE TAILOR-MADE TO PRE-DETERMINED ISSUES

Annex C
(16)

SELF-EVALUATION PROCESS



Annex C.
(17)

PROJECT PERFORMANCE EVALUATION REPORT (PPER)

WHY IS IT DONE?

- TO RECORD PROGRESS
- TO IDENTIFY PROBLEMS
- TO SUGGEST REMEDIAL ACTIONS
- TO IMPROVE IMPLEMENTATION
- TO ESTABLISH LIMITS OF UNIDO'S PROJECT EXECUTING RESPONSIBILITY

WHAT DOES IT DO?

- LOOKS AT: EACH OUTPUT (STATUS, PROBLEMS, LIKELIHOOD OF BEING PRODUCED)

  CRITICAL ASSUMPTIONS (RELATIONSHIP WITH ENVIRONMENT)

  PROJECT OBJECTIVE (HYPOTHESIS - APPROACH STILL VALID?)
- COMPARES WITH PLAN (PRO-DOC)
- SUGGESTS WHETHER RE-DESIGN, UP-DATE OF WORKPLAN OR IN-DEPTH EVALUATION IS NEEDED
- IDENTIFIES ISSUES FOR TPR

Annex C.
(E)

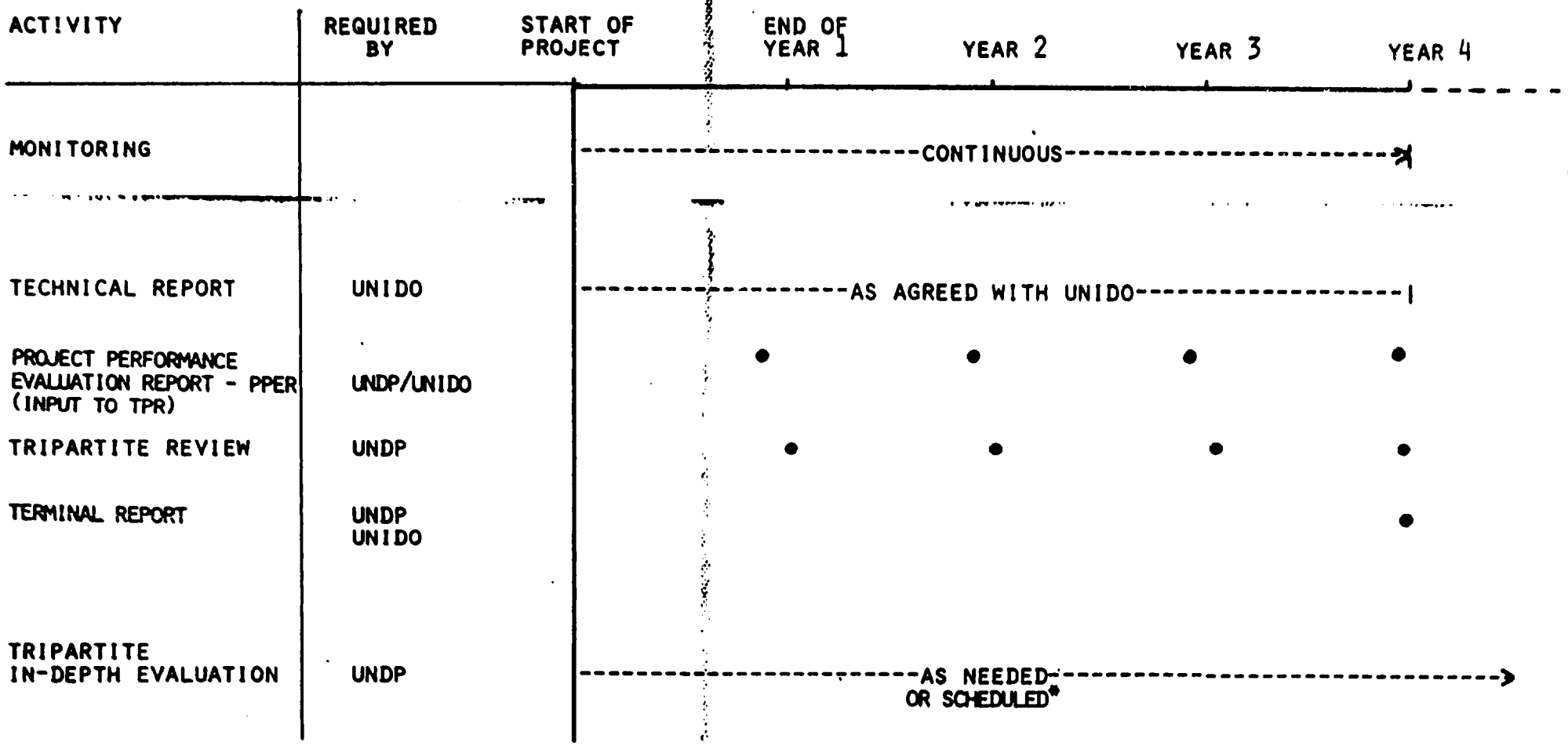
OVERLAP AND DIFFERENCES AMONG MONITORING, SELF-EVALUATION AND IN-DEPTH EVALUATION

PRINCIPAL AREAS OF FOCUS	PROJECT MONITORING	SELF-EVALUATION	TRIPARTITE IN-DEPTH EVALUATION
INPUT DELIVERY	X		
CRITICAL ASSUMPTIONS LINKING INPUTS TO ACTIVITIES	X		
PROGRESS/ACHIEVEMENT OF ACTIVITIES	X	X	
CRITICAL ASSUMPTIONS LINKING ACTIVITIES TO OUTPUTS	X	X	
PROGRESS/ACHIEVEMENT OF OUTPUTS	X	X	X
CRITICAL ASSUMPTIONS LINKING OUTPUTS TO PROJECT OBJECTIVE		X	X
PROGRESS/ACHIEVEMENT OF PROJECT (IMMEDIATE) OBJECTIVE		X	X
CRITICAL ASSUMPTIONS LINKING PROJECT OBJECTIVE TO DEVELOPMENT OBJECTIVE OR PROBLEM			X
CONTRIBUTION TO ACHIEVEMENT OF DEVELOPMENT OBJECTIVE OR SOLUTION OF PROBLEM			X

TRIPARTITE REVIEW IS THE MECHANISM FOR DISCUSSING FINDINGS OF ABOVE PROCESSES AND MAKING DECISIONS.

MONITORING/EVALUATION SCHEDULE (FOR PROJECTS OVER $400,000)

Annex C.
(UP)



*AT LEAST ONCE FOR PROJECTS OVER $1,000,000; MANDATORY IF PROJECT BUDGET REVISION EXCEEDS $100,000.

ANNEX D
(1)

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

W o r k i n g p a p e r

on

UNIDO Technical Assistance

to

INTEGRATED CHEMICAL INDUSTRY DEVELOPMENT

by

J.A.Kopytowski SIRA

Chemical Industries Branch
Department of Industrial Operation

Vienna ,May 1986

This document was issued without formal editing.

Annex D
(2)

TABLE OF CONTENTS:

Annex D
(3)

CHAPTER I. What is the Integrated Development Programme (Master Plan) for the chemical industry?

1. In the industrialization process the main question for the politicians, decision makers and industrial managers, is the future structure of the industry. The demand for industrially produced goods is growing steadily accordingly to the general increase of the GNP, income distribution, trends and fashions and patterns developed in other more industrialized countries etc. The natural trend is to build the national industry to cover the market demand and this issue does not depend very much on the economical system prevailing in the country.

2. In many developing countries the chemical industry is constructed as a result of import substitution policy. The thin layer of industrialization is covering the market of pharmaceuticals, detergents and soaps, paints and varnishes, dyes and inks, plastic appliances, rubber tyres and technical goods. On the other hand in countries where raw materials are available, mineral extraction and crude oil processing is developing to cover the local demand and for export.

3. The initial rates of that parachemical industry development may reach 8%-15% per year due to low capital cost of such projects, high value added of the operation, and easy access to the unsophisticated technology. At this stage backward integration of the chemical industry is extremly low and their operations have character of mixing, formulating and packing. That is creating strong pressure on the importation of the inputs for the processing industry. Also final goods for the resale are imported by the industrialists to cover the whole range of the demand.

4. Foreign investors are also participating willingly in that stage of industrial structure development. For them, new markets are created, and bulk chemical products from their factories are the inputs for the host country industry.

5. The dilemma for the decision makers is obvious: either curtail imports and keep idle or not fully use already existing national factories capacities, or to allow import of inputs free at the credit conditions.

Because the very limited number of countries have large scale revenues from exports,the only solution to keep the imports on a resonable for an economy level,is the imposition of import licences or other regulatory actions of the Governments.These regulations from the economical point of view are inefficient and statistically distributed over the branches,without specific priority,even if such was stated at the policy formulation stage.Natural reaction is to blame for the investment decisions and request for developeent of production of imported inputs.After new projects are implemented the situation is repeated at a higher level of value of inported raw materials and industrial inputs.Only when structure became rich and a lot of internal interlinkages were built to the national natural resources economical situation and balance of payments may be improved.

6.But construction of the modern structure of the industry requires technological know- how,licences,machinery and equipment which at the poor industrial structure cannot be produced inside the country.That is creating the new indebtness and permanent dependence on spare parts,maintenance and technology as well as product quality development to meet the requirements of foreign importers.Therefore investment decisions and project implementation are calling for coordinated and a well prepared plan.

7.Very often the master plan is interpreted as contradictory to the market economy principles.Avoiding the examples of the developed market economy countries or multinational companies which are preparing that kind of planning documentation,one can suggest to follow the reasoning of simple logic of necessary actions.What is to be prepared?The market study.Is the market study typical for any type of economical system? Of course yes;the only differences are the pattern functions,which in planned economies may be established as directive targets and in typical market economies as trend analysis results and restructuralization derivatives.Next the technological network should be built linking the raw materials available and products requested in the market study.Is the technological network of the chemical industry dependent on economy type?It looks like that it depends only on process availability and on the chemistry of the transformations which are fully independent of the economical systems.This network forms a model of the industry.

The last step in the project priority selection,is the analysis of the econometric optimisation model.This model is also independent of the economy type.Of course the targets of optimum solution may be different.One prefers the social benefit,the other will prefere the profit after taxes as the goal function.

Annex D
(5)

Some decision makers may prefer the balance of payment as optimized parameter,some others overall sales value.But methodology is allowing simulation of any variable or parameter change,to look into internal rules of network development.As a result of the master plan preparation,in the planned economy the investment allocations will be decided,and in market economy the economical instruments like taxes,duties,subsidies,credit facilities and conditions will be issued by the governing bodies,to motivate requested development direction.

8.The chemical industry,by its nature,is extremley interlinked by inputs and outputs.The natural resources,agricultural or mineral origin,are processed in long chains of technological lines crosslinked between themselves.Final consumer goods originating from the chemical industry are a small share of the total output of the chemical processing industry and at the developed structure of that industry consumers market production, does not contribute to more than 25% of the total turnover of the chemical industry.

9.The investment unit cost and total investment expenditures are growing when the process is nearer to the raw material than to the market.On the other hand,to make the production competitive to the imported supply,as a rule higher capacities are required when processing the agricultural and mineral resources than when market goods are produced.Therefore the chemical industry may be presented as a large scale network with very differentiated capital costs,energy consumption,manpower requirements and pollution potential of each element of the technological chains.

10.To generate such a network in an analytical way and to attach to each unit parameters of the production and investment cost,is not a very difficult task but it requires a very large data bank availibility which is rarely at the disposal of the governments of developing countries and their industrial development organizations.Normally this information is to be supplied by specialized consulting companies, or UNIDO itself. By using these data and having the market data on actual consumption and scientifically prepared forecasts of future demand,well correlated with the pattern of consumption and the general macroeconomical parameters such as a national economy growth rate,one can prepare the target situation of the given country structure of the chemical industry,taking into consideration the specific raw materials situation of a given economy.

Annex D
(6)

11.But this network description does still not represent the plan or development programme,however it is well integrated between the market demand and raw materials availibility.To distribute the available resources such as capital,manpower,energy,environment protection,among the network elements in the time at the particular goal function performance(like maximum added value or profit,or minimum imports costs),special procedure of project priority selection are required.And only when scientific methodology of structure optimum development in a Backward Integrated Programming is introduced to the project priority selection and specific parameters of economical policies are evaluated,than the master plan of the chemical industry development is created.

12.The described procedure may be applied not necesarily to the whole chemical industry.Moreover,to do that exercise for the whole chemical industry would be difficult and very often an unnecessary task.Very often decision makers are focusing their interest on a specific branch of the chemical industry,which in the obvious way is calling for the development.The reasons for such selective approach may be numerous,as specific raw materials situation of the country , some strategical concepts and policies,to mention only the most frequent ones. Therefore the branch master plans for the pharmaceutical, dyes,pesticides, soaps and detergents etc.are also and preferably executed,using the described approach.

13.The planning horizon for the preparation of the master plan should be selected depending on the intention of the decision maker.The following types of the planning activities can be covered by this methodology:

-restructuralization programme of the existing industry(to answer the question which units should be closed,which requests the modernization and scale enlargment,and which new technological elements are necessary to make the structure more resistant to external perturbations)..

-short and medium term plans of the developmet of the chemical industry(2-5 years,showing if the prepared decisions on the investment programme implementation are reasonably answering the strategic goals of the chemical industry.)

-long term development programmes (10-15 years,showing the preferable direction of growth in the specific technological areas and indicating on which chain research and engineering effort should be concentrated on.)

Annex D
(7)

14.Uncertainties and risks are incorporated in each master plan as in any other forecasting performance.However,in the methodology some safety valves are incorporated to indicate limits of risks and to show the reserve solutions.The most important uncertainties are:the raw material and product future prices,expected investment cost and foreign trade component of the master plan.

15.The network analysis is giving the opportunity to investigate not only the one selected price,but the chain of dependent prices(price of polymers depends very much on crude oil prices etc).Experiments are showing that change of raw material price in the long term are influencing all the prices along the technological chain and also have impact on investment costs.Therefore, solutions are to a large extent resistant to raw material price fluctuation.

16.The investment costs used in the model are taken from available resources at the same level of credibility,therefore the same impact of error may be expected on the all elements and their optional selection.

17.The national market study is much more easy to be prepared due to the smaller number of potential scenarios.The dominating difficulty is the determination of the export component of the plan.Here the international situation of the given branch of the chemical industry in the region and continent, and sometimes the world overview should be prepared.Even the studies are carried out,the risk still is high because it is not known what decisions will be taken by other operators and decision makers.Therefore for developing countries in specific cases the regional branch master plans for selected branches of the chemical industry are advisable eg.plastics production,bulk pharmaceuticals production,additives and catalyst production etc.to avoid unnecessary duplication and waste of human resources.

Annex D
(8)

CHAPTER II. Why to Prepare a Master Plan?

18.After reaching certain level of technical capability responsible organizations in developing countries are looking for the methodology of optimization of their development programmes.At some level of sophistication of industrial structure in the chemical industry,it is more important to investigate all options of future needs and their correlation with production potential,than to develop and implement "any attractive" programme in a given industrial branch.The internationalization and global character of many chemical branches of industries,like crude oil processing,petrochemistry,and even pharmaceutical bulk procuction,is one of the main reasons why the concept of preparation of the optimal master plans is quickly spreading out over many groups of decision makers in developing countries.An integrated development programme is a powerful tool in the hands of the decision makers on project priority selection.

19.The task of master plan preparation ,which is a kind of intermediate level of economical analysis,is to answer following questions:

-what are tha market options:internal and external for the whole production profile of the chemical industry(not for one product)?

-which production structure may assure the consumption priorities?

-what is overall efficiency of an industrial branch in micro-and macroeconomical terms?

-which industrial structure may improve the macroeconomical variables of the national economy?

-is the flow of raw materials available?

-are the energy,manpower and capital resources adequate for development of a given industrial structure?

-which time distribution of capital spendings is the most suitable for development efficiency and which order of investment is preferable?

-which individual projects should be considered for feasibility studies preparation?

20.The selection of the project priority,is a result of the decision making process in which two levels of economical parameters are considered(Fig. 2). The macrolevel evaluates variables for a development process and is trying to formulate economical parameters for industrialization processes (taxes,duties, credit facilities,rates of exchange,rates of interest etc.)The microlevel is trying to correlate these parameters to individual potential project outputs and select the "priority" projects from the portfolio.

21.Very few companies and governmental planning organizations have large project portfolios in the stage of prefeasibility,or feasibility studies.Very few can afford the preparation of numerous feasibility studies in a short period of time and at random selection.Therefore,sometimes they are choosing the first implementable project(from the market and economical feasibility point of view).In a case when the industrial structure is very rich,this concept may serve its purpose,because in fact only innovations are looking for a place in the investment portfolio,and new products are trying to appeal to the consumers vision.

But when an industrial structure is very poor,what is the case of the developing countries,when macrolveel can not define parameters which are compatibile with all policy goals, then decision maker is trying to repeat the policies of others,originating from very different economical enviroment.At the same time,thin project protfolios may not give the proper answer on project priorities ar against the established strategic goals like food production,housing and accommodation,specialized exports etc.

Many developing countries,and others as well,are in that position.

22.This creates the needs for some intermediate economical type of analysis in the decision making process,allowing correlation of the strategic goals from macrolevel with project priority selection on the microeconomical level.The master plan of the development of the chemical industry is the answer to such intermediate level economical analysis.

CHAPTER III.Why and When to Seek the UNIDO Assistance?

23.UNIDO,acting as a large scale international consulting body,has a priviledged position on the following aspects of master plan preparation:

-it has at its disposal,large quantities of data collected from previous projects concerned with similar technologies or investment concepts;

-it has at its disposal an international group of high quality experts which acting under the supervision and on the basis of neutral instruction.In this case consultants do not represent any foreign interests and are serving the purpose of the project;

-the overhead costs of UNIDO are many times lower than that of any consulting or engineering company;

Annex D
(10)

-the unified methodology applied allows the assurance of a high standard of services,and at the same time takes into account the specific situation of the national economy;
-training of the national staff at workshops and seminars and in the"learning by doing exercises"is leaving in their hands the final decisions on the projects priority selection,which assures the souvereignity of the decision-making process;
-computerisation of the methodology makes its application easy and flexible;
-selected hardware and software gives the possibility of revisions of the plans and updating of the data banks;
-a strong link to the further project feasibility evaluation of UNIDO methodology is being kept.

24.UNIDO is ready to meet the requests of governmental bodies,parastatal organizations and companies interested in the application of master plan preparation methodology.When starting to prepare long term plans or preparing the decisions on backward integration of an existing industry or its restructuralization,responsible managers may contact UNIDO for a project formulation mission.

25.Financial resources for the master plan preparation are of the same origin as in all technical assistance UNIDO programmes:
-country programme funds;
-trust funds of countries and organizations;
-bilateral donor funds;
-joint UNIDO-Country Programmes;

CHAPTER IV.Who can Benefit?

26.Recipients of UNIDO technical assistance first of all are the member countries but also could be other developing countries.The most efficient assistance may be given for the countries which have already developed to a certain extent the parachemical industry and are looking for further backward integration and have many constraints on capital spendings,human resources,energy resources and on industrial pollution.

Annex D
(11)

27.Ministries of Planning and Plannig Bodies in the Ministries of Industry,and parastatal organizations like Industrial Development Corporations (Organizations) are the first who can benefit from implementation of the master plan preparation.Also large-scale companies with complex structures,like petrochemical integrated companies,may use the services to establish the development programme and select the projects for feasibility studies.Medium size companies which are also looking for independence from the foreign suppliers of raw materials and wish to establish bulk production of the pharmaceuticals ,textile additives,dyes and inks,and polymeric resins,may benefit in the project prefeasibility evaluation by application of master plan methodology.In some cases also National Industrial Development Banks may use UNIDO services for the evaluation of project portfolios proposed by the investors to select the order of project implementation in certain branches of the chemical industries.

Annex D
(19)

CHAPTER V. TERMS OF REFERENCE FOR MASTER PLAN PREPARATION .

1. Interactive economic decision making model.

The model is built as a multi-element system of technological units and the flow of inputs (raw materials like minerals or agricultural products) is converted into outputs (consumer goods or final industrial inputs). Each technological unit, which belongs to the conversion chain, contributes to the system with some part of added value or profit, using raw materials, energy, labour and capital. The mono- and multi-criteria optimization of the established production goal functions enables simulation of sectoral development and analysis of the best choice options. Monetary, as well as physical measures, are used. An applied model is also enases in establishment of macroeconomical parameters, like shadow prices for intermediate products and maximum investment costs allowed to be spent at on certain level of economic efficiency of the network.

The practical application of the model requires computerisation of the system and the following operational modules should be implemented:

1) module of data base operation
2) module of data processing (network construction and balance of flows)
3) module of linear programming optimization-simulation procedures.
4) module of post optimal analysis

2. Data and measures.

In order to construct a model and the respective modules, the means of identifying not only the variables and parameters of the model, but also its constraints and objective function, should be established.

Three distinct types of values have been choosen to characterize a specific technological process or group of processes: natural resource requirements, technological parameters and secondary (integrated) parameters.
The first group reflects the requirements of a process for natural resources such as water, energy, land, materials and manpower, the availibility of which determines whether a given process is feasible in a particular environment. These factors have an important effect on the economic efficiency of the process.

Resource requirements reflect two distinct phases of industrial activity, namely the construction (or project implementation phase), and normal operation.

Included in the second group of values, are the technological parameters. These cover the total consumption of raw materials, the level of output of final products, production capacities and the kinetic and thermodynamic parameters of the production process.

The third group of values are the secondary or integral parameters of the process, which can only be determined by combination and transformation of the data from the previous two groups of parameters. These are coefficients and the consumption figures of material and energy per unit output, the productivity of labour, investment increments and equations and efficiency of the process. Their linkages to the economic feasibility evaluation parameters are very straight, and the process of selection of the project priorities is carried out mostly using these integral parameters. The list of variables and parameters used in the problem solving process is given at Annex 1.

3.General Model of the Technological Network.(Production Distribution Area-PDA)

We refer to the chemical industry as being divided into a number of subsectors each dealing with a group of closely technologically related chemical products. These subsectors are called Production Distribution Areas (PDA), because they basically comprise a network of production processes and principles of distribution flow to different markets. The PDAs are linked to each other and also to other industrial sectors through the market (buying and selling process). PDAs are also supposed to process inputs to certain profile of outputs, as required by the demand-supply balance using specific technological processing units called Network Elements.

Therefore, a general model of a PDA must take into account the following functions:

- -the processing and flow of inputs within the PDA;
- -the flow of outputs and inputs of PDA, linking it to other PDAs and to other chemical industry subsectors or to other subsectors and sectors of national and foreign economies;
- -the flow of other intensive and extensive means, necessary to process inputs into outputs such as capital, other resources like energy, a manpower etc.

The model of the network module is given in its basic form, so that its structure may be more easily understood. However, the complexity of the full computer implementation should not be underestimated.

Firstly the external links of the PDA should be defined. The basic equation describing the flow of any product from and to a PDA is described by a simple balance equation(Fig.3):

$$y_j = y_j^{ms} - y_j^{mp} + y_j^{cs} - y_j^{cp} \qquad j \in J$$

where:

y_j^{ms} - sales (market demand) of chemical product "j"

y_j^{mp} - purchases (demand of a PDA) of chemical product "j"

y_j^{cs} - coordinated supply (sales) of chemical product "j"

y_j^{cp} - coordinated purchases (by a PDA) of chemical product "j"

At a first glimpse, coordinated sales and purchases are not different from the marketed products. This concept of coordinated trade was introduced to make definite linkages between the PDAs,when larger networks should be built after preliminary analysis of the smaller ones.This makes it possible, in the operational sense to achieve some form of inter-PDA coordination without giving open insight into the selection of the projects in separated PDAs.This is important when methodology is applied in the competitive market and results of runs are confidential.

Resources other than basic chemical products (raw materials) which are required for the functioning of the PDAs, are denoted by "q" and include other industrial materials, capital expenditures, water, energy, a manpower needs etc.

All data included in a PDA model allow the formulation of performance requirements of a PDA on the basis of a strategy or policy adopted during the simulation run. However initially no parameter in the PDA model has a primary dominating role; all are equal for further evaluation procedures.

At this stage, it is now possible to look at the form of the production/distribution network from the interior. The PDA network (model) is formed by two types of elements:

-process elements,which represent the chemical processing procedure;

-balance nodes,which represent the total flow of any chemical product.

"j" denotes the set of indices describingthe chemical processes taking place in the PDA under consideration.The way in which the network is constructed ensures that all the conditions related tothe links to and from the environment are taken into account, regardless of the number of elements and balance nodes.

Let us consider a process element (one technological unit) PE_k ($k \in J$).(Fig. 4)

The variables used to describe the process elements may be defined as follows:

z_k - production level of PE_k

z_k - production capacity of PE_k

$a_{jk}\ z_k$ - quantity of chemical product "j" consumed by PE_k

$b_{jk}\ z_k$ - quantity of chemical "j" produced by PE_k

$q_k(z_k)$- consumption of necessary intensive resources

For each balance node, the following balance equationcan be written:

$$y_j = x_j^+ - x_j^-$$

For each chemical product "j" where:

y_j - total output of "j" from PDA

x_j^+- total production of "j" inside PDA $\quad x_j^+ = \sum b_{jk}\ z_k \quad j \in J$

x_j^- total consumption of "j" inside PDA $\quad x_j^- = \sum a_{jk}\ z_k \quad j \in J$

The network is constructed from process elements and balance nodes in a way which reflects all the technological interconnections present in the system,and all process elements are linked together by balance nodes.

Subetitution and combination of the balance equations lead to network description equation:

$$y^{BS} - y^{BP} + y^{CS} - y^{CP} = (B-A) \times Z$$

Where:

B,A - matrix of consumption coefficients of chemical product "j" in "k" processes of"Z"capacity.

This type of model allows the inclusion of all alternative technologies in the network leading to the same final product, recycling of by-products, coupled production of a given number of chemicals in one plant etc.

This model provides us with the basis for formulating the decision-making problems concerned with the efficient alternative structures of PDA and project priority selection.

5.Optimization model and simulation procedure.

It should be emphasized that the problem of choosing the most appropriate industrial structure, given the availibility of technologies, resources and product demanducts, from the mathematical point of view, cannot be formulated as a linear single-criterion problem, mathematically speaking.

First of all, performance variables and criteria for large-scale systems may be measured in monetary terms but very often it is necessary to use physical units or other non-addition measures.Therefore the optimization problem for network evaluation, has to be defined in the form of a multi-objective optimization problem.The next complication is the non-linearity of some variables describing the network performance. The most non-linear parameter is the investment increment (unit investment cost). Therefore minimization of the production cost, which includes operation cost, depreciation and other capital cost components, should be made using the non-linear optimization algorythms. The search for an optimum solution in such systems depends to large extent on the concepts of feasibility of the decision-maker, but an overall optimum could only be achieved in the case where the problem epigraph is concave,not convex. In the case of non-linear solutions including operational and capital costs for large- scale technological networks it is difficult to prove that an epigraph is not convex, and therefore a theoretical doubt arises concerning the overall optimum solution selection.

These constraints in problem formulation impose difficulties in mathematical treatment, and this may disadvantge limits the decision-maker's participation in the process of project priority selection. Therefore to make it operational for any size of technological network, and controllable during the simulation-decomposition procedure of the problem,it is necessary to introduce some simplification without changing accuracy of the solution. A large scale non-linear system can be decomposed in such a way that each aspect of system performance may be evaluated separately. This leads to an heuristic approach using a parametrisation study via a linear programming approach, by exclusion of the capital cost from the overall cost evaluation. The capital investment cost and its derivatives will be used as a criterion or constraint.A comparison of the approaches has been investigated in practical cases and this has shown that marginal difference in accuracy of solutions is not higher than 2%-3%. Therefore a feasible decomposition of the problem leads to an optimum solution with such a range of error which is still lower than the accuracy of data used in network definition and description.But simplification of problem formulation makes the solution search a multi-step exercise. In the particular case of the optimization of the industrial structure, the mono-criteria approach is transformed into a multi- criteria problem by investigation of the relevant states of the model in the criteria space.

Annex D
[17]

Each state of the model represents a particular subset of available technologies, together with a particular level of technology utilization. We are interested in those states which belong to the so-called Pareto-optimal set in criteria space. The concept of a Pareto optimal set is illustrated in Fig.5.This figure shows the set of states (combinations of structure of network elements) which can be attained under the conditions and constraints specified in the model.It should be noted that these states are specified here in terms of criteria Q_1 and Q_2 which could be profits (social benefif or other form of efficiency parameter $Q_1 \rightarrow max$) and investment costs ($Q_2 \rightarrow min$), respectively, in classical minimax problems. The Pareto optimal set comprises those attainable states for which an improvement in the value of one of the criteria automatically leads to the deterioration in the value of the other. This set therefore represents in a sense the best feasible compromise soultion, and the quest for a satisfactory concordance between technologies and resources becomes an analysis of bi- or tri-parameter relations. The search for the optimum compromises, in multi-criterion cases may also be algortythmised and computerised.

The resulting linear programming (LP) problem established for analysis of a technological network may be presented, as follows:

maximize	$c^T x$
with relation to	$Ax=b$
and	$0 \leqslant l \leqslant x \leqslant u$
where	$c,x,l,u,b \in R^n$ and

$\dim A=(n,m)$ when $n \geqslant m$.

For our purposes the symbols are denoted as:

x-denotes variables of chemical product flows and production outputs,

c-denotes evaluation in terms of output and inputs(prices and costs),

A-denotes full balance of resources,

b-denotes the constraint on resources,

l,u,-denotes upper and lower levels of the supply-demand system defined in the development scenario.

The main criteria inserted in the model consider the possible interchange of roles from constraint to a objective.They may be analysed as physical measures or in monetary evaluation terms as extensive parameters (the total consumption of network):

-energy
-manpower
-investment cost
-raw materials consumption
-enviroment protection and pollution control(impacts or costs)
-sales
-social benefit
-profit etc.

In the case where the decision-maker wishes to know how much output he may expect from limited inputs, which can be allocated,then the most common performance measure is the ratio analysis. The extensive parameters may be transformed into intensive type ratios of :

Efficiency/investment cost;
Efficiency/energy consumption;
Efficiency/labour cost, etc.

Ratios are also equivalent in reverse relations, from the mathematical point of view, and they may be inserted as objectives in the optimization run. Ratio performance measures may also be used as a basis for the comparision of various structures selected from the network, as well as to compare different PDA.

It is thus easy to understand how the simulation run procedure will lead the decision-maker to understand the properties of the technological complex network performance and options for possible solutions at given constraints or opportunities.

6.Simulation of the development process.

The most important feature of the Integrated Development Programming is the participation of the decision maker in the programme formulation. In other "classical planning" exercises, programmes are prepared by consultants or experts and submitted for approval or rejection.In our case decision maker creativly participates in the structure definition and optimization of resource-benefits relation selection.

What can the decision maker expect from this methodology? As already stated, the approach to the decision problem should be interactive, which means that the decision maker is able to experiment directly with the model, learn from the results,and tailor his expectations and solutions accordingly.

In terms of overall development strategy, the decision maker may expect to obtain results relating to system design if the whole interactive process is well embedded in the management system responsible for the development of the industry.

What are decision making options during the simulation procedure?

A decision maker has to decide on the composition of the PDA network. The main feature of the network is that it contains a finite repertoire of possibilities, described in terms of parameters, technologies. The decision-maker can experiment with various combinations of technologies within the finite repertoire of possibilities. The options of decision-maker include the consideration of critical resources, technology and auxiliary constraints. These three categories are not specified formally in the model but are defined by the decision maker during the formulation of the decision problem. Critical resources are those which are seen by the decision maker as being particulary scarce or difficult to obtain. In practice, the set of critical resources is also the set of criteria in the optimization model, since the optimal solution is to be found with respect to all critical resources. Technological constraints are easily identified and are related to factors such as whether a resource is treated as critical or not, which depends on the formulation of the decision problem. In fact, a resource can be moved from one category to the other by the decision-maker and this makes the analysis much more flexible in relation to the real situation.

All the constraints are taken to be criteria in the phased linear programming solutions. Thus, monotonic (structurally defined) results may be obtained for each constraint separately (within the range of its activity), assuming all other constraints are stabilized at some level. The consequence of such a possibility of unrestricted (or "limited" restricted) level of resource availibility, is an investigation and optimization of the model of a PDA to maximum earnings (profits or other benefits). Results produced represent ones the best possible outcome for the full range of technological repertoires at certain levels of constraints.

The next problem will be to compare the set of different unconstrained and constrained solutions within the range of criteria. A decision-maker who wishes to make an assessment of a PDA performance will turn automatically to its input- output relations. The most common performance measure is the ratio of some inputs to ouputs.

A number of such performance ratios may be formulated using different critical resources, providing the decision maker with a range of information on the intensive properties of the model structure.Performance measures may be also used as a basis for comparision of various structures within the repertiore of a given PDA or between different PDAs.

This leads to the possibility of formulating the decision problem as a minimax problem based on performance ratios or their functions of extensive parameters. The development of performance ratio analysis and the utilization of the Pareto approach in the selection of compromise solutions leads to a post-optimal analysis. Then several comparable solutions are selected from different constraint simulation runs, which should be analyzed from the point of view of feasible structure. The final selection of the "best" in the given enviroment solution is therefore a result of search after concordance between resources and benefits, taking into consideration the physical state of the technological industry structure, as well as the optional sequence of the programme realization at given stages of resource availibility.

Annex D
(31)

VI.REFERENCES .

1. Borek A.,Dobrowolski G.,Zebrowski M.,"GSOS_-a growth strategy optimization system for the chemical industry".Advances in Measurement and Control- MECO -78 Vol.3 p.1128-1131 (1978) Acta Press.

2. Sophos A.,Rotstein E.,"Thermodynamical bounds and the selection of technologies in the petrochemical industry".Chemical Engineering Science.Vol 35 p.1049-1065,(1980) Pergamon Press Ltd.

3. Gorecki H., Dobrowolski G., Kopytowski J., Zebrowski M.,"The quest for a concordance between technologies and resources as a multiobjective decision process".Multiobjective and Stochastic Optimization.Collaborative proceedings CP-82-S12(1982).IIASA,Laxenburg.

4. Jimnez A.,Rudd D.F.,"A study of the development of a mexican petrochemical industry" Computers and Chemical Engineering Vol.6 N3 p.219-229(1982) Pergamon Press Ltd.

5. Lu C.Y.,Wiesman J.,"Close approximations of global optima of process design problems".Ind.Eng.Chem.Process Des Dev. Vol.22 p.391-396 (1983) American Chemical Society.

6. Dobrowolski G.,Kopytowski j., Wojtania J., Zebrowski M.,"Alternative routes from fossil resources to chemical feedstocks"Research Report RR-84-19 (1984) IIASA,Laxenburg.

INDUSTRIAL DEVELOPMENT CYCLE

RESEARCH	2 - 10 YEARS
DESIGN AND ENGINEERING	2 - 5 YEARS
INVESTMENT IMPLEMENTATION	1 - 5 YEARS
PLANT OPERATION	3 - 15 YEARS
TOTAL CYCLE	8 - 35 YEARS

Annex D
(33)

INVESTMENT PROJECTS TYPOLOGY

NEW INVESTMENT (GREEN GRAS)

QUANTITATIVE OUTPUT INCREASE

ADDITIONS TO THE PRODUCTION PROGRAMME

PRODUCT QUALITY IMPROVEMENT

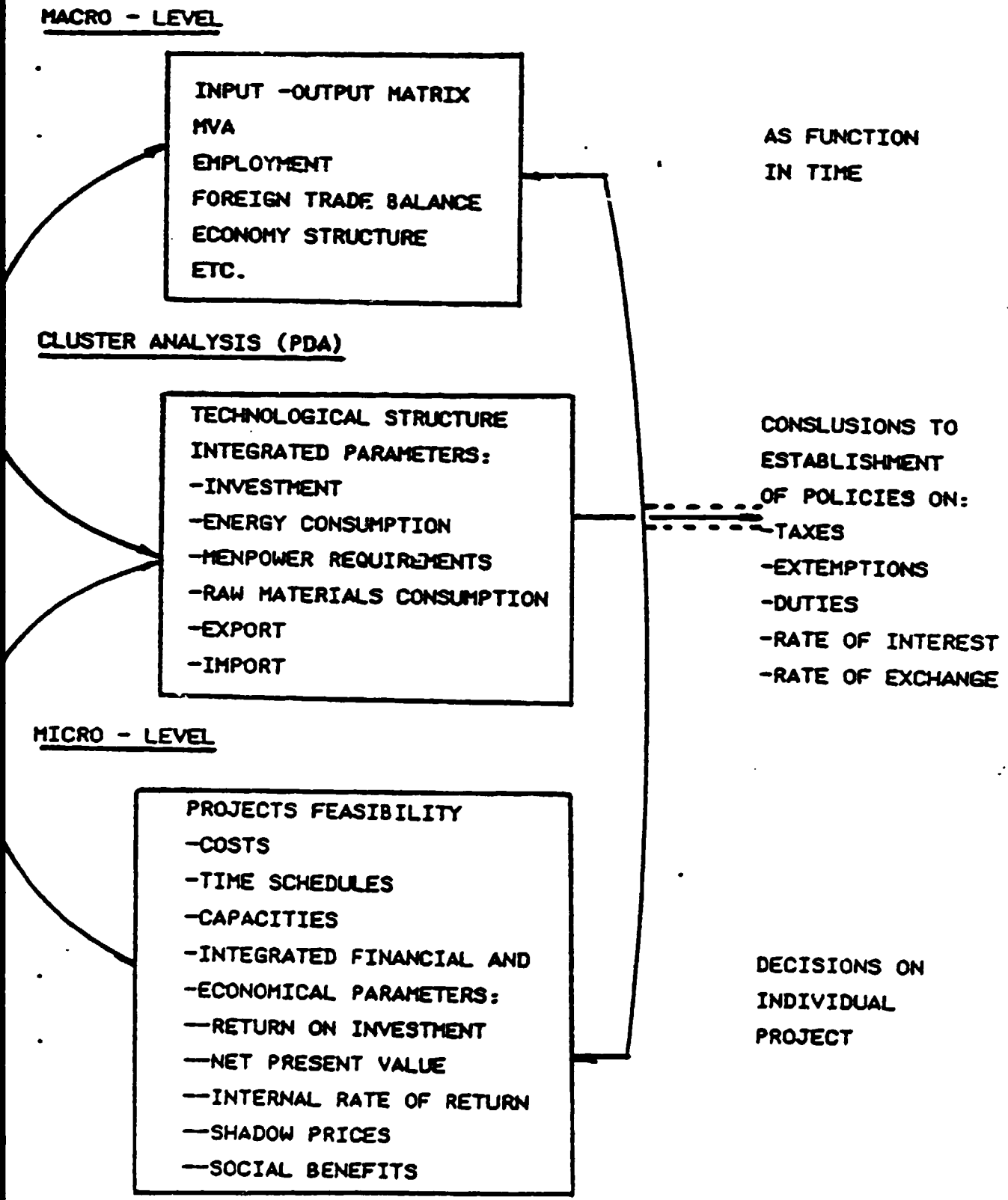
UP-DATING TECHNOLOGY

UP-DATING EQUIPMENT

AUTOMATION AND ROBOTIZATION OF THE PROCESS

Annex D
(24)

PARAMETRIZATION OF ECONOMY ON
DIFFERENT LEVELS OF PLANNING PROCESS



Annex D
(25)

METHODOLOGICAL APPROACH

GOALS

DESIGN OF DEVELOPMENT STRATEGY
PROGRAMMING OF DEVELOPMENT
CONTROL OF INDUSTRIAL STRUCTURE DEVELOPMENT

BY

DECISION MAKING PROCESS

ON DELIMITED AREA OF INDUSTRIAL STRUCTURE (PDA)

INSPIRED BY

DEVELOPMENT THESIS

Annex D
(26)

WHAT IS INSIDPENSABLE ?

DECISION MAKER

-CAST IN ACTIVE PART OF DRAMA

MODEL

-MAPPING INDUSTRY TO HELP DECISION
-MAKER IN CONVERSION DEVELOPMENT
-THESIS INTO STRATEGY

METHODOLOGY FOR

-IDENTIFICATION(LEARNING STRUCTURE FEATURES'
-GENERATION OF THE ALTERNATIVES
-VERIFICATION OF DEVELOPMENT THESIS
-POINTING AT ACCEPTABLE STRATEGY AND
-CORRESPONDING ECONOMICAL INSTRUMENTATION

Annex D
(37)

TOWARDS FORMAL PRESENTATION OF PDA

DEFINITION

-PRODUCTION - DISRIBUTION AREA

COMPONENTS

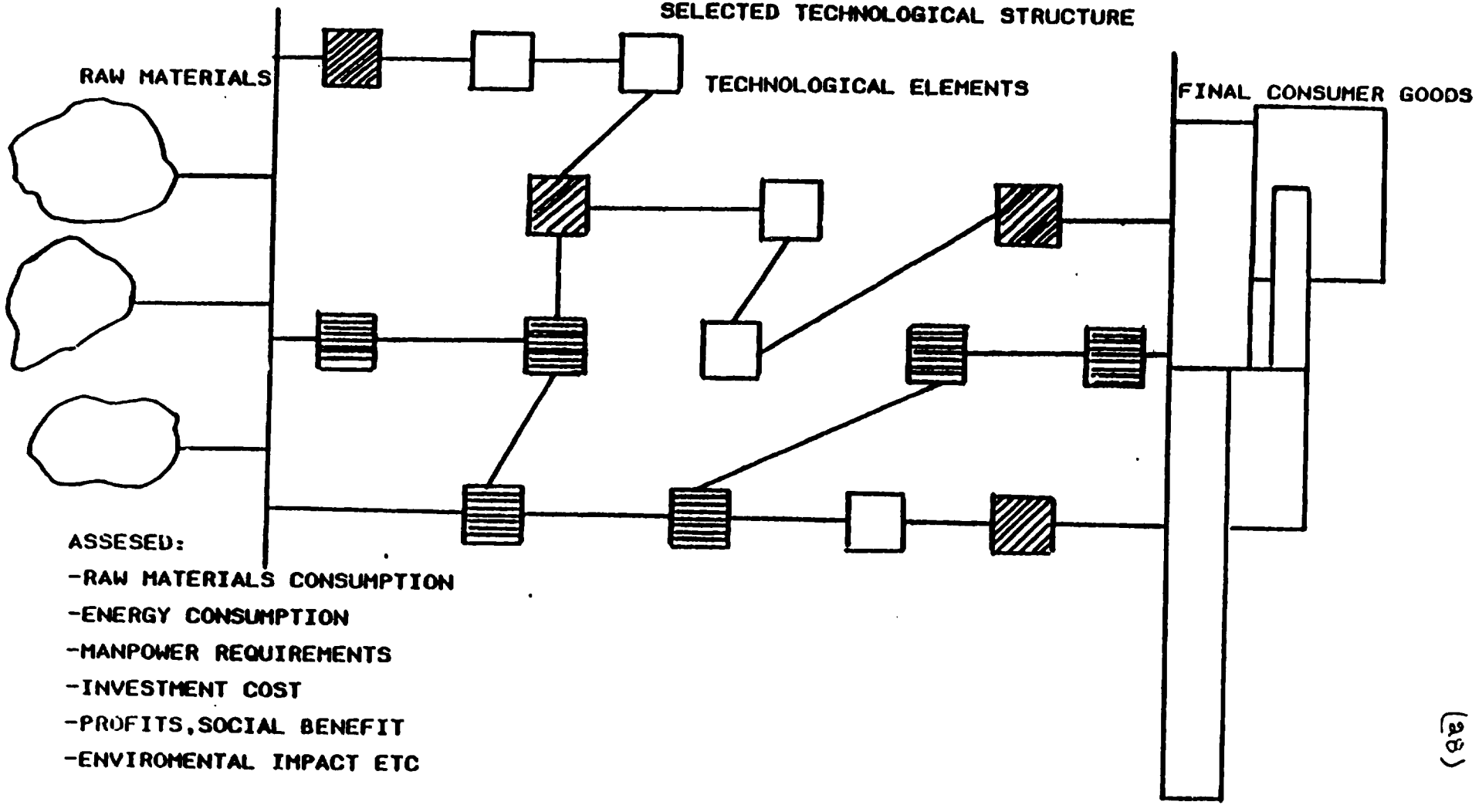
-CHEMICAL PRODUCTS AND THEIR FLOWS
-CHEMICAL INDUSTRIAL TRANSFORMATIONS
-OTHER INPUTS (RESOURCES,SERVICES AND UTILITIES)

PHENOMENA

-CHEMICALS CAN EITHER BE EXTERNAL INPUT OR CAN BE
-PRODUCED THROUGH THE NUMBER OF THE TRANSFORMATIONS INTERNALLY
-CHEMICALS TRANSFORMATIONS ARE RUN ON CHEMICAL INSTALLATIONS
-STRUCTURE OF INSTALLATIONS IS VERY DIVERSIFIED (ONE LINE-ONE PRODUCT OR MULTIPURPOSE BATCH PLANTS)
-CHEMICAL PRODUCTS AND RESOURCES VIA FLOWS CAN BE EXCHANGED WITH ENVIROMENT (EXTERNAL LINK ON THE OUTPUTS).
-PRODUCTION STRUCTURE IS CHANGING ALONG THE OBJECTIVE STRATEGY (NOT ASSUMED OR APPARENT)

TIME STATUS

-DISCRETE
(TO EMPHASIS STRUCTURAL AND FLOWS CHANGES)


SELECTED TECHNOLOGICAL STRUCTURE
RAW MATERIALS
TECHNOLOGICAL ELEMENTS
FINAL CONSUMER GOODS
ASSESED:
-RAW MATERIALS CONSUMPTION
-ENERGY CONSUMPTION
-MANPOWER REQUIREMENTS
-INVESTMENT COST
-PROFITS,SOCIAL BENEFIT
-ENVIROMENTAL IMPACT ETC

Annex D
(a8)

Annex D
(29)

BASIC RULES AND ASSUMPTIONS OF PDA MODEL

BIPARTITE GRAPH OF TWO TYPE ELEMENTS:

- -BALANCE NODES REPRESENTING CONSERVATION RULE OF CHEMICALS FLOW
- -PROCESS ELEMENTS REPRESENT CHEMICAL TRANSFORMATION OF SALABLE CHEMICALS INTO OTHER SALABLE CHEMICALS (ONE - LINE OR MULTIPURPOSE MODE)

INTERACTION WITH ENVIROMENT: (MAY BE SUBJECT TO CONSTRAINTS)

- -INPUT/OUTPUT FLOWS OF CHEMICAL PRODUCTS ARE CONNECTED TO NODES
- -FLOWS OF OTHER RESOURCES ARE CONNECTED TO PROCESSES

TRANSITION IN PROCESS ELEMENTS IS DESCRIBED IN THE TERMS OF TECHNOLOGY:

- -YIELD/CONSUMPTION COEFFICIENTS
- -CAPACITY AND ITS LEVEL OF UTILIZATION
- -RESOURCES CONSUMPTION COEFFICIENTS OR EXTENSIVE VOLUMES (INVESTMENT COSTS, ENVIROMENT PROTECTION COST ETC.)

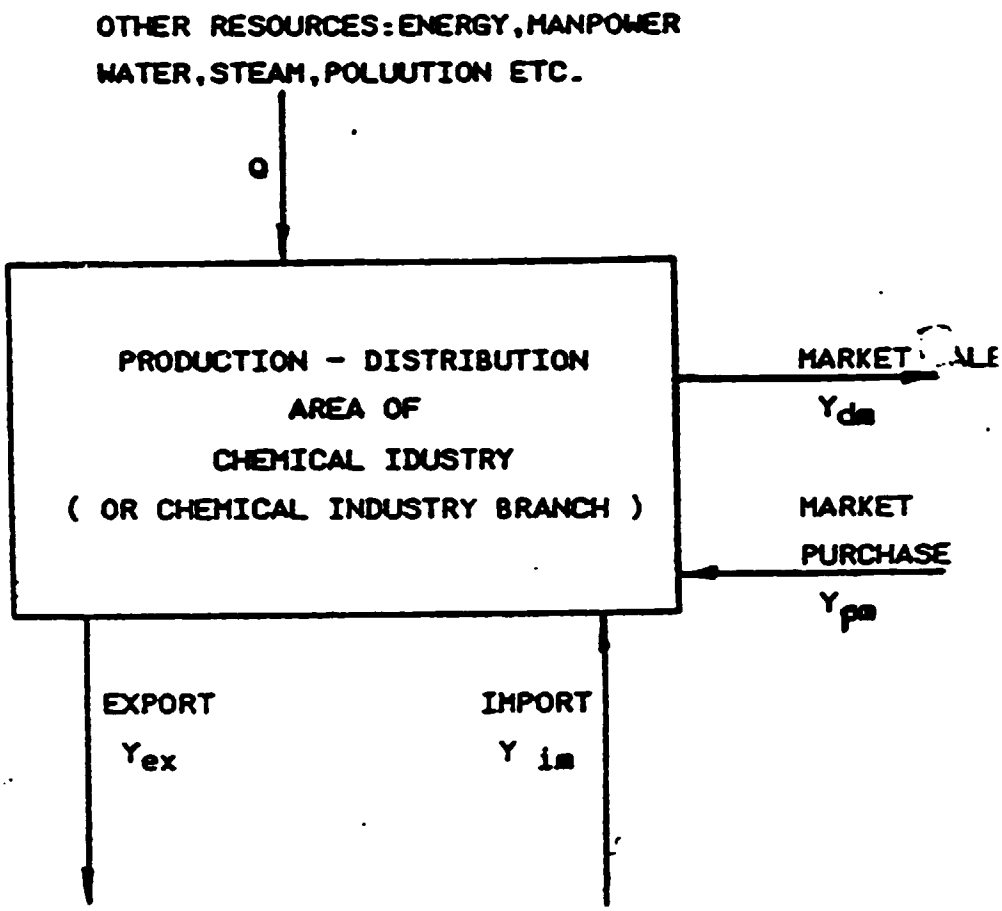
INTERFERENCE OF ENVIROMENT EVALUATION:

- -TERMS OF TRADE (PRICES)
- -AMOUNT (FLOWS RISKS)

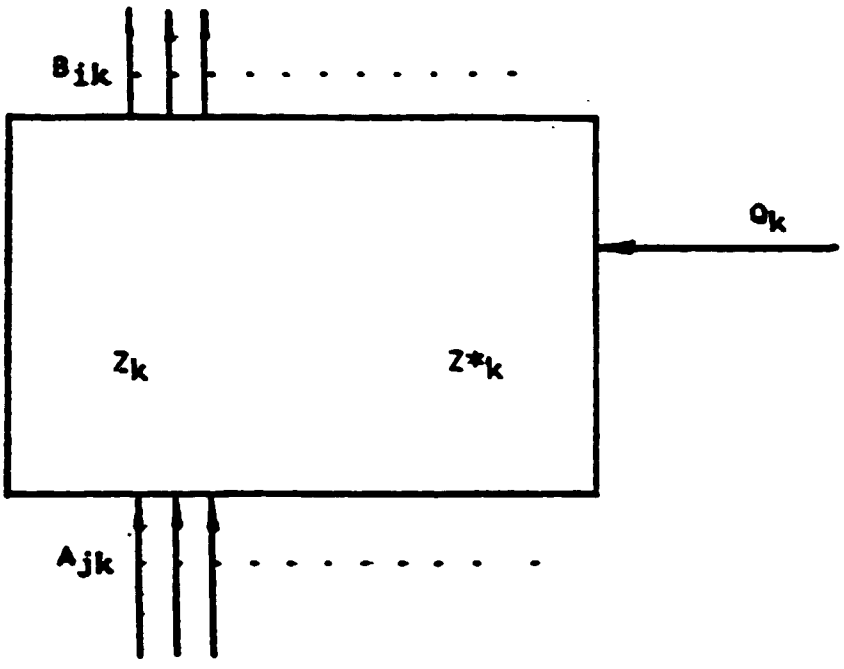
LINEARIZATION OF THE PROBLEM

- -TRANSFORMATION OF THE NON-LINEAR COMPONENTS INTO LINEAR BY TIME OR QUANTITY LIMITS

Annex D
(30)


OTHER RESOURCES: ENERGY, MANPOWER
WATER, STEAM, POLUUTION ETC.
Q
PRODUCTION - DISTRIBUTION
AREA OF
CHEMICAL IDUSTRY
(OR CHEMICAL INDUSTRY BRANCH)
MARKET SALE
Y_{dm}
MARKET
PURCHASE
Y_{pm}
EXPORT
Y_{ex}
IMPORT
Y_{im}

PROCESS ELEMENT (PE_k)



WHERE:

Z_k - VARIABLE DESCRIBING PRODUCTION LEVEL OF PE_k

Z^*_k - PRODUCTION CAPACITY OF PE_k

$A_{jk}Z_k$ - QUANTITY OF PRODUCT j CONSUMED BY PE_k

$B_{ik}Z_k$ - QUANTITY OF PRODUCT i MADE IN PE_k

Q_kZ_k - OTHER RESOURCES CONSUMED BY PE_k

TOTAL PRODUCTION OF PRODUCT j:

$$X_j^+ = \text{SIGMA on k } B_{jk} Z_k \quad \text{AT j J}$$

TOTAL TECHNOLOGICAL CONSUMPTION OF PRODUCT j:

$$X_j^- = \text{SIGMA on k } A_{jk} Z_k \quad \text{AT j J}$$

BALANCE EQUATIONS OF PDA:

$$Y^{ex} - Y^{im} + Y^{dm} - Y^{ds} = (B - A)Z$$

$$Q = \text{SIGMA on k } Q_k Z_k$$

Annex D
(32)

DEVELOPMENT THESIS

COMPOSITION OF PDA
- -INITIAL RAW MATERIALS
- -FINAL PRODUCTS VECTOR
- -TECHNOLOGICAL FEATURES (ADVANCED,STABLE,PRIMITIVE UNIQUE,MULTIPLE)

LEVEL OF DEMAND FOR PRODUCTION VECTOR
- -MARKET STUDY
- -PROJECTIONS OF DEMAND CORRELATED WITH MACROECONIMICAL PARAMETERS OF COUNTRY DEVELOPMENT
- -EXPORT OPPORTUNITIES
- -ALLOWED RISK COEFFICIENT(NONHARMFULL ERROR)

GOAL FUNCTION OF THE ANALYSIS
- -MAXIMUM PRODUCTION OUTPUT (SALES)
- -MINIMUM INVESTMENT EXPENDITURES
- -MINIMUM RAW MATERIALS OR ENERGY CONSUMPTION
- -EFFICIENCY OF OPERATION

(MONO- OR MULTI- GOAL IDENTIFICATION)

CONSTRAINTS OF THE DEVELOPMENT
- -INVESTMENT EXPENDITURES
- -ENERGY CONSUMPTION
- -RAW MATERIALS CONSUMPTION
- -HUMAN RESOURCES AND SERVICES
- -ENVIROMENT RESTRICTIONS

STRUCTURAL PREFERENCES
- -SELF-RELIANCE
- -OPEN TRADE
- -MIXED PREFERENCES AT GIVEN DEMAND VECTOR

Annex 5

CLASSIFICATION OF THE PARAMETERS AND VARIABLES IN THE PDA MODEL

EXTERNAL INPUTS TO THE MODEL

- -DEMAND OF THE FINAL CONSUMERS GOODS RELATED TO THE
- -MACROECONOMICAL PARAMETERS (BASIC AND PROJECTIONS)
- -EXPORT - IMPORT DATA
- -LOCAL PRODUCTION ENCYCLOPEDIAE
- -BASIC RAW MATERIALS AVAILIBILITY
- -INDUSTRIAL INFRASTRUCTURE IDENTIFICATION
- -TECHNOLOGICAL NETWORK
- -CONVERSION FACTORS(CONSUMPTION COEFFICIENTS)
- -"OPTIMAL" CAPACITIES OF THE TECHNOLOGICAL UNITS
- -TECHNOLOGICAL PROFILES OF PROCESS ELEMENTS

SIMULATION EXPERIMENTS EXTERNAL DATA

GLOBAL RESOURCES AVAILIBILITY (GUESS)

- -INVESTMENT CAPITAL
- -ENERGY
- -MENPOWER
- -FOREIGN EXCHANGE
- -ENVIROMENT PROTECTION

SIMULATION GOALS

- -EFFICIENCY
- -RATIOS

SPECIAL MODEL APPLICATION

NETWORK PRICES ASSESMENT

SIMULATION RESULTS

OPTIMAL STRUCTURE OF THE CHEMICAL INDUSTRY

Annex D
(34)

TRANSFORMATION OF DEVELOPMENT THESIS INTO DEVELOPMENT STRATEGY

FORMAT OF THE DEVELOPMENT THESIS:

-GOALS FUNCTION
-PDA STRUCTURE
-CRITERIAL PREFERENCES
-RESOURCES AVAILIBILITY
-TERMS OF TRADE
-TECHNOLOGICAL PREFERENCES

SPECIFIC SHAPE OF PDA MODEL

-CRITERIA:

$$F = S\ (Q, Y^{ex}, Y^{im}, Y^{dm}, Y^{ds} \ldots)$$

-FLOWS INGRAPH:

$$Y^{ex} - Y^{im} + Y^{dm} - Y^{ds} = (B - A)Z$$

$$Q^* = Q_t Z$$

-CONSTRAINTS ON:

$$Q^*, Z, Y^{ex}, Y^{im}, I \ldots\ldots$$

STRATEGY DEVELOPEMNT

-IMPORT SUBSTITUTION STRATEGY
-EXPORT STRATEGY
-PARTICULAR RAW MATERIALS CONSUMPTION STRATEGY
-ENERGY SAVINGS STARTEGY
-ENVIROMENT PROTECTION STRATEGY

Annex E
(1)

UNITED NATIONS DEVELOPMENT PROGRAMME AID PROJECT

"BEIJING SPECIALTY GAS RESEARCH AND DEVELOPMENT CENTER"

DP/CPR/85/005

SPEECH OUTLINES IN VIENNA HIGH TECHNOLOGY CONFERENCE

CHEN JINMING

(PROJECT DIRECTOR)

BEIJING SPECIALTY GAS RESEARCH INSTITUTE

PEOPLES REPUBLIC OF CHINA

MAY,10,1988

First part

The tantative plan of Chinese government for developing the high technology specialty gas and efforts for striving to get the international aid.

This part briefly introduces the background in producing this project and the support to this project by Chinese government.

Second part

Chinese government inputs to this project

Mainly, this part introduces the basic contents of the project, the Chinese government input budget and the real input from Chinese government about personnel, train:, construction, equipment purchasing and others.

Third part

UNDP inputs to this project

Mainly, this part introduces UNDP input budget and the real input from UNDP about experts, training, equipment purchasing etc.

Fourth part

At present, the project activities already completed and the applications in industries. This part introduces mainly the real results obtained, including development of new products, establishment of organizations, and those technical development work relating to this project.

Fifth part

Understanding and realizing about the project activities

Based on the realizing in doing the project activities, the project director will introduce systematically what we must pay attention about striving the aid canal, set up C.T.A., inviting experts, making technical investigation, training abroad, equipment purchasing and those experiences can be used for reference. finally, summarize the job description about the project director.

Sixth part

A commentary about the development of international specialty gas

In this part, the project director will make a summarized description about the new development industry---specialty gases, which is based onthe impression of studying tour to different developed countries. this part has 8 aspects:

1. The system concept of specialty gas
2. The technical construction of specialty gas
3. The technicallegislation of specialty gas
4. The technical features of specialty gas at the present age
5. A brief introduction about the advanced technologies of specialty gas in the forward development nowadays
6. Main pillar : of specialty gases
7. The fundamental characteristics of specialty gas in management
8. Future development of specialty gas

Annex E
(4)

TABLE I CHINESE PERSONNEL IN THE PROJECT

NO.	NAME	SEX	POSITION AND TITLE	RESEARCH FIELD	WORKING TIME
1	Chen Jinming	M	Project director Vice director of BSGRI, Engineer	low temp. tech. & Gas purify process	full
2	Liu JingYi	M	Honourable director, senior engineer	Chem. Eng. & gas preparation	partial
3	Gao DeMing	M	Consultant of chemical analysis, senior engineer	Chemical analysis	Partial
4	Guo BingShen	M	Consultant of safety protection professor	Chemical engineering	Partial
5	Xue HungBao	M	Vice director of BSGRI, senior engineer	Chemical machinery & equipment	Partial
6	Chang FengLin	M	Head of 1st research section, engineer	Chem, Eng.	Full
7	Wang teiling	M	Head of 2nd research section, engineer	Chem. analysis	Full
8	Long Jinglin	F	Head of 3rd research section, engineer	Standard measurement & gas blending	Full
9	Chao changLi	M	Head of 4th research section, engineer	Chemical equipmets	Partial
10	Liu Zilian	M	Head of 5th research section, engineer	Applied techniques	Full
11	Li Yiliang	M	Head of 6th research section engineer	Technical informations	Partial
12	Wang lu	M	Directing engineer of research management office project secretary	Science management	Partial
13	Chen ZiFen	F	Head of researching group, Engineer	Analytical chemistry	Full
14	Fan Jinwen	F	Engineer	Analytical Chemistry	Full
15	Meng wenzi	M	Engineer	Chem. Eng.	Full
16	Jiang Yulin	M	Head of researching group Engineer	Chemical equipments	Full
17	Lu chenxin	F	Engineer	Gas purification	Full
18	He jinghung	F	Head of researching group engineer	Low temp. technique	Full
19	Hu kaihung	F	Engineer	Organic chemistry	Full
20	Li shang	M	Head of researching group Engineer	Physical Chemistry	Full
21	Liu Jingxing	M	Engineer	Spectrum analysis	Full
22	Luo Gang	M	Engineer	Low temp. technique & gas separation	Full
23	Li wei	M	Head of research	Application of com-	Full

24	Chang Ke	F	Engineer	Application of computer	Full
25	Wang kuiying	F	Head of Inspection, Engineer	Chemical analysis	Full
26	Yan xiaohua	F	Engineer	Environmental protection	Full
27	Jiang chinyu	M	Engineer	Gas blending	Partial
28	Chang ron Zhen	F	Vice section head of scientific research bureau of chemical Eng. of Beijing	High polymer chem.	Partial
29	Huang Dongtao	M	Director of BOP Engineer	Organic synthesis	Partial
30	Wang deyi	M	Chief engineer of BOP, senior engineer	Low temp. technique & gas separation	Partial
31	Wang tong	M	Head of researching group	gas purification	Partial
32	Guo Meishong	F	Engineer	Biological research	Partial
34	Min kuihua	F	Chemical engineer	Chemical ana lysis	Partial
35	Duan huimin	F	Assisstant engineer	High purity gas analysis	Partial
36	Wang Ning	M	Technician	Instrumental analysis	Partial
37	Sun Gong	M	Technician	Applied technology	Partial

Annex E
(6)

TABLE II DOMESTIC TECHNICAL TRAINING COST

TIME	PERSON	TRAINING ORGANIZATION	TRAINING CONTENT	TRAING YIELD RESULTS	COST (RMB)
1985.9-1986.7	2	Vaccum specialty, Dept. of radio, Jinghua Univ.	Massspectrum analysis	It can use the massspectrometer to analyze the trace impurities in high purity gases	4,000
1986.1-1986.6	4	Semi-conductor Inst. China Academia Sinca	Spectrum analysis	It obtains a preliminary understanding about theprinciple, construction and analytical method of AAS	8,000
1986.1-1986.6	3	Standard material research Inst. China science Inst. of Metrology	Standard measurement	Control the principle and operation method of blending gas by gravimetric method. after passing the examination,they can undertake the secondary standard gas transferring activities	6,000
1986.6-1986.10	3	Dept. of Chem. Eng. Beijing Inst. of Chem.tech.	Chem. Eng. design	To have a deep understanding about the theory of distillation and adsorption, participate to manufacture high purity CO_2	3,000
1986.9-1986.12	2	Kellai tech. training center	Programming	Use the theory to be learned, make the program of two component mixed gases	3,000
1987.9-1987.12	1	Dalian Phy. Chem. research Inst. China Academia sinca	Analytical Chemistry	Use the knowledge to be learned, work out the high purity Ar synthetic analyzer and Hcl online analyzer	10,000
1987.9-1987.12	1	Dept. of computer, Beijing Normal Univ.	Application of computer	To build a foundation for further training at abroad	1,000
Total	16				35,000

Annex E
(7)

TABLE III DOMESTIC TRAINING COST ABOUT FOREIGN LANGUAGE

TIME	PERSON	TRAINING ORGANIZATION	THE TIME OF PASSING QUALITY EXAMINATION	COST (RMB)
1985.3-1986.2	5	Foreign language class, Beijing Industrial Institute	1986.5 passed Michigan Univ. of USA English test	40,000
1985.1-1985.12	1	UN English training center, Beijing 2nd foreign language Inst.	1986.9 passed Michigan Univ. of USA English test	9,000
1985.9-1986.2	1	UN English training center Beijing 2nd foreign language Inst.	1986.10 passed TOEFL examination	5,000
1985.9-1986.2	1	English training class, Beijing radio Inst.	1986.10 passed TOEFL examination	5,000
1986.1-1986.8	1	Japanese training class, Beijing	1986.8 passed the final examination	6,000
Total	9			65,000

ANNEX E (E)

TABLE IV COST OF DIFFERENT ITEMS OF CAPITAL CONSTRUCTION

NO.	NAME OF ENGINEERING COST	COST (RMBX10^4)	REMARKS
I	Engineering cost	225.26	
1.	Construction engineering, among which:	106.25	
	a. civil engineering	97.68	
	b. water supply	1.09	
	c. lighting	2.75	
	d. heat and ventilating	4.55	
2.	Process devices	72.08	
3.	Communications	1.38	
4.	Electrical devices	10.39	
5.	Air conditioning	35.16	
II	Miscellaneous		
1.	Profit of construction unit	8.07	
2.	Technical equipments of construction unit	9.98	
3.	Prospecting	2.00	
4.	Designing	5.7	
5.	Overhead of construct unit	2.6	
6.	Afforest	1.00	
7.	Electricity subisidy	6.70	
8.	Migration	38.69	
	Total	300.00	

TABLE V OUTCOME OF THE PROJECT SCIENTIFIC ACTIVITIES

NO.	Items or name of equipments	Details	Cost* (RMBx10⁴)
1	Laboratory equipments for electronic grade high purity NH_3	1 Fractional distiller 1 Cooling box 1 Adsorber	10.55
2	Laboratory equipments for electronic grade high purity HCl	1 Double stage fractional distiller 1 low temperature adsorber 1 partial distiller	20.00
3	Laboratory equipment for food grade high purity CO_2	4 sets medium pressure adsorber 1 distilling system	17.00
4	Blending equipment for mixed gas of phosphine and silane	specilized blending platform ventilating device pipe fitting for precise valve	6.5
5	Manufacture about the sterilizing analy-zer	3 sets instruments and its related accessories	3.5
6	Cylinders for environmental protective gas	50 Al alloy cylinders with different specifications 41, 81, 401	7.0
7	Food preserving container	10 food preserving barrel 20 food preserving cylinders	5.0
	total		69.55

* N.B. The cost denotes government input only.

TABLE VI OUTCOME FOR PURCHASING INSTRUMENTS & EQUIPMENTS

NO.	NAME OF EQUIPMENTS TO BE PURCHASED	TYPE	QUANTITY	COST (RMBX10^4)
1.	Gas chromatography	2700	1	12
2.	Thermometer		1	8
3.	Gas chromatorygraphy	GC-7A	1	9
4.	Ultrasonic chromatography	1500	1	9
5.	Gas chromatography	SP-1307	2	4
6.	Dust particle counter	Y09-4	1	1.09
7.	Alkane gas alarming	HD-1	2	5.6
8.	Direct reading dew point meter	H-880	1	1.2
9.	Gas chromatography	S7-04	1	2
10.	Spectrum column aging box	SCL-01	1	0.26
11.	Trace oxygen analyzer	648A-5	1	2.4
12.	Gas chromatography	SP-2305	1	2.4
13.	Gas chromatography	S7-04	3	7.2
14.	water analyzer	SH	1	0.8
15.	Trace water analyzer	VSI-1	2	3.2
16	Muffle furnace		1	0.1
17.	Drying oven		1	0.2
18.	Moving inspection car for specialty gases		1	11
	total			80.45

Annex E
11/(12)

TABLE VIII UNDP INPUT FOR INVITING EXPERTS

CLASS OF EXperts	NAME	NATIONALTY	WORKING TIME	UNDP INPUT (USD)
1. C.T.A.	Willard L. Ent	USA	1986,7,16-1986,7,24	4297
2. C.T.A.	Willard L. Ent	USA	1986,11,17-1986,12,5	4297
3. C.T.A.	Willard L. Ent	USA	1987,8,20-1987,9,2	8133
4. C.T.A.	Willard L. Ent	USA	1988,4,29-1988,5,13	
5. Safety & toxicological expert	Willard L.Ent	USA	1987,12,1-1987, 12, 5	3127
6. Atomic absorption spectrum expert	Berceik	Czekslovakia	1987.8.20-1987,9,2	5500

TABLE IX UNDP INPUT FOR STUDY TOUR

NAME OF STUDY GROUPS	PERSON	TIME	PLACES	DATE FOR SUBMITTING REPORT	UNDP INPUT (USD)
1. Project delegation, Western Germany group	6	1986.9.11-1986.9.30	France Allied Germany England	Chinese manuscript 1986.10 English manuscript 1987.2	35,635
2. Project delegation, USA, Japan group	5	1987.10.9-1987.11.12	USA Japan	Chinese manucript 1988.4 English manucript 1988.5	40,000
Total					75635

TABLE X UNDP INPUT FOR EQUIPMENT PURCHASING

CLASS	NAME OF EQUIPMENTS	PRICE (USD)	STATE OF PURCHASING AFFAIRS
Expandable equipments	1. AAS & its accessories	101,434	Arrived at 1986.6 & already put in operation
	2. Computer & its accessories	8,825	Arrived at 1987.5 & putin operation already
	3. Precise accessories	11,980	Purchased well at1987.7
	4. Vapour phase chromatography	47,129	Purchased order received at 1987.12
	5. Electronic capture detector	118,350	Purchased order at 1988.3 received
	6. Deionized water device	4,100	Submit the requirements of order at 1988.?
non-expandable equipments	1. Physical properties data & handbook of toxicology	2,166	Arrived at 1986.12
	2. Standard gases	24,000	In purchasing
	3. Fluids package	500	It will be brought to China by the computer expert at 1988.6

TABLE XI UNDP TOTAL INPUT FOR THE PROJECT

ITEMS	APPROVED BUDGET IN 1987	REAL OUTPUT	ESTIMATED OUTPUT IN 1988	N.B.
1. Experts	122,177	28,525	58,000	+35,652
2. Investi-gation	75,628	75,628	0	
3, Training	97,972	0	150,000	-52,028
4. Equipme-nts	188,473	176,528	26,945	-15,000
5. Travel	12,000	0	12,000	
6. Unforseen	3,750	0	3,750	

BEIJING INSTITUTE OF CHEMICAL REAGENTS

Address: Huagong Road East Suburb,
Beijing, China
Telephone: 78-3126
Cable: 7091

FOUNDATION in 1958

ORGANIZATION There are 8 departments: Ultra-clean High Purity Reagets, Organic Reagents, High Purity Inorganic Reagents, Sensitive Materials, High Purity Inorganic Analysis, Organic Analysis, Environmental Monitoring, and Instrumentation.

FIELD AND TASK Fine chemicals and new microelectronic chemicals are mainly researched, including following fields: ultra-clean high purity reagents, photoresists and their necessary chemicals, doping for optical fibers, printing photoresists and their necessary chemicals, colour formers for film and photographic paper, chemicals for printed circuit boards, packing materials for high performance liquid chromatograph, analysis of organic and inorganic chemicals, environmental monitoring, analysis of unknown materials and so on.

LEADING STAFF There are 80 senior engineers and engineers in the Institute.

OUTCOME AND TECHNIQUE POPULARIZED AND TRANSFERED Main outcomes are listed: 22 kinds of MOS Reagents, 22 kinds of BV-1 Reagents, BN302 and BN303 Nerative UV Photoresists, BP-212 Positive UV Photoresists, PS Plate's Chemicals for Printing Industry, Dopings for Optical fibers, Liquid Crystals, analysis and research of Colour Formers for Colour Industry, Packing Materials for High Performance Liquid Chromatograph, Special High Purity Gases (such as Silanes, Boranes,

Phosphorous Hydride and Arsenic Hydride), 115B Brightener for Plating Tin. During the 6th 5-year plan the Institute was encouraged and praised many times by the State Scientific and Technological Commission of China, the Ministry of Chemical Industry, and Beijing Municipality. All above outcomes can be transfered.

Honorary Director	Wang Min-rui
Director	Yu Xiang-dong (concurrently)
Routine Director	Sun Jing-yu
Assistant Director	Sun Shi-ming
	Wang Zi-mo

Government Inputs (in kNB)

	Budget	Actual Expenditure	Estimated Reinputs	Total
1. Staff				
Director	15,000	10,000	10,000	20,000
Secretary Services	15,000	10,000	10,000	20,000
Services for Experts	50,000	10,000	20,000	30,000
Training of Language (230m/m)	100,000	77,500	22,500	100,000
Salaries for Researchers	200,000	200,000	100,000	300,000
Sub-total	360,000	307,500	162,500	470,000
2. Construction				
Setting up a new Building	6,500,000	6,000,000	1,000,000	7,000,000
Renovation of existing building	200,000	300,000	100,000	400,000
Sub total	6,700,000	6,300,000	1,100,000	7,400,000
3. Equipment				
NMR	1,100,000	1,330,000	100,000	1,430,000
4. Others				
Costs of experiments	300,000	250,000	100,000	350,000
unforeseeable costs	150,000		150,000	150,000
Total	8,510,000	8,187,500	1,512,500	9,800,000

Annex F
(4)

Ultra - clean High Purity Reagents BV 1

Reagents BV 1 are special ones for Very Large Scale Integrated Circuits (VLSIC). Their quality is better than normal Metal Oxide Semiconductor (MOS) Reagents. They are a necessary condition for the research and production of Large Scale Integrated Citcuits (LSIC) of 16k and more than, especially of VLSIC of 64k and more than, and are reliable guarantee to the improvement of quality and the increase of rate of finished products.

Characteristics

1. Stringent particle control: the particles of 2μm and more than not more than 300 per 100 ml
2. Low content of impurities: metal ions at the level of $10^{-6} - 10^{-7}$ %

The reagents are finely prepared and purified under ultra - clean condition of 100 grade. They are contained in glass or polyethylene container. Their quality is stable and reliable because all products are analyzed by means of advanced instruments.

Package is not removed until to be transfered into production line. It is very important to wash all containers carefully. Handle and operation must be in the ultra - clean condition. Mixing the reagents with other low grade ones is forbidden.

The reagents are also suitable to other fields of moden science and technology requiring ultra - clean or dust - free conditions.

In 1984 the reagents were successfully investigated and prepared, and passed through the confirmation of the Ministry of Chemical Industry. Now 21 reagents are produced in batches and series. Welcome to use them and give your advices and demands.

List of Reagents BV 1

1.	Acetic acid	12.	iso - Propynol
2.	Sulfuric acid	13.	Ethylene glycol
3.	Nitric acid	14.	Acetone
4.	Hydrochloric acid	15.	Toluene
5.	Hydrofluoric acid 50%, 40%	16.	Xylene
6.	Phosphoric acid	17.	Ethyl acetate
7.	Hydrogen peroxide 30%	18.	n - Butyl acetate
8.	Ammonium hydroxide (Ammonia solution)	19.	Trichloroethylene
9.	Ammonium fluoride 40%	20.	Cyclohexane
10.	Methanol	21.	Butanone
11.	Ethynol absolute		

Annex F
(5)

Sensibilizer for Positive Graph Presensitive(PS) Plate

1. Properties

A clear amber viscous liquid, inflammable, deposited with water, decomposed with heat and light

In alcohol, acetone, ether and other solvents : miscible

2. Specification

ITEM	SPINNING COAT	COATER COAT
Solids content	)=14%	)=15%
Viscosity at 30 C,cTs	6.0±0.5	8.0±0.5
Water content	(=1.0%	(=1.0%
Type of sensibilizer	I. U	II, UI

3. Advantage and Usage

3.1 Advantage:

3.1.1 Excellent adhesion

3.1.2 High sensitivity, good photospeed, wide latitude for exposure and development, ease to master

3.1.3. Obvious matachroatism after exposure, good for exposure operation

3.1.4 High resolution: sharp net - point of 98%, the other 2% not to be losed

3.1.5 Excellent printing - durability, not less than 100,000 times, maximum 200,000 times

3.1.6 High stability, storage life more than one year below 20 C

3.2 Usage:

3.2.1 Preparation of coat liquid

40ml dye is added into 1000ml sensibilizer and mixed completely, then it can be used after 1 or 2 days.

3.2.2 Coat

A well - treated plate is treated with 2% H PO again, washed, baked and coated

METHOD	SPINNING COAT	COATER COAT

METHOD	SPINNING COAT	COATER COAT
Coat liquid (ml)	60	15 - 20
Baking at C	40 - 50	70 - 80
Baking time (m)	8 - 10	1 - 2

After baking the plate is put into a box and stored below 25 C

3.2.3 Exposure

A expodure time depends on the light power and the distance .

Light source *	Distance	Time
6000 W Cold Xe-lamp	1.5 M	6 - 7 m
8000 W Cold Xe-lamp	1.0 M	2 - 2.5 m

* other light sources such as Pulse Xe-lamp, High pressure Hg-lamp, High efficient fluorescent lamp, etc.

3.2.4 Development

After exposure the plate is put into a bath of developer, brushed slightly and washed

	FOMULAR A	FOMULAR B	FOMULAR C
NaOH	4g	3g	
Na_3PO_3	20g		
Na_2SiO_3		30g	40 - 50 g
Water	1000ml	1000ml	1000ml

The fomular B.C are suitable to sensibilizer I-U, while the fomular A to sensibilizer II and IV.

4. Package

3000 ml in a brown (or white) bottle. enclosed with black plastic bag outside 4 bottle of sensibilizer and one bottle of dye in a box

5. Storage and Transportation

5.1 storage

store below 25 C, sealed, far away from fire, dry. Avoid lighting.

5.2 Transportation

Inflammable, placed under dry and cool condition.

Annex F
(7)

Positive Photoresist BP 212

To meet with LSIC and VLSIC , a new UV Positive photoresist has been prepared . Through stringent quality cntrol and series function tests its advantages are shown:

Good photospeed

* Projection printing and repeat exposure

High resolution

* At level of sub - micrometre

* Excellent linewidth control

Clean film

* Even film thickness without interference streak

Steady quality

Excellent adhesion

* Oxides and metals

High etch resistant

Wide atitude

* For exposure and development

Ease strip

High heat stable

* Up to 140 C

1. Properties

There are two types of the photoresist

ITEM	BP212D	BP212T
Viscosity at 30 C, cTs	30 + 1.5	6.0 + 0.3
Special density at 30 + 0.5 C	1.032 - 1.052	1.005 - 1.025
Water content	<=0.5%	<=0.5%
Solids content	28%	17%
Impurities of 10 metal ions, ppm	<=1	<=1
Particles	Through the filter of 0.2 um	
Flash point (closed cup)	39 C	39 C
Permissible limit in environment, ppm	100	100
Lift film rate	>94%	>94%

Annex F
(2)

2. Instruments for use

2.1 Dehydration Bake

To obtain maximum process reliability, bake all substrates immediately prior to coating at 100 C for 15 minutes to printing process. Soak then in Surface Treat Agent BP212 for 10 - 15 minutes and bake at 180-200 C for 30 minutes to photoetching process .

2.2 Coat

Coat in the ultra - clean condition of grade 100. The relative humidity is not more than 70% for printing process, while not more than 50% for photoetching process.

ITEM	PRINTING	PHOTOETCHING
Spin speed,r.m	2200-2600	5000-6000
Film thickness	6000+200 A	1.0 - 1.3 um

See the relation between spin speed and film thickness in Figure 1

2.3 Soft Bake

ITEM	PRINTING		PHOTOETCHING
Temperature, C	80*	90 + 5	90 - 95
Time ,m	60*	20	20

* without hard bake

2.4 Exposure

LIGHT SOURCES	DISTANCE	PRINTING(T)	PHOTOETCHING(D)	
80W High Pressure Ball Lamp	10 cm	20 - 35 s	35 - 60 s	Ball
250W Aligner	10 cm	7 - 9 s	10 - 15 s	
250W Lamp	10 cm	7 - 9 s	10 - 15 s	

2.5 Development

Photoetching :

Positive Photoresist Developer BP 212 is diluted by deionized water into 1:1 or 2:3 . 2 - 2.5 % $(CH_3)_4N(OH)$ can also be used. The temperature of development is at 23 + 1 C.

Printing :

0.5 - 0.7 % NaOH

at 23 + 1 C

2.6 Rinse

Wash with lot of deionized water and blow to dry with clean nitrogen gas.

2.7 Hard Bale

A hard bale is recommended for all photo levels to optimize process reliability in wet etching and maximize selectivity in dry processing steps. Higher hard bale temperatures give even greater resistance to subscquent processing steps, however, some thermal distortion of resist images may occur. The temperature is 120 -140 C for 30 minutes .

2.8 Etch

2.8.1 Wet etching

Aluminium :		Water	100 ml
		H_3PO_4	800 ml
		HAc	50 ml
		HNO_3	10 ml
Chromium :	Water	2000 ml	1000 ml
	$(NH_4)_2Ce(NO_3)_6$	330 g	200 g
	$HClO_4$	100 ml	/
	HAc	/	35 ml
Iron oxide :	a)	H_3PO_4	at 70 C
	b)	Water	50 ml
		$FeCl_3$	160 g
		HCl	500 ml
	c)	HI	
Si , SiO_2 :	40%	NH_4F	6
		HF	1
SiO_2 :		NH_4F	6
		HF	3
		Water	9 - 10
Copper :		a)	NH_4Cl
		b)	$(NH_4)_2S_2O_8$
Gold and Pitinum :			HCl 3
			HNO_3 1

2.8.2 Dry etching

Si	:	CF or CF and O
SiO	:	CF or CF and N
Si N	:	CF or CF - H - N
Al	:	CF or BCl

2.9 Strip

It is soaked in ketone and stripped by ultrasonic if the temperature of hard bake below 120 C. It can be stripped by H SO - H O or Positive Photoresist Stripper BP212 at 50 - 60 C if the temperature of hard bake above 120 C.

Notes

* It should not be diluted generaly.
  If it is diluted, the solution sould be laid for 3 - 5 days and filtered.
* It should not be used with negative photoresists at the same time.
* Store in dry area below 15 C in closed original containers away from light, heat, sparks, and open fire. Its storage life is not less than one year.
* Avoid contact with skin and eyes.
  Handle with care and wear protective clothing and gloves.
* 250 ml in a brown bottle with black plastic bags outside

Annex F
(16)

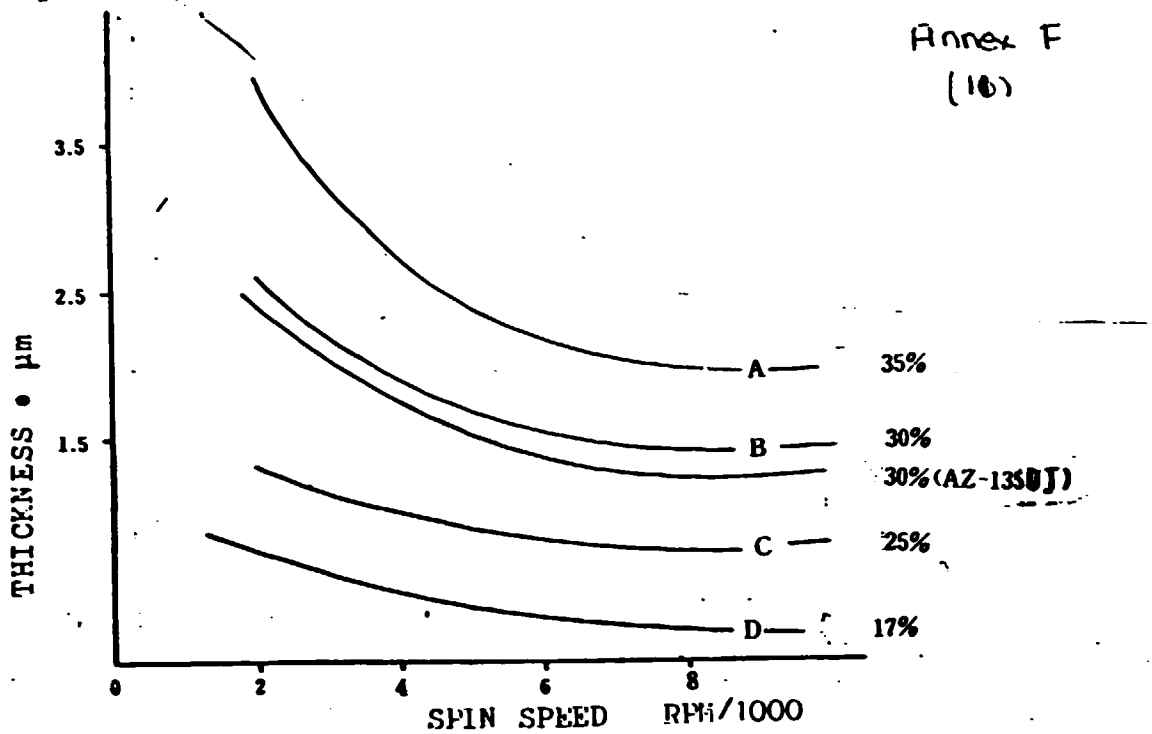


Figure 1.

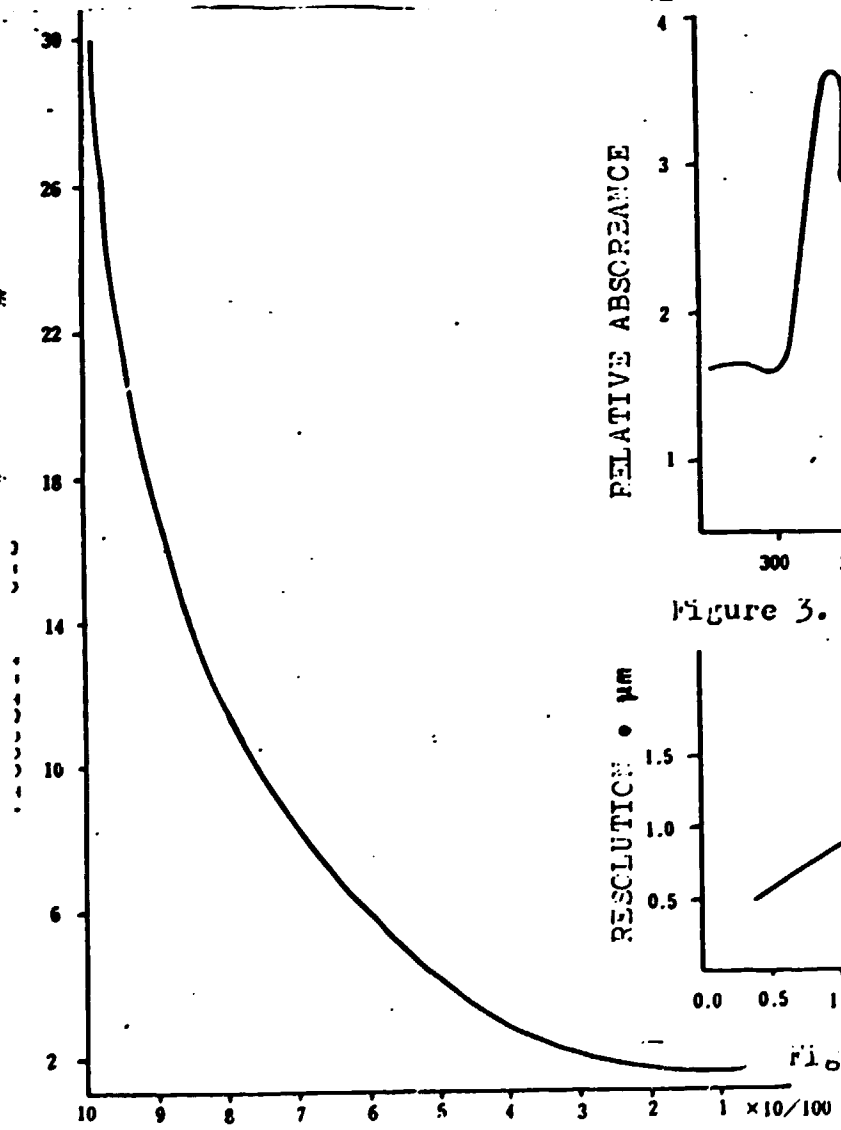


Figure 2.

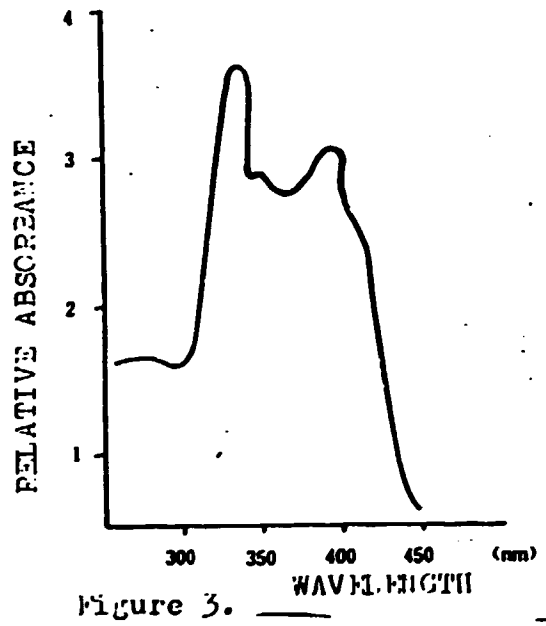


Figure 3.

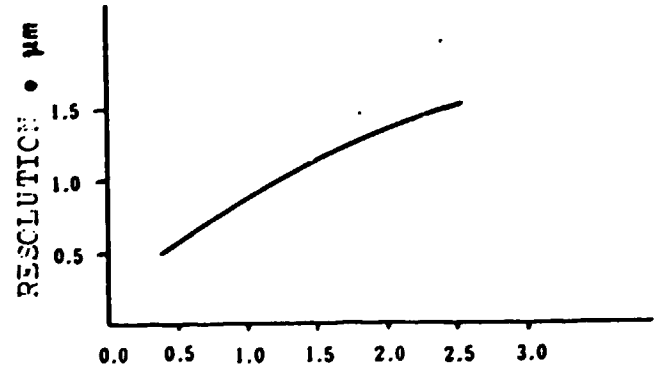


Figure 4.

Annex F
(12)

Negative Photoresist BN303 (3026/312)

1. Properties

A clear light yellow liquid, a bit viscous

In toluene, xylene and other solvents : readily solubale

In ketone and alcohol: deposited into a flucculent solid

Store below 25 C, Avoid lighting .

2. Use

Excellent adhesion

* On the surface of sillicon dioxide, polystalline sillicon, sillicon nitride, aluminium, chromium, iron oxide and copper

High etch resistant

* Against acidic and altalic etchant

Wide atitude

* In photoetching operation

Stringent particle control

* Though the filter of 0.2 um

Steady quality

Low density of pinhole

It is mainly used for middle and large scale integrated circuits .

3. Instructions for use

3.1 Coat

For example, a photoresist of 58 cTs is coated at 3000 r.p.m. the film thickness will be about 1.1 um.

3.2. Soft bake

At 80 C for 20 minutes

3.3. Exposure

It depends on the light power, for example, a exposure time is about 5 seconds for 75 W High Pressure Hg - lamp.

3.4. Development

Shaked for 1 minute in Negative Photoresist Developer BN 303

3.5. Rinse

Shaked and washed for 30 seconds in Negative Photoresist Rinser BN 303 . Please

3.6. Hard Bake

At 130 - 140 C for 30 minutes

3.7. Etch

By general method or plasma

3.8. Strip

Boiled in concentrated H_2SO_4, or by low temperature plasma, or with Negative photoresist Stripper BN 303

Its solvent is xylene. A ventilation must be used. The flashing point of xylene is 16 C. So it must be far away from fire and high temperature.

4. Storage and Transportation

Its storage life is 2 years under correct storage conditions (sealed, below 25 C and avoided lighting). Avoid to meet with acidic substances. A carbon dioxide extinguisher should be used in the case of fire.

5. Package

500 or 250 ml in a brown bottle with two black plastic bags outside and then in a paper box

Any user's demands will be met.

Negative Photoresist Developre BN 303

1. Properties

A clear colourless liquid, volatile

In benzene, chloroform, oil and other solvents : soluble

In water: insoluble

2. Specification

Boiling Range 80 - 120 C

According to the standard BN 1

Filtered through the filter of 0.2 um

3. Use

Used for the development of Negative Photoresist BN 303 or the same type of photoresists abroad

4. Instruction for use

A wafer is put into 1 or 2 baths of developer, stired (or shaked) for 60 - 90 seconds,

the same type of photoreidts abroad .

4. Instruments for use

A wafer is put into a flask of the stripper, warmed on water bath at 80 - 90 C for 10 - 15 minutes, took out and washed with deionized water.

Be careful ! it is toxic and corroptive, used in ventilative window with glasses and gloves. Please wash it at once with a lot of water if it is splashed on the skin .

Storege : Water - free

Package : 250, 500, or 1000 ml in a brown bottle

Negative Photoresist Thinner BN 303

1. Properties

A clear colourless inflammable liquid, toxic

In alcohol, ether and chloroform : miscible

In water : insoluble

2. Specification

Its main component is xylene. Its impurities meet with the reagent standard of grade 2 and the other items with the MOS Reagent Standard .

3. Use

Used for dilution of Negative Photoresist BN 303 as well as the same type of Photoresists abroad .

4. Instruments for use

A certain quantity of the thinner is directly added into the Photoresist (owing to filtering through the filter of 0.2 um) and stayed over a night, which can be used . It is operated on a ultra - clean table with ventilation .

Fire and high temperature must be forbidden .

Please store in a cool and ventilative place .

5. Package

500 or 1000 ml in a brown bottle, meeting with the package of Reagent Standard BN 1

ANNEX G

Speciality Gases and Reagent Chemicals

Questionnaire - Answers

Country: BRAZIL

I. a) No

b) c) The microelectronic industry in Brazil has a market of appr. US$ 270 million plus US$ 15 million of exports. From these US$ 150 million are imports of assembled and tested components, and US$ 135 million represent the local production. It is estimate' that about US$ 300,000 is the market for electronic grade chemicals imported. About 20% of the local production invoives the complete cycle (front end, assemblying and testing), and 80% refers to assemblying and testing (chips imported).

This ma:ket tends to be stabilized. The exaggerated competition betweer. USA and Japan in the field of microelectronics has generated an agreement on semiconductors. In view of this, it is doubtful that other industries will want to try this market war, except in specific and independent small functions, where come up strategic aspects.

II. Yes a) No b) Yes c) Yes

Heavy metal industry is well established in Brazil. It uses technology compatible to USA and Japan, and exports and imports normally. Due to this stage of operation it was possible to consolidate the capital goods industry to back up the installation of petrochemical poles.

Differently of the iron and steel industry, which is mostly Government-owned, the metallurgy section, including allays is mostly private. Although small, it is rapidly growing.

About 22 research groups in universities and other 20 public research institutes and industries have activities related to its deve'opment.

III. Energy sources in Brazil are oil, hydroelectric, ethanol (from sugar cane) for engines combustion, charcoal (for use in siderurgy). There is one nuclear reactor; natural gas is starting to be used; solar energy is incipient as well as shale-oil and biomass residues.

Oil consumption is of about 1 billion barrels/day from which 60% is locally produced. Ethanol production is about 11 billion litres/year and accounts for 60 - 70% of the consumption of combustibles in cars. About 80% of all running cars are moved on ethanol.

IV. Brazil has all types of industries listed. Date on chemical industries has been presented during the meeting.

V. a) Wheat, apple, and eventually rice and beans and meat.
b) Corn, coffee, sugar, soy benas, orange juice and eventually rice and beans.

VI. In terms of the economics involved, we estimate that the agrarian participation equals the industrial participation.

Staple crops - corn, rice, soy beans, beans.

Specialty crops - grapes, oranges.

VII. As in the questionnaire.

VIII. No. a) No b) No c) Financial + Facilities

Having adequately trained personnel, the lacks reside mainly in distribution in the country.

IX. The analytical laboratories are provided with the equipment listed. Mass spectrophotometers, atomic absorption units, thermal conductivity and NMR's are found in smaller quantities, but in good number.

X. a) Yes b) Yes c) Yes d) Yes

20/5/1988

Annex G
3/(4)

QUESTIONNAIRE FOR ATTENDEES TO UNIDO SYMPOSIUM
ON SPECIALTY GASES AND REAGENT CHEMICALS
16-20 MAY 1988

INTRODUCTION:

This questionnaire has been designed to assist those who are preparing the Symposium to better understand the specialty chemical and specialty gas industries in your country. Questions are generally directed at the various facets of these industries as well as the government organizations who would normally be involved in regulating these industries or its employees and management organizations.

Please respond openly to the questions and feel free to add information if it is felt the additions will be beneficial to the evaluation.

QUESTIONS:

1. Concerning the electronics industry in your country:

   a. Is it a basic manufacturing activity to the level of producing silicon "chips"? Yes or No.

   b. Is its main activity the assembly of finished products or sub-parts from smaller components? Yes or No

   c. Is there a better way to describe the electronics industry in your country. Yes or No. Explain: _____
   _____
   _____

2. Is there a well established heavy metal (iron and steel) industry in your country? Yes or No

   a. If present, does the industry tend to specialize in relatively small volume high quality products? Yes or No

   OR:

   b. If present, does the industry tend to concentrate on the production of high volume (non-specialty) products? Yes or No

   c. If 2, b was answered Yes, does the industry utilize modern basic oxygen processes in its production? Yes or No

3. Concerning the energy production industry in your country, check the fuel sources below which are utilized:

   _____ Oil
   _____ Natural Gas
   _____ Anthracite Coal
   _____ Bituminous Coal
   _____ Hydroelectric
   _____ Nuclear Reactor
   _____ Other

4. If there is a well established chemical industry in your country, check below the facets of that industry which exist:

_____ Petrochemical
_____ Synthetic Fibers and Plastics
_____ Agrichemical (Ammonia and Fertilizer)
_____ Pulp, Paper and Allied Products
_____ Soap, Detergents, Cleaners, Solvents
_____ Basic Inorganic Chemicals (Acids and Bases)
_____ Basic Inorganic Chemicals (Industrial Gases)
_____ Petroleum Refining
_____ Other

5. Is your country self sustaining as far as its agriculture products are concerned? Yes or No

   a. If not, what are the major food-stuff needs which are imported:

   _____
   _____
   _____

   b. If there are major exports of foodstuffs, what are those:

   _____
   _____
   _____

   c. Are there other major imports or exports of agriculture items, (Cotton, Flax, etc.): List as Import or Export.

   _____
   _____
   _____

6. Would you describe your country as being more agrarian than industrialized? Yes or No

   a. If yes, list the major staple crops (corn, wheat, rice, etc.)

   _____
   _____
   _____

   b. If yes, list the majo. specialty crops (dates, fruits, coffee, etc.):

   _____
   _____
   _____

7. Other than the agrarian activities, how would you describe the level of education of the persons employed in industry:

Annex G
(G)

Type Employee	Education Level*				
	Less than Secondary School	Completed Secondary School	2 Yr. College Degree	4 Yr. College Degree	Advanced Degree
1. Factory Laborer	XX	XX	X	X	
2. Factory Foreman			X	X	X
3. Maintenance Employee		X	XXX	XX	
4. Maintenance Supervisor				X	
5. Accounting Personnel			X	X	
6. Laboratory Technician				X	X
7. Laboratory Scientists					X
8. Laoratory Supervisors				X	X
9. Stenographic & Secretarial		X	XXX	XXX	X
10. Factory Manager				X	XX
11. Company Owner (Manager)		X	X	X	X

* Check more than one level, if appropriate.

8. Is the health-care industry well advanced in your country? Yes or No

   a. Is health-care in modern hospitals available to all citizens? Yes or No

   b. Are well trained physicians available to all citizens? Yes or No

   c. If 8, a and 8, b are not answered yes, is the reason financial or lack of facilities and trained personnel:

      _____ Financial
      _____ Facilities
      _____ Trained Personnel

9. Are industrial and government laboratories involved in analyses for process control and quality control; or for governmental monitoring activities equipped with modern analytical equipment? Check below if equipment listed would be found in typical analytical laboratories:

      _____ Gas Chromatography (Vapor Phase)
      _____ Liquid Chromatography
      _____ Infrared Spectrophotometry
      _____ Mass Spectrometer
      _____ Atomic Absorption
      _____ Thermal Conductivity
      _____ N.M.R.

10. Are there national standards organizations or other regulatory organizations extant in your country relating to:

    a. Weights and measures (similar to USA's National Bureau of Standards) Yes or No

b. The establishment of hazardous goods or chemical shipping regulations and the specifying of shipping containers (similar to USA's Department of Transportation) Yes or No

c. The protection of workers in the workplace (similar to the USA's Occupational Safety and Health Administration). Yes or No

d. The protection of air, water, and land from chemical or other hazardous waste spills (similar to USA's Environmentl Protection Agency). Yes or No

11. Please add any other comments about the specialty gas, industrial gas or reagent chemical industries in your country:

COMMENT_____

_____

_____

_____

_____

Annex H
(I)

REPUBLIQUE ALGERIENNE DEMOCRATIQUE ET POPULAIRE

MINISTERE DES INDUSTRIES CHIMIQUES ET PETROCHIMIQUES

ENTREPRISE NATIONALE DES GAZ INDUSTRIELS (ENGI)

REUNION DE GROUPE D'EXPERTS DANS
LE DOMAINE DES GAZ SPECIAUX SOUS
L'EGIDE DE L. ONUDI
16 - 20 Mai 1988

CONDITIONNEMENT DE GAZ PURS ET MELANGES AU CENTRE DE REGHAIA (ENGI) ALGER

Annex H
(2)

I/- PREAMBULE :

L'Entreprise Nationale des Gaz Industriels (ENGI) assure la production et la distribution des gaz industriels en Algérie -
La production des gaz en grandes masses étant acquise, les besoins du pays en gaz purs et mélanges ont nécessité l'acquisition d'un investissement complémentaire de faible valeur relative mais de productivité importante.
Le document que nous présentons concerne le Centre de Conditionnement de Gaz Purs et Mélanges de Réghaïa (Alger), dans ce centre nous conditionnons des mélanges de gaz jusque là importés alors que nous possédions l'ensemble des produits de base.

Nous espérons que les données techniques fournies par ce document aideront nos collègues à tirer une expérience utile pour leur pays et restons à leur disposition pour toute forme de collaboration.

Annexe H
(3)

C.C.A.M. / REGHATA

NOTIONS

GAZ PURS ET MELANGES

Annex H
(4)

- SOMMAIRE -

../..

7.1 Description générale de l'appareillage

7.2. Possibilité d'analyse

7.3. Principe sommaire des appareils

- UTILISATION DES GAZ PURS ET MELANGES GAZEUX - METHODES D'ELABORATION

I - 1. UTILISATIONS

Les gaz purs et les mélanges gazeux trouvent leur application dans toutes les industries :

Alimentaire et Agricole

- Protection des emballages - des cargaisons dans les navires. Conservatic

Ce sont essentiellement des mélanges :

N_2 / CO_2
N_2 / N_2O
N_2 / CO_2 / O_2

Médecine

- Mélanges respirables - Mélanges d'anesthésie :

N_2 / O_2
O_2 / N_2O
O_2 / CO_2

Mécanique

- Atmosphère de protection d'appareils de traitement :

Ar/ O_2
Ar/ CO_2

- Soudage :

N_2 / H_2
Ar / H_2

Electrique

- Fabrication des semi - conducteurs :

N_2 / He

../.

Annex H
(7).

Electronique — Tubes d'éclairage :

Ne / Ar

Chimie — Protection d'atmosphère :

N_2

- Synthese
- Analyses :

Ar

Cette liste n'est absolument pas exhaustive, elle ne concerne pas obligatoirement tous les mélanges que nous pouvons fabriquer.

Les gaz purs et les mélanges trouvent également leur application dans les laboratoires de contrôle industriel, de recherche :

- Gaz porteur
- Gaz étalon
- Gaz de contrôle
- Gaz d'instrumentation

Pour les différents types d'analyseurs :

- Chromatographes, spectrographes.

I - 2. METHODES D'ELABORATION

La méthode d'élaboration est fonction du nombre de constituants que l'on souhaite introduire dans le mélange gazeux, des teneurs souhaitées pour chaque constituant, de la précision désirée par les utilisateurs.

D'une façon générale, il existe deux méthodes :

- méthode dite manométrique
- méthode par pesée.

Il apparait aujourd'hui sur le marché des " mélangeurs automatiques ". Ils font appel à des techniques évoluées, la quantité de chaque constituant introduit est déterminée par exemple, à partir de mesure de vitesse de passage dans une tuyère. Nous n'aborderons pas le fonctionnement de ce type d'appareils.

De notre côté, nous avons retenu la méthode manométrique pour équiper le C.C.A.M. de Réghaïa. Elle permet un mélange de deux ou trois constituants, convient bien lorsque l'on veut réaliser des mélanges dont la teneur minimale du constituant introduit dans la plus faible quantité avoisine 1 % environ; la précision relative des mélanges réalisés varie suivant les cas de $\pm$ 1 % à $\pm$ 5 %.

Retenons seulement que par pesée suivant la méthode, simple ou double pesée, la qualité du matériel utilisé, le type d'emballage bouteilles de 1,5, 20 ou 50 litres, il est possible de réaliser des mélanges à n constituants dont la précision relative peut atteindre $\pm$ 0,1 %, la teneur des constituants peut être de l'ordre de quelques p.p.m.

Pour les mélanges effectués au C.C.A.M. Réghaïa, la pureté du constituant d'un mélange ne pourra pas être meilleure que celle du constituant de base produit à Réghaïa (O_2, N_2, Ar, CO_2).

../..

Annex H
(9)

GAMME DES PRODUITS DONT LE CONDITIONNEMENT EST PREVU AU C.C.A.M.REGHAIA

Le C.C.A.M. Réghaïa permettra de conditionner les produits suivants :

	BOUTEILLES	CADRES	GAMME DES MELANGES POSSIBLES
...te pur	X	X	
...on pur	X	X	
...te - Hydrogène	X	X	0 à 30 % H_2 q.s. N_2
...on - Hydrogène	X		0 à 30 % H_2 q.s. Ar
/ CO_2 / O_2 *	X		0 - 30 % max. en CO_2 et 0-30 % q.s. N_2
CO_2	X		0 - 30 % max. en CO_2 q.s. Ar
/ O_2	X		30 % max. en O_2 q.s. Ar
/ N_2	X		60 % max. en He
/ O_2	X		Toute la gamme
... les binaires			
CO_2	X		30 % max. en CO_2
... / O_2	X		30 % max. en CO_2
/ O_2	X		Toute la gamme

Nous allons maintenant définir les découpages en fonction du type d'emballage et des puretés des produits. La liste ci-dessous représente en fait, le catalogue commercial du C.C.A.M.

../..

II - 1. BOUTEILLES

Les types d'emballages utilisés dans un premier temps seront des bouteilles de 20 à 50 L. Les pressions finales de remplissage sont fixées à 150 bars.

II - 1.1. Gaz purs

Ce sont les remplissages en argon et en azote, les bouteilles seront soumises à un contrôle statistiq
- 1 bouteille par lot de remplissage ira à l'analyse.

Dans l'azote, il est prévu de contrôler la teneur des impuretés suivantes :

- H_2O 0... 5 p.p.m.
- O_2 0... 5 p.p.m.

Les autres impuretés susceptibles d'être contenues dans ce cas principalement l'argon, l'hydrogène, puis Ne, He, CO_2, CO, Hydrocarbures.

La provenance directe depuis les tanks situés près de l'appareil de fabrication et le contrôle par l'analyse des teneurs en O_2 et H_2O nous permet de situer ce gaz à une pureté de 99,995 % .

Dans l'argon, il est prévu de contrôler la teneur des impuretés suivantes :

- H_2O 0... 5 p.p.m.
- O_2 0... 5 p.p.m.
- N_2 0...10 p.p.m.

.../...

Annex H
(II)

Les autres impuretés susceptibles d'être rencontrées sont H_2, He, CO, Hydrocarbures.

Comme pour l'azote et pour les mêmes raisons, la pureté de ce gaz se situera à 99,995 % ,

soit un total d'impuretés 500 ppm volume.

Pour ces deux gaz purs, nous pourrons indiquer la teneur en % tel que défini ci-dessus et afficher azote de pureté 99,995 %.

II - 1.2. Mélanges pouvant être realisés au C.C.A.M. Réghaïa

Compte tenu des installations, des analyseurs prévus au C.C.A.M. , de nos conditions standard de commercialisation, (pression de remplissage 150 bars), il sera possible de réaliser des mélanges dans les compositions suivantes :

- N_2 / H_2 1 à 20 % en Hydrogène q.s. Azote
- Ar / H_2 1 à 20 % en Hydrogène q.s. Argon
- Ar / O_2 1 à 20 % en Oxygène q.s. Argon
- Ar / CO_2 1 à 20 % en Gaz Carbonique q.s. Argon
- N_2/CO_2/O_2 pour 1 à 30 % de Gaz Carbonique et 1 à 20 % d'Oxygène q.s. Azote
- N_2 / O_2 1 à 50 % en Oxygène q.s. Azote
- N_2 / CO_2 1 à 30 % en Gaz Carbonique q.s. Azote
- He / H_2 1 à 50 % en Hélium q.s. Azote
- He / O_2 1 à 50 % en Oxygène q.s. Hélium

Ces mélanges seront garantis avec une précision relative * qui est fonction des précautions prises lors de la réalisatio mais aussi du type de matériel et des matières premières mises en oeuvre.

A ce sujet, les calculs d'erreurs menés ont montré que des opérateurs attentifs respectant les instructions de service pourront réaliser sans difficulté des mélanges dont la précision relative n'excède pas ± 1 %.

Pour cette gamme de produit, on effectuera un contrôle statistique c'est à dire qu'une (1) bouteille par lot de fabrication 5 ou 10 bouteilles sera analysée.

Une certaine clientèle demandera peut-être un produit sortan de cette gamme ou exigera une plus grande précision sur la teneur des constituants.

Dans ce cas, la décision de réalisation du mélange sera mise par le Service Exploitation, les bouteilles pourront être contrôlées individuellement: en tout état de cause, la précision affichée ne pourra être supérieure à ± 1 % qui es la précision de nos appareils d'analyse.

II - 2. CADRES

Les gaz purs et mélanges commercialisés en cadres seront l'argon et l'azote pureté 99,995 %
Les mélanges [illegible] 10 % d'hydrogène dans N_2

Chaque cadre sera analysé individuellement.

* Pour les termes précisions se reporter au paragraphe - III.

../..

III - NOTIONS IMPORTANTES - LANGAGE UTILISE

III - 1. IMPURETES - NOTION DE P.P.M. VOLUME

L'introduction des impuretés que nous allons trouver dans les mélanges est inhérente :

- à la qualité des matières premières utilisées pour l'élaboration des produits de base,
- aux process utilisés et à la qualité des appareils utilisés pour l'élimination de ces impuretés (systèmes physico-chimiques ou mécaniques),
- aux erreurs de manipulation, au mauvais état du matériel d'élaboration des mélanges.

Pour illustrer ceci, nous prendrons deux cas :

- pour obtenir l'oxygène et l'azote, nous utilisons des appareils de liquéfaction alimentés en air: Mais si les principaux constituants de l'air sont l'azote et l'oxygène, on trouve également les constituants : Ar, H_2, He, X, Kr, CO, CO_2, C_nH_m, H_2O.

Parmi ces constituants, la teneur de certains, reste à peu près constante (Ar, He, Xe, Kr) la teneur des autres constituants varie en fonction du lieu ou des conditions climatiques du prélèvement.

Dans les installations classiques (Réghaïa et Arzew) les échangeurs reversibles assurent l'élimination de l'eau et du CO_2 voire de certains hydrocarbures. L'élimination totale, absolue reste cependant très délicate.

../..

De la même façon, la séparation par distillation des produit O_2 et N_2 ne peut empêcher que des traces de l'un des constituants reste présent dans l'autre.

Dans la fabrication de O_2 après une série de pièges (dessiccation..) et liquéfaction, on élimine les gaz inertes par une purge (appelée purge des incondensables).

En résumé, même si l'on pense à bloquer toutes les impuretés pour des raisons de technologie et de coût de la production, on n'atteint jamais l'élimination complète, absolue de ces impuretés.

Les impuretés subsistent en très faible proportion; pour exprimer ces faibles fractions, on utilise le terme de p.p.m. volume qui est au niveau du langage et de l'écriture plus facile, plus parlant :

- p.p.m. signifie partie par million et exprime un rapport de volume qui est donc comme un pourcentage (%) un nombre sans dimension.
- 1 p.p.m. représente la $\frac{1}{1.000.000}$ (millionième) partie.

Lorsque l'on dit qu'il y a 10 p.p.m. d'O_2 dans de l'azote, ceci signifie que le volume d'oxygène est le $\frac{10}{1.000.000}$ du volume total du mélange.

De façon pratique et pour imager la faible fraction que représente le p.p.m., il est bon d'avoir à l'esprit que 1 % = 10.000 p.p.m.

.../..

N.B. / On a ou écrit ou même utilisé le terme V.p.m.

A cette époque, on avait fait la différence entre :

- partie par million exprimée en volume : V.p.m.
- partie par million exprimée en masse : p.p.m.

L'appellation V.p.m. est maintenant proscrite pour éviter toute confusion et malentendu.

La teneur en impuretés s'exprime en partie par million; On doit écrire p.p.m. volume ou p.p.m. ceci sous-entend qu'il s'agit d'un rapport de volume.

Garder à l'esprit que 1 % = 10.000 p.p.m.

Si l'on veut exprimer le rapport d'une impureté dans un autre rapport que celui des volumes, il est obligatoire de noter les unités.

Exemple : 5 mg/tonne ou 5 mg/m3 ou 5 ml/tonne

III - 2. RAPPEL DES QUALIFICATIFS DU TERME PRESSION

Lorsque l'on fabrique des mélanges, on utilise souvent les qualificatifs absolues, relatives, effectives, partielles, totales, atmosphériques, résiduelles...

Il est bon d'en connaitre la signification.

Avant tout, il faut rappeler que l'unité légale de pression dans le système international SI est le N/m2; dans notre industrie, nous utilisons le bar,

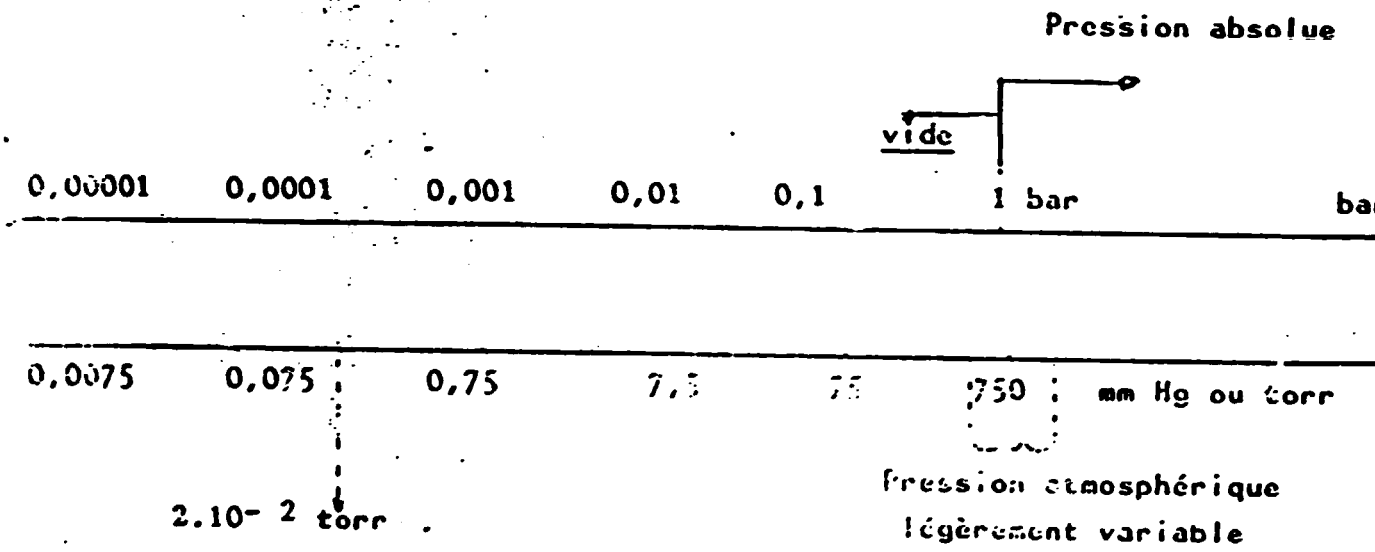
$$1\ N/m^2 = 10\ bars \text{ et } 1\ bar = 750\ mm\ Hg$$

que par ailleurs 1 mm Hg = 1 Torr

../..

Il est indispensable de connaître ces trois unités :

- la pression atmosphérique est lue le plus souvent sur un baromètre à mercure en m. Hg.
- Le vide quant à lui est souvent exprimé en torr, ainsi la caractéristique d'une pompe à vide est exprimée de la façon suivante :
  - " la qualité du vide atteint 2 X 10^{-2} torr ",
- les autres pressions au delà de la pression atmosphérique sont exprimées en bars *.



Pression atmosphérique :

Que l'on écrit parfois en abrégé Patm. est celle qui règne autour de nous et dans tout système ouvert, sa valeur est fixée par convention à 1 bar.

* Pour cette unité, deux écritures sont tolérées 100 bars ou 100 bars

Pression absolue :

PA celle qui est la plupart du temps lue sur les manomètres est égale à la pression qu'un gaz exerce sur les parois d'une enceinte fermée, augmentée de la pression atmosphérique (1 bar).

Pression relative ou effective PR :

C'est la pression exercée par un gaz ou un mélange de gaz sur les parois d'un système fermé PR = PA - 1 bar.

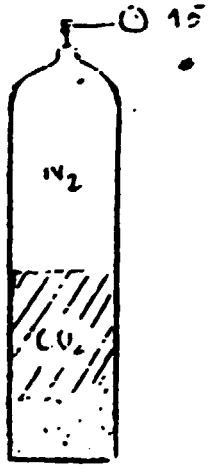
Pression partielle :

Pp c'est la pression qu'exercerait un des constituants du mélange gazeux sur les parois d'une enceinte fermée.

Pression totale P_T :

Terme employé pour désigner la somme des pression partielles des constituants d'un mélange. P_T = Pp (Somme des pressions partielles).

Exemple illustrant ce vocabulaire :



- Pression absolue P_A lue au manomètre 150 bars.
- Pression relative P_R du mélange 149 bars.
- Pression partielle d'Oxygène: Pp O_2 = 10 bars
- Pression partielle de CO_2 : Pp CO_2 = 20 bars
- Pression partielle d'Azote : $P_p N_2$ = 120 bars

P_T = Pp = 150 bars

Remarques :

Il est important de noter que la pression partielle est une pression absolue et comme nous le verrons plus loin pour son calcul, on s'en refère toujours à la pression absolue.

Dans la plupart des cas, les manomètres utilisés sont des manomètres indiquant la pression en pression relative.

II - 3 . TERMES O.S. ET PURETES

Lorsque l'on réalise un mélange à deux ou trois constituants, l'un des constituants que l'on désigne sou le qualificatif " principal " présente une teneur souver supérieure à 60 % voire 80 %.

On présente l'écriture de ce mélange de la façon suivant

. Ar 4,5 %
N_2 q.s. } au lieu d'écrire { Ar 4,5 %, N_2 95,5 %

ou CO_2 10 %
O_2 3 % } au lieu d'écrire { CO_2 10 %, O_2 3 %
N_2 q.s. N_2 87 %

Il s'agit d'une simplification d'écriture qui n'est pas obligatoire mais évite des erreursdu styie :

[- CO_2 12 % - O_2 6 % - N_2 83 %
avec Σ % > 100]

Le terme q.s. signifiant quantité supplémentaire pour atteindre la pression finale souhaitée

../..

Puretés :

Les fabricants européens utilisent des conventions pour désigner leurs gaz purs.

Ainsi à l'AIR LIQUIDE N45 ou 60
chez MESSER qualité 5.5. ou 4.8. ou 6.0.
chez B.O.C. on indique la pureté 99,995 % ou 99,997 %

C'est la forme d'expression que l'on adoptera pour le moment.

Dans les deux premiers cas :

. le 1er chiffre désigne le nombre de 9 significatifs

. le 2° chiffre désigne le chiffre significatif suivant :

Exemple : N 45 ou qualité 5.5. est un gaz d'une pureté de : 99,995 %

Le vide est obtenu à l'aide d'une pompe à palette, la qualité du vide atteint est de l'ordre de 2.10^{-2} torr,

(Soit un volume de gaz parfait à 15°C $1,5\ 10^{-3}$ l dans une bouteille de 50 l de capacité en eau).

III - 4. 1. Contraintes de la mise sous-vide

III - 4.1.1. Au niveau de l'équipement tout le matériel

- vannes
- soufflets
- flexibles
- clapets
- manomètres
- soupapes

../..

Sont d'un type spécial et doivent " tenir le vide ".

Il faut en particulier éviter de mettre sous vide, les bouteilles équipées de robinets à " gros passage ".

III - 4.1.2. Il faut éviter de démonter une bouteille de la rampe de mise sous-vide qui aurait été isolée par le robinet et la laisser en l'état.

Pour cela, chaque rampe de mise sous-vide est reliée à une bouteille de gaz permettant l'inertage.

" Inertage " : mise d'une pression de gaz depuis le vide jusqu'à la pression atmosphérique ou légèrement au delà dans la bouteille.

III - 4.1.3. L'inertage d'une bouteille doit toujours être fait avec un gaz neutre pur.

Afin de limiter les risques d'accidents, il est interdit d'inerter avec un combustible ou un comburant.

La raison de cette règle est la suivante :

- Considérons une bouteille de mélange Ar/H_2 avec 4 % d'Hydrogène, elle est équipée d'un robinet C pour gaz neutre. Après mise sous-vide, elle sera inertée à l'argon. Si cette bouteille était inertée à l'Hydrogène et qu'elle soit ensuite conduite par inadvertance vers la rampe de remplissage Ar/O_2 avec $O_2 < 20$ % sur laquelle il serait possible de la monter puisque cette bouteille est également équipée d'un robinet C, on courrait le risque de compression de l'oxygène au dessus d'un volume d'hydrogène !

../..

Se rapporter aux schémas [illegible] : 27 303 B D_2 -
27 987 B D_2
988 B D_2

III - 4.2. Mise sous-vide avec séchage

Comme nous le verrons dans le paragraphe IV-3, le traitement de certaines bouteilles avant remplissage nécessite le passage sur cette rampe.

D'une façon générale, ce sont les bouteilles susceptibles de contenir de l'eau sous forme liquide.

On a dit précédemment que la mise sous vide permettait d'éliminer les constituants gazeux d'un récipient.

Lorsqu'un récipient contient de l'eau, les caractéristiques physiques de ce corps entravent et rendent difficile et longue son élimination par simple mise sous-vide.

Rappels :

L'air contient de l'eau sous forme gazeuse. Ceci s'exprime dans les bulletins météorologiques par les termes degré hygrométrique, degré hygroscopique, humidité relative.

On désigne par là : quantité d'eau à saturation (1)
le rapport quantité d'eau réelle (2)

(1) C'est la quantité d'eau (sous forme vapeur) maximale que peut contenir un volume d'air ambiant dans des conditions de P et T bien définies.

.../...

(2) C'est la quantité d'eau (sous forme vapeur) mesurée et réellement contenue à cet instant dans un volume d'air ambiant à des conditions P et T bien définies (volume, P et T sont bien sûr identiques).

Des courbes et des expériences simples nous montrent que les quantités d'eau (sous forme vapeur) susceptibles d'être contenues dans un même volume d'air, varient avec la pression et la température.

- Quand la température diminue, cette quantité diminue.
- Quand la pression diminue, cette quantité augmente.

Un récipient dont le robinet est resté longtemps ouvert contient de l'air ambiant, les différences de température entre la nuit et le jour amènent une condensation de la vapeur d'eau, il est à craindre que cette bouteille contienne de l'eau sous forme liquide.

De même qu'un récipient après épreuve hydraulique qui est simplement retourné pour la vidange et séché à l'air chaud contient encore de l'eau sous forme liquide.

Lorsque l'on fait le vide, au bout de 15 mn environ, le manomètre indiquera bien 2.10^{-2} torr. Si l'on referme le robinet de la bouteille et que l'on attende quelques heures; dans la bouteille, il y aura remise en équilibre de la phase vapeur et de la phase liquide et l'on pourra lire par exemple :

- 20 mm de Hg s'il reste encore de l'eau liquide et si la température ambiante $\simeq$ 18°C.

Par mise sous-vide successive, on arriverait à éliminer totalement cette eau, mais cette opération serait très longue.

../..

Annex #
(c3)

Aussi, pour éviter cela, on chauffe de façon à n'avoir dans la bouteille que de l'eau sous forme gazeuse. L'eau est alors éliminé de la même façon qu'un constituant gazeux.

Pour cela, consultez le schéma nGI 712 27 304 B D_2.

III - 5. PRECISION SUR LA TENEUR DES CONSTITUANTS

III - 5.1. Rappels

Erreur absolue :

C'est par exemple l'erreur de lecture sur une mesure de longueur. On a lu 153 cm alors que la mesure vraie est 150 cm. Cette erreur peut être engendrée soit par l'opérateur soit inhérente à la règle utilisée.

L'erreur absolue est désigné par :

$$\Delta l = (153 - 150) = 3 \text{ cm}$$

Erreur relative :

C'est le rapport de l'erreur absolue à la mesure vraie. Dans l'exemple précédent, l'erreur relative que l'on désigne souvent par α et que l'on exprime en % sera :

$$\alpha = \frac{3}{150} = 0,02 = 2\ \%$$

Généralement, la qualité des appareils de mesure en plus de leur fidélité, s'exprime par leur précision.

.../...

Exemple :

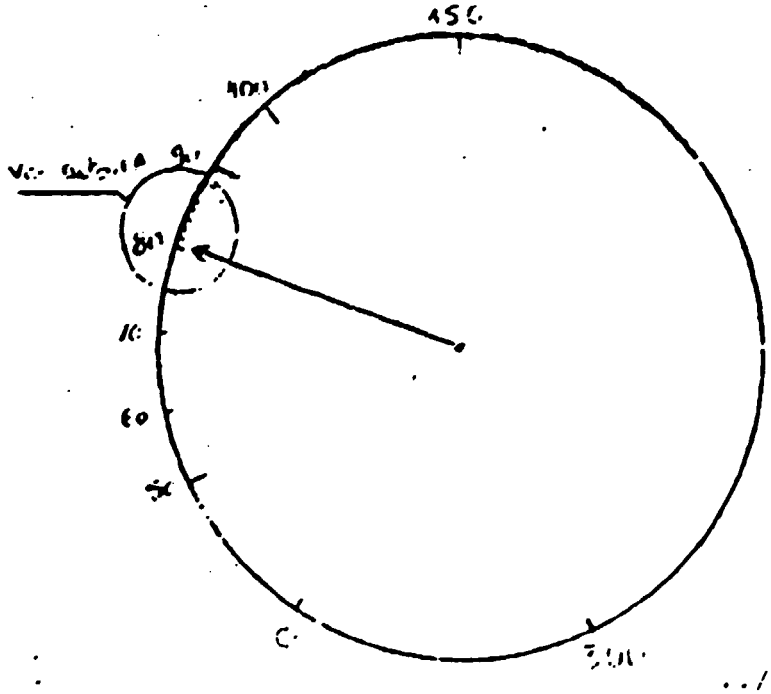
On va utiliser pour effectuer une mesure de pression, un manomètre 0 - 300 bars désigné pour ses qualités de la manière suivante :

- Précision commerciale ou classe 1 %
- Précision de lecture 0,6 bars

- La précision commerciale signifie que pour une valeur vraie de la pression P la valeur affichée P' peut varier de 1 %. Cette précision commerciale est donc l'erreur relative, engendrée par le manomètre $\frac{\Delta P}{P} = 1\ \%$

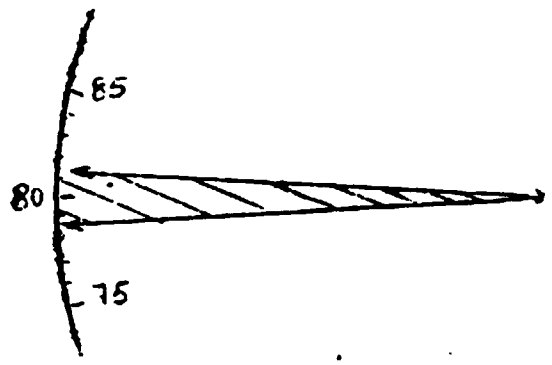
- La précision de lecture donnée également par le constructeur est inhérente à la construction (diamètre du cadran - graduations...). Elle est connue sous forme absolue.

- Ainsi, supposons que sur ce manomètre, on veuille faire une mesure de pression dont la valeur vraie serait 80 bars.



../..

Détail : A .



L'erreur totale que l'on va commettre lors de la lecture sera :

ΔP = erreur dûe à la précision de la lecture + erreur dûe à la précision commerciale

ΔP_1 ΔP_2

$\Delta P_1 = \underline{0,6}$ bars

$\Delta P_2 = 0,01 \times 80 = 0,8$ bars

Soit une erreur totale relative de $\frac{1,4}{80} = \pm 1,75\ \%$

Pour une valeur vraie de 80 bars, notre lecture pourra varier de :

78,6 à 81,4 bars

III - 5.2. Précision des mélanges

Dans notre méthode, les sources d'erreurs sur la teneur des constituants d'un mélange sont introduites du fait :

. des erreurs de lecture sur les manomètres,

. des erreurs intrinsèques de ces manomètres (précision commerciale),

../..

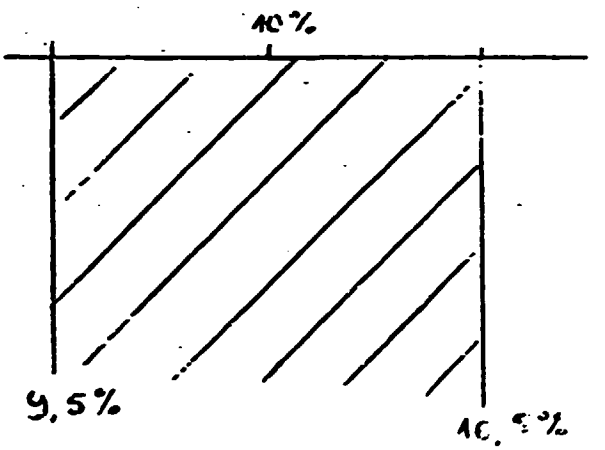
. des erreurs de lecture des thermomètres.

Les calculs d'erreurs effectués, montrent que pour la gamme des mélanges prévus, un opérateur attentif réalisera sans difficultés des mélanges dont la précision oscillera entre :

$\pm$ 1 % et $\pm$ 4 %

Pour les mélanges réalisés au C.C.A.M., nous pourrons alors afficher une précision de $\pm$ 5 %.

Ceci signifie par exemple, que pour un mélange Ar/H_2 avec 10 % d'H_2, la teneur possible en hydrogène pourra varier de 9,5 % à 10,5 %.



Ce mélange pourra être commercialisé avec une fiche de contrôle.

	TENEURS	PRECISIONS
Mélange AR/H_2	H_2 10 % Ar q.s.	$\pm$ 5 %

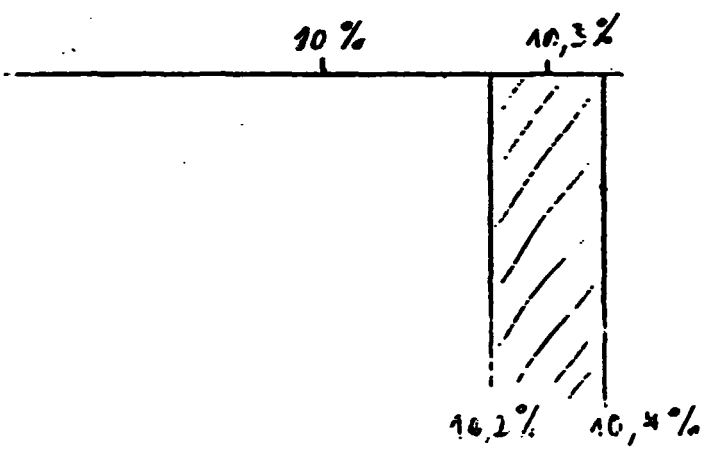
../..

Pour ces mélanges, nous avons retenu le principe d'une analyse par rampe (une rampe représente suivant le cas, un lot de 5 ou 10 bouteilles).

Dans ce cas précis, l'analyse qui sera faite, donnera une teneur par exemple 10,3 %.

Cette valeur sera également entachée d'une erreur inhérente aux appareils d'analyse. La précision des appareils d'analyse est voisine de ± 1 %.

Ainsi pour ce mélange prévu à 10 % en H_2, si l'analyse indique 10,3 %, la teneur possible en hydrogène peut varier de 10,2 à 10,4 %.



Dans le cas des mélanges " précis " chaque bouteille sera analysée et pourra être commercialisée avec sa fiche d'analyse.

	TENEURS	PRECISION
Mélange Ar / H_2	H_2O = 8 ppm O_2 = 30 ppm H_2 = 10,3 %	± 1 %

IV - EMBALLAGES

Un lot de 200 bouteilles à gaz comprimés destinées à contenir des mélanges gazeux sera affecté au C.C.A.M.

Dans un premier temps, ces bouteilles seront répertoriées en notant :

- N° du constructeur - Nom du Constructeur - date de Construction.
- Pression d'épreuve - Date d'épreuve
- N° SNS/GI - Pression de service à 15°C. - Affectation

Ce premier lot de 200 bouteilles sera affecté de la manière suivante :

- 30 Mélanges Azote/ Hydrogène avec Hydrogène < 5 %
- 30 " Argon/ Hydrogène avec Hydrogène < 5 %
- 10 " $N_2/CO_2/O_2$ avec Oxygène < 20 %
- 10 " Ar/CO_2
- 5 " Ar/O_2 avec Oxygène < 20 %
- 10 " He/N_2
- 5 " He/O_2 avec Oxygène < 20 %

- 40 Mélanges Azote /Hydrogène avec Hydrogène ≥ 5 %
- 40 Mélanges Argon /Hydrogène avec Hydrogène ≥ 5 %

- 10 Mélanges N_2 / CO_2 / O_2 avec Oxygène ≥ 20 %
- 5 " Ar / O_2 avec " ≥ 20 %
- 5 " He / O_2 avec " ≥ 20 %

../..

Les bouteilles devront être peintes et équipées de robinets neufs.

Pour cela, consulter les chapitres :

- Utilisation et identification aux couleurs
- Raccord de sortie des robinets.

Pour l'azote pur, il faudra également retirer un lot de 100 bouteilles neuves et les équiper correctement.

Pour le gaz pur argon, nous utiliserons les bouteilles en service actuellement.

De même pour les cadres de gaz pur argon ou azote et éventuellement de mélanges.

IV - 1. REGLEMENTATION

- De façon succinte, les bouteilles à gaz comprimé appartiennent au groupe des appareils à pression de gaz soumis à la réglementation suivante :

  - Réepreuve obligatoire tous les cinq ans pour les appareils mobiles dont le produit P.V. > 60 avec $P > 4$

    La pression étant exprimée en bars, le volume en litres.

  - Pour ces récipients, la pression d'épreuve doit être au moins les 3/2 de la pression de service à 50°C.

$$PE = \frac{3}{2} PS \quad (50°C)$$

Dans notre parc, nous trouvons des bouteilles dont les pressions d'épreuve varient suivant l'âge et la provenance des bouteilles. Les cas les plus fréquents sont cependant des bouteilles dont la pression d'épreuve est 300 bars ou 261 bars.

../..

Ceci en appliquant la règle des gaz parfaits $\frac{PV}{T}$ = Cte. nous conduit à des pressions de service à 15°C suivantes :

- P_E = 300 bars P_S (50) = 200 bars P_S (15°C) = 178 bars
- P_E = 261 bars P_S (50°C) = 172 bars P_S (15°C) = 155 bars
- P_E = 258 bars P_S (50°C) = 166 bars P_S (15°C) = 147 bars

Pour éviter toute confusion, une seule pression de remplissage est retenue 147 bars. (par abus de language, on dit 150 bars).

IV - 2. PRINCIPE D'UTILISATION ET D'IDENTIFICATION AUX COULEURS DES BOUTEILLES DE MELANGE DE GAZ

La convention retenue s'appuie sur les couleurs conventionnelles actuellement utilisées. Elle permet parmi un lot de bouteilles de gaz comprimés :

-de repérer une bouteille de mélange de gaz,
- d'identifier les constituants du mélange et parmi ceux-ci le constituant principal,
- de déterminer le type de robinet qui équipe la bouteille.

Ce dernier point est important, car une bouteille contenant un mélange dont l'un des constituants est un combustible (hydrogène) doit être équipée d'un robinet type C quand la teneur en combustible est inférieure à 5 %, d'un robinet type E quand la teneur en combustible est supérieure ou égale à 5 %.

De la même façon, une bouteille contenant un mélange dont l'un des constituants est un comburant (oxygène - proto) doit être équipé d'un robinet type C quand la teneur en comburant est inférieure à 20 %; d'un robinet type O quand la teneur en comburant est supérieure ou égale à 20 %.

../..

IV - 2.1. La bouteille de gaz comprimé contenant un mélange se distingue de la bouteille contenant un gaz pur par la couleur du corps et du chapeau qui seront peints en orange.

Rappel :

Pour les bouteilles de gaz purs (Azote, Argon, CO_2) seuls l'ogive et le chapeau sont peints suivant les teintes conventionnelles.

IV - 2.2. Les teintes apposées sur l'ogive permettent :

a) d'identifier les constituants en présence (2 ou 3 suivant le cas) en utilisant les teintes conventionnelles que nous rappellons en partie ici :

- Azote : Noir
- Oxygène : Blanc
- Argon : Jaune
- Hélium : Marron
- CO_2 : Gris
- Proto : Bleu
- Hydrogène : Rouge

b) la couleur de fond de l'ogive (celle qui couvre la plus grande surface) est représentative du gaz principal. La (les) couleur(s) de la (des) bande(s) est (sont) représentative(s) de (des) l'autre(s) constituant(s).

../..

IV - 3.3. La bande colorée située à mi-corps de la bouteille permet d'identifier le raccord de sortie du robinet donc le type de robinet qui équipe la bouteille.

Pour cela, nous avons retenu la convention suivante

- Bande noire raccord " neutre " robinet type C
- Bande blanche raccord "comburant" robinet type G
- Bande rouge raccord " combustible " type E

La planche jointe en annexe montre différents exemples des principaux mélanges que nous rencontrerons.

* Pour les cadres lorsque le cas se présentera, nous suggérons de peindre la plaque d'identification du cadre aux couleurs des constituants et de reprendre l'identification en toute lettre concernant les caractéristiques du mélange.

IV - 3. CONTROLE DES BOUTEILLES AVANT REMPLISSAGE

Nous reprenons dans ce chapitre, plusieurs règles essentielles à observer dans le cadre de l'exploitation du C.C.A.M.

Règle 1 :

Avant de remplir un récipient, s'assurer que celui-ci est Algérianisé (poinçon du S.M.A. - croissant + étoile). Seul le remplissage de ces récipients est autorisé. Dans les autres cas, en référer au Service Exploitation de la Division.

Règle 2 :

Avant remplissage, toutes les bouteilles doivent être obligatoirement vidées à l'air libre du gaz qu'elles peuvent encore contenir.

.../...

Lors de cette vidange, en profiter pour déceler à l'odorat la présence d'autres gaz; si tel est le cas, écarter cette bouteille avant expédition vers un centre de réepreuve.

Règle 3 :

S'assurer que la bouteille n'est pas périmée d'épreuve (en lisant la date de réepreuve inscrite sur l'ogive), s'assurer que la pression de service gravée sur cette même ogive est bien 150 bars à 15°C.

Règle 4 :

Contrôle de l'état général de la bouteille.

- Un contrôle visuel extérieur permet de déceler des déformations des fissures, un état de corrosion avancé, des traces d'échauffement du corps par coups d'arc ou de chalumeaux, le mauvais état d'un robinet, un robinet ayant reçu un choc.
- Un contrôle sonore en frappant légèrement la bouteille avec un maillet ou un objet en bois peut révéler un son mât anormal.

Si une partie de cet examen s'avère positive, écarter la bouteille et la diriger sur un centre de réepreuve.

Règle 5 :

Contrôler pendant le remplissage et/ou après remplissage les fuites éventuelles au niveau du robinet à l'aide d'eau savonneuse.

Ne jamais laisser partir une bouteille en clientèle sans qu'elle soit munie de son chapeau.

../..

Annex H
(34)

Toutes ces règles générales reprennent les I.T. 2/75 - 3/75 01/79 et sont communes à tous les centres de conditionnement.

Pour le C.C.A.M. avant remplissage d'autres opérations spécifiques devront être effectuées, les règles sont définies ci-dessous.

Règle 6 :

La bouteille contient une pression de gaz résiduelle importante. Ceci pourrait être déterminée par manométrage, cependant chez un opérateur habitué, cette sensation est nette.
Le robinet de cette bouteille, si toutefois, il n'y a pas de doute quant au test de l'odorat, était fermé.

Cette bouteille sera entièrement vidangée, mise sous-vide et remplie sur les rampes correspondantes.

Règle 7 :

La bouteille contient une pression de gaz résiduelle faible ou nulle. Il peut y avoir deux causes à cela :

a) - Le robinet ne joue plus son rôle par défaut mécanique
b) - Le robinet de cette bouteille est resté ouvert.

Afin de déterminer cette cause, on utilisera une poire (cf. schéma annexe). Si après manoeuvre du volant du robinet en position ouverte, il est impossible d'introduire le gaz contenu dans la poire; un défaut mécanique du robinet est à craindre, cette bouteille sera écartée avant expédition vers un centre de réépreuve.

Dans le cas contraire, la bouteille dont le robinet est resté ouvert, peut contenir de l'air et donc un taux d'humidité non négligeable. Cette bouteille devra d'abord être conduite au super-séchage, puis à la mise sous-vide et au remplissage sur les rampes correspondantes.

../..

Comme nous le verrons plus loin, une simple mise sous-vide ne permettrait pas d'éliminer l'eau contenue dans la bouteille.

Toutes les bouteilles revenant du centre de réepreuve devront suivre ce même circuit.

Règle 8 :

Comme précisé à la règle 1, la vidange des bouteilles sera faite à l'air libre. Ici cependant, il faudra dans la mesure du possible vidanger les bouteilles par lot groupé de même mélange et dans tous les cas, éviter de vidanger côte à côte des mélanges à base d'oxygène et des mélanges à base d'Hydrogène.

Règle 9 :

Applicables aux cadres seulement.

Quand il s'agit d'un cadre de gaz purs,

- si la pression résiduelle est importante, contrôler par analyse, la qualité du gaz résiduel.

  . Si cette analyse est conforme à nos garanties, envoyer le cadre au remplissage.

  . Si cette analyse n'est pas conforme : vidanger, mettre sous vide, puis remplir.

- si la pression résiduelle est faible, contrôler qu'il ne s'agit pas d'un défaut mécanique du robinet, mettre sous-vide puis remplir.

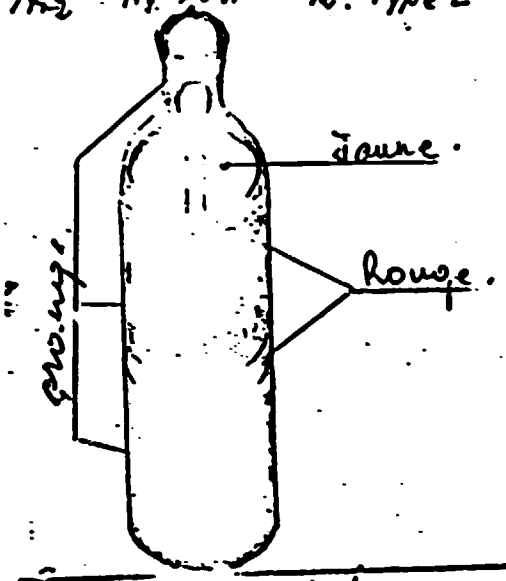
Quand il s'agit d'un cadre de mélange,

- vidanger, mettre sous-vide dans tous les cas, puis remplir.

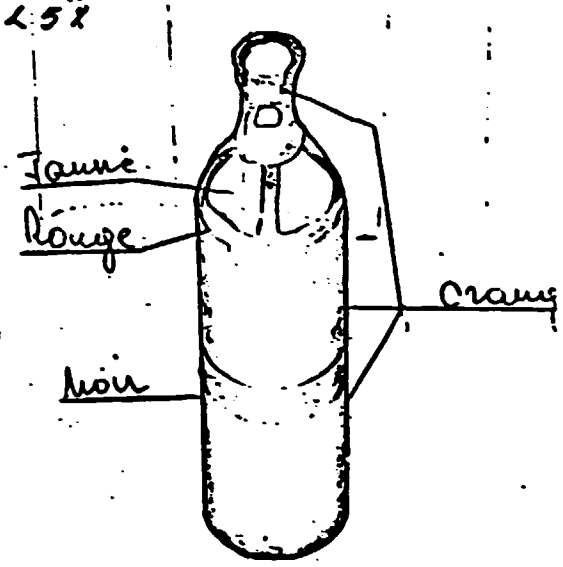
.....

Ar/H_2

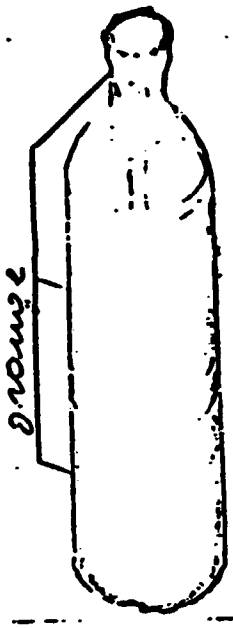
Ar/H_2 H_2 > 5% R. Type E



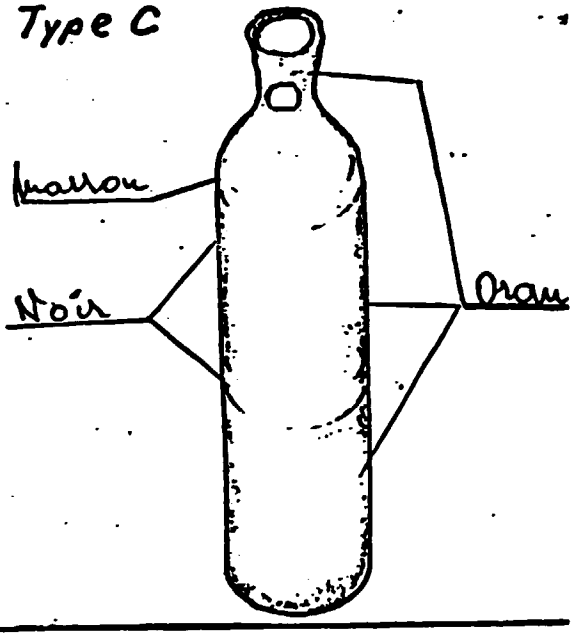
Ar/H_2 H_2 < 5%
R. Type C



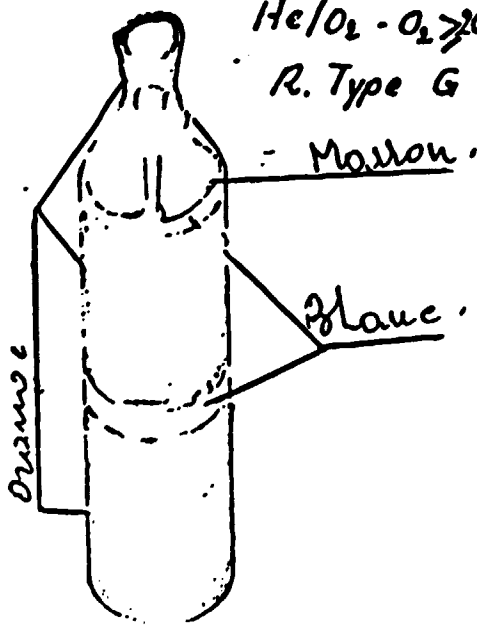
Ar/CO_2
R. Type C



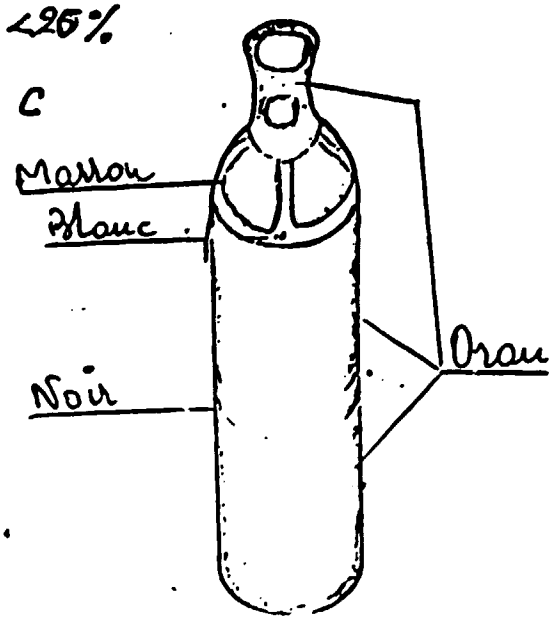
N_2/He - R. Type C
R. Type C



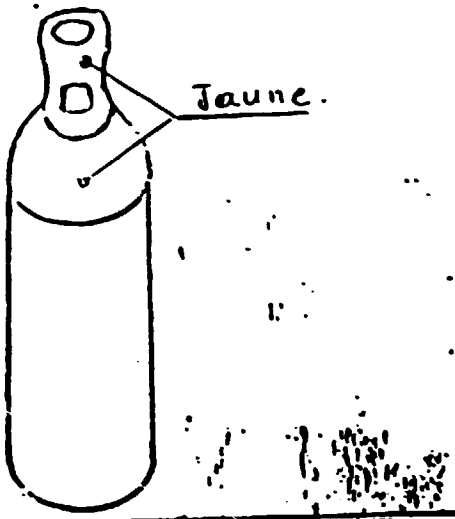
He/O_2 - O_2 ≥ 26%
R. Type G



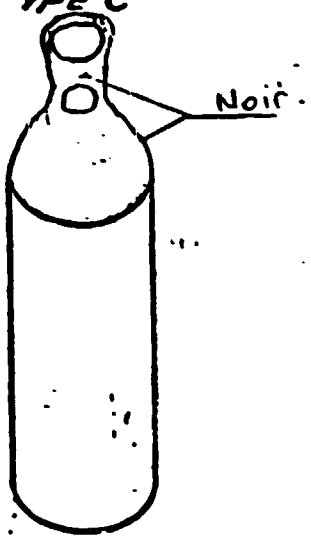
He/O_2 - O_2 < 26%
R. Type C



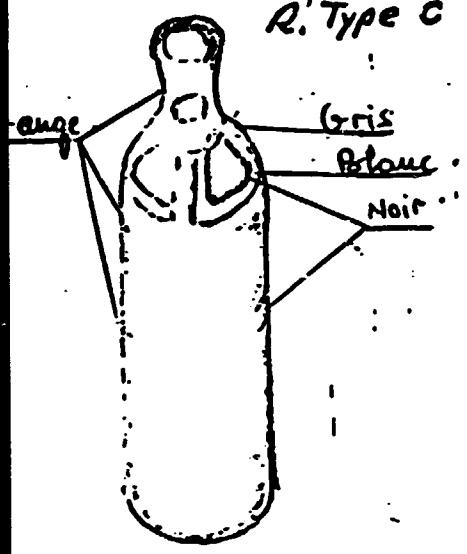
ON PUR. ROBINET TYPE C



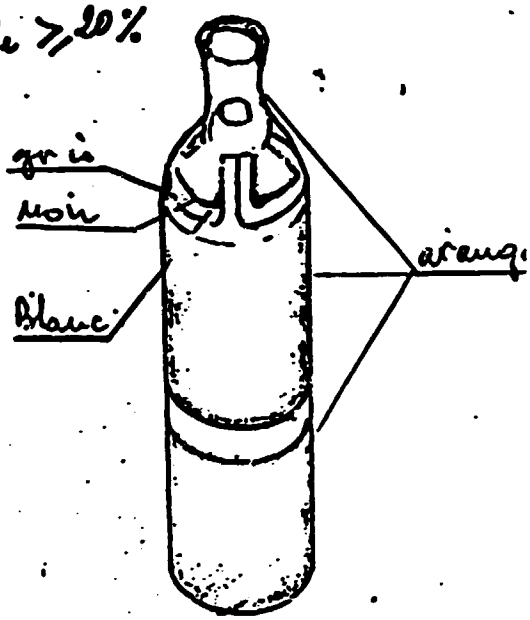
AZOTE PUR. ROBINET TYPE C



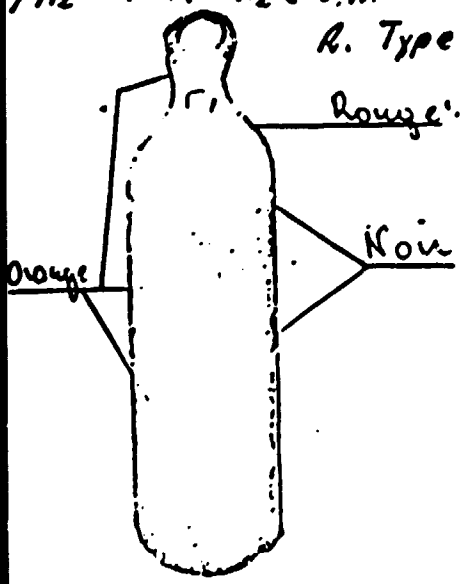
$_2/CO_2/O_2$ $O_2 < 20\%$
R. Type C



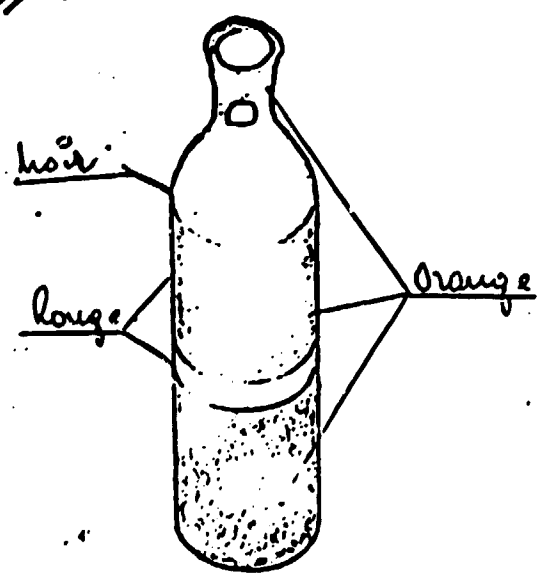
$N_2/CO_2/O_2$ $O_2 \geq 20\%$
R. Type G

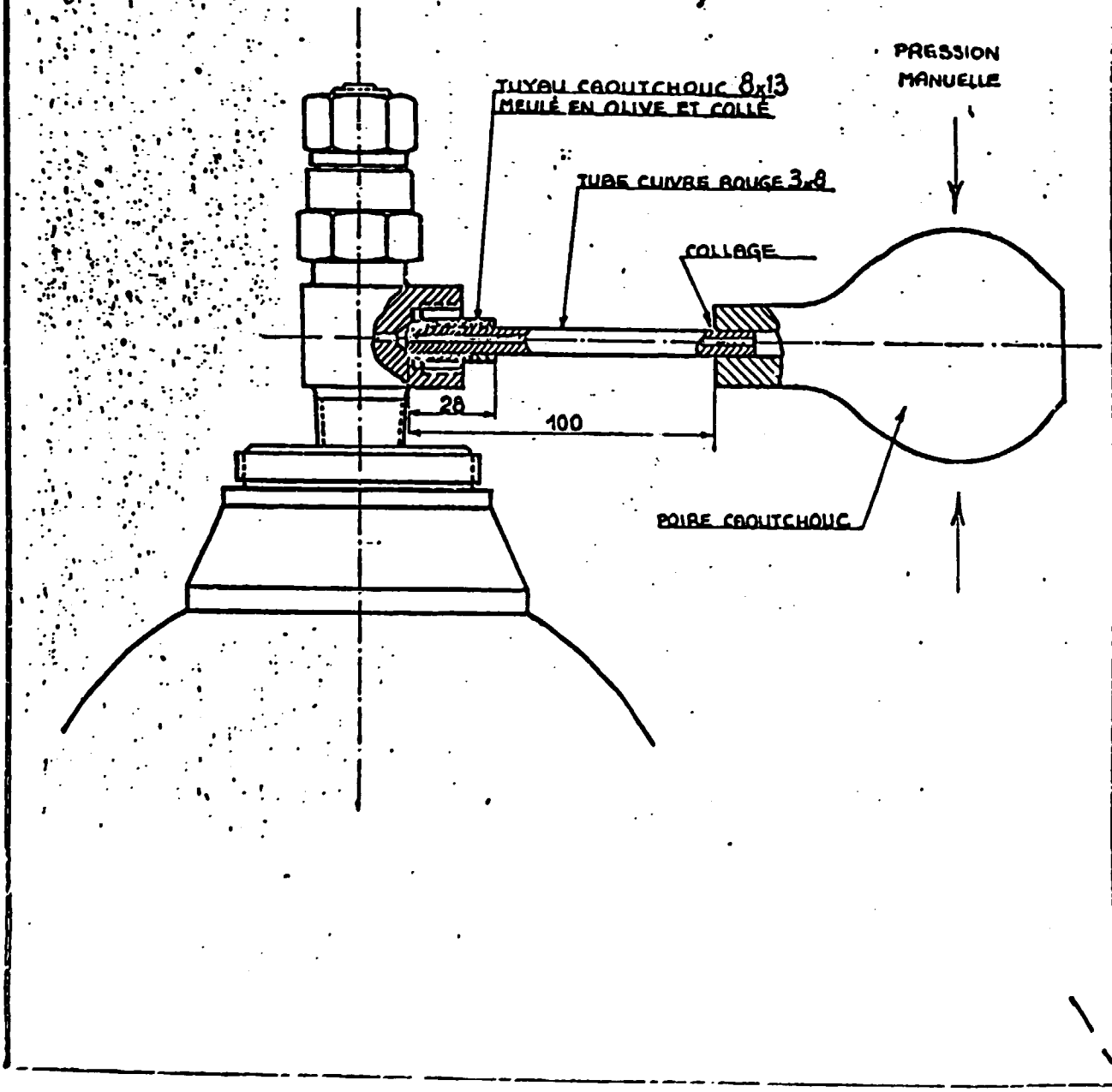


$/H_2$ $H_2 < 5\%$
R. Type C



N_2/H_2 $H_2 \geq 5\%$
R. Type E



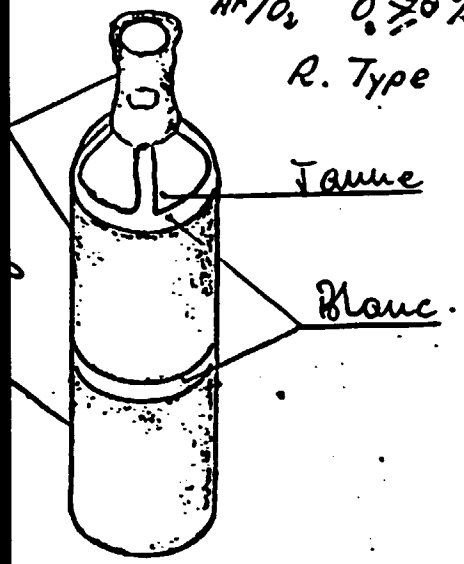


: Dispositif permettant de detecter l'obturation du robinet des bouteilles à GAZ.

SNS/GI 6 16/07/80

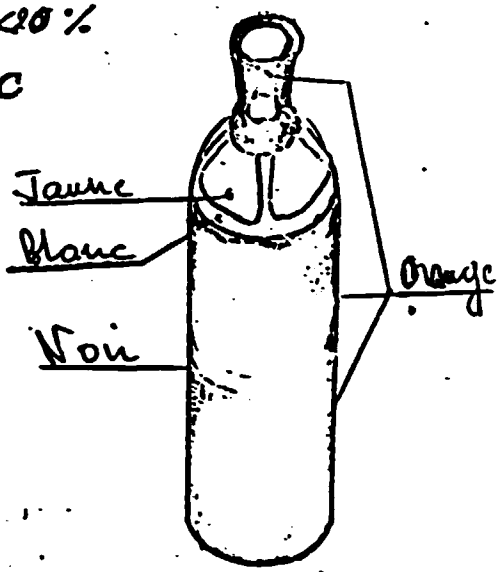
Ar/O_2 $O_2 \geq 20\%$

R. Type G



Ar/O_2 $O_2 < 20\%$

R. Type C



V - PRINCIPE GENERAL

Se reporter au schéma M.G.I. intitulé : " schéma de la centrale de remplissage P + I 790 25 918 FH_2 ".

La centrale de remplissage est alimentée depuis des stockages liquides pour le CO_2, l'Argon, l'Azote, l'Oxygène ou des stockages gazeux (cadres) pour l'Hélium et l'Hydrogène.

Les produits liquides sont prélevés dans les tanks des installation de production. L'Argon, l'Azote, l'Oxygène seront pompés, vaporisés et conduits sous canalisation H.P. vers trois réservoirs tampons. Le CO_2 sera pompé liquide vers le réchauffeur installé dans le laboratoire. La distribution des 6 produits vers les rampes de remplissage s'effectue toujours sous forme gazeuse.

Les différents éléments pressostats, soupapes, manomètres, clapets détendeurs, vannes... assurent la sécurité de l'ensemble , permettent l'isolation, le remplissage, les purges.

Lecture du schéma - Explication du rôle de chaque élément.

Remarquer les deux analyseurs O.I.A 9300 et O.I. . 9301 qui sont branchés en permanence et détectent la présence d'Hydrogène dans l'Argon ou l'Azote ——— sécurité " clé " de l'installation.

Noter le rôle de la soupape 50 bars sur le circuit CO_2.

VI - METHODE DE FABRICATION

La méthodologie détaillée sera fournie par CERSEM, elle fera l'objet d'une notice d'exploitation.

On peut cependant évoquer les paramètres qui seront à contrôler et à suivre pendant la fabrication. La méthode retenue est dite " manométrique "; ceci signifie que c'est par l'intermédiaire d'une mesure de pression que l'on repère et détermine la teneur du ou des constituants du mélange.

../..

VI - 1. LES GAZ PARFAITS

En première approximation, considérons que les gaz utilisés suivent les lois des gaz parfaits :

- Loi de Mariotte : $PV = nRT$

  dans laquelle R est une constante

  T la température du gaz en °K

  P la pression absolue du gaz en ata

  V le volume du récipient en litre

  n le nombre de molécules de gaz

  R exprimé en $\frac{\text{ata - litre}}{K}$ dans ce cas

- Application :

  Calculer R dans ce système et dans les systèmes

  $\frac{\text{bars - litre}}{K}$ ou $\frac{\text{bar - m3}}{K}$

- Loi de DALTON qui exprime pour un mélange de gaz, chacun d'eux étant supposé parfait, il existe la relation suivante entre les pressions partielles et la pression totale $PT = \sum P_p$

  De ces deux lois, on en déduit que dans le cas de deux gaz parfaits, la teneur de chacun d'eux (le rapport du volume de gaz de l'un ou l'autre au volume total de gaz $\frac{V_1}{V}$ ou $\frac{V_2}{V}$ exprimé en pourcentage est aussi égal au rapport de la pression partielle à la pression totale absolue :

$$X_1\ \% = \frac{V_1}{V} = \frac{P_1}{P} \quad \text{et} \quad X_2\ \% = \frac{V_2}{V} = \frac{P_2}{P}$$

. . . .

Ceci peut être généralisé $Xn\ \% = \frac{Vn}{V} = \frac{Pn}{P}$

avec $X_1 + X_2 + .. + Xn = 1$
$V_1 + V_2 + .. + Vn = V$
$P_1 + P_2 + .. + Pn = P$

Ainsi supposent trois gaz a, b et c parfaits, on souhaite réaliser un mélange tel que Xa = 10 %, Xb = 30 %, Xc = 60 %.

La pression finale de remplissage est fixée à 150 bars (pression absolue).

Après avoir inerté avec a, on introduira le constituant a jusqu'à la pression.

Pab = Xa.P = 0,1.150 = 15 bars lue au manomètre (pression absolue

puis le constituant b jusqu'à la pression P'b

P'b = Xb.P + Pab= 0,3.150 + 15 = 60 bars lue au manomètre

puis le constituant c jusqu'à la pression P'c

P'c = Xc.P + P'b = 0,6.150 + 60 = 150 bars lue au manomètre et qui est bien la valeur finale que l'on s'était fixée.

Dans cet exemple, nous avons introduit les constituants dans la bouteille à l'inverse de leur ordre d'importance; ceci n'est pas une règle stricte, elle est impérative dans certains cas (cf. schéma et expliquer pourquoi) elle permet d'atteindre une meilleure précision.

VI - 2. LES GAZ REELS

En fait, les gaz ne suivent pas la loi des gaz parfaits énoncés par Mariotte, pour être plus exacte, cette loi doit tenir compte du coefficient de compressibilité qui exprime et montre, que suivant la nature du gaz, une molécule n'occupe pas dans les mêmes conditions de température et de pression le même volume (sauf à 0°C et 1 atm. !).

../..

La loi de Mariotte devient $PV = nRTZ$
Z étant fonction de P et T.

Pour illustrer ceci, nous donnons ci-dessous quelques valeurs des coefficients de compressibilité :

Ar	300 °K *	10 atm.	Z	= 0,9938
CO_2	"	"	Z	= 0,9486
H_2	"	"	Z	= 1,0059
O_2	"	"	Z.	= 0,9940
N_2	300 °K	70 atm.	Z	= 0,9984
O_2	"	"	Z	= 0,9636
Ar	"	"	Z	= 0,9643
H_2	"	"	Z	= 1,042

Si l'on ne tenait pas compte de ces coefficients de compressibilité, suivant les gaz utilisés, on pourrait introduire des erreurs allant jusqu'à 10 % sur la teneur de chaque constituant.

On voit que si l'on tient compte de ce coefficient, il faut également suivre avec précision la température.

Le fournisseur aura lorsque c'est nécessaire tenu compte de Z et fournira des planches indiquant les valeurs à afficher sur les manomètres suivant la température ambiante, le type de mélange, la teneur des constituants.

Ex. Mélange Ar / CO_2 5 % CO_2 afficher P CO_2 = X
Pour une pression finale
voisine de = 150 bars 10 % CO_2 afficher P CO_2 = Y
et T = 30°C 20 % CO_2 afficher P CO_2 = Z

* Rappel 0°C = 273 °K.

../..

VI - 3. EXEMPLE DE CALCUL

VI - 3.1. Calcul théorique

Nous allons d'abord montrer l'influence du coefficient de compressibilité.

Supposons un mélange de deux gaz que l'on souhaite obtenir à la pression finale absolue P dans des proportions X_1 et X_2.

VI - 3.1.1. Si les gaz étaient parfaits

$X_1 = \frac{P_1}{P}$ ⟶ Pression partielle absolue du gaz1
⟶ Pression finale absolue du mélange

$X_2 = \frac{P_2}{P}$

Avec $X_1 = \frac{n1}{n}$; $X_2 = \frac{n2}{n}$; $n1 + n2 = n$

VI - 3.1.2. Les gaz ne sont pas parfaits, on doit tenir compte de Z

et appliquer la loi $PV = nRTZ$ (1)

Appliquons la loi à chacun des constituants, puis au mélange :

$P_1 V = n_1 RTZ_1$
$P_2 V = n_2 RTZ_2$
$PV = n RTZ$

D'où l'on peut tirer

$$\frac{V}{RT} = \frac{Z_1 n_1}{P_1} = \frac{Z_2 n_2}{P_2} = \frac{Zn}{P} \qquad (2)$$

../..

$\frac{V}{RT}$ est une constante que l'on peut désigner par k

et l'on peut écrire alors que

$$k\,(P_1 + P_2) = Z_1 n_1 + Z_2 n_2 \quad (3)$$
$$k\,P = Z.n. \quad (4)$$

Pour résoudre ce système, admettons que $P_1 + P_2 = P$ ce qui serait vrai pour des gaz parfaits.

On peut alors tirer

$$Z = \frac{Z_1 n_1}{n} + \frac{Z_2 n_2}{n} = Z_1 . X_1 + Z_2 . X_2$$

ou encore de (2) $P_1 = \frac{Z_1}{Z} \cdot \frac{n_1}{n} P = P . X_1 . \frac{Z_1}{Z}$

$$P_2 = P . X_2 . \frac{Z_2}{Z}$$

On voit donc que les coefficients de compressibilité influent sur la valeur des pressions partielles et que d'autre part, le coefficient de compressibilité du mélange sera tel que :

$$Z = Z_1 . X_1 + Z_2 . X_2$$

Il faut noter que ce calcul n'est cependant pas absolument rigoureux puisque l'on a fait des hypothèses simplificatrices et qu'il ne peut s'appliquer que dans le cas d'un mélange à trois constituants maximum.

Que d'autre part, les calculs numériques devront être menés par itération (approximations successives) en déterminant d'abord des valeurs approchées des pressions partielles puis en recherchant la convergence des valeurs calculées de façon à être en accord avec les trois équations :

$$Z = Z_1 X_1 + Z_2 X_2$$
$$P_1 = P . X_1 . \frac{Z_1}{Z}$$
$$P_2 = P . X_2 . \frac{Z_2}{Z}$$

../..

VI.3.2. Exemple numérique - Méthode pratique

On souhaite réaliser un mélange CO_2-N_2 avec 20 % de CO_2, 80 % d'azote à la pression finale absolue de 150 bars, la température ambiante est de 30°C.

VI.3.2.1. Détermination d'une valeur approchée de Z

On considère que les gaz sont parfaits

$PCO_2 = 0,2 \cdot 150 = 30$ bars $\quad ZCO_2$ à 30 bars, 30°C = 0,8615

$PN_2 = 0,8 \cdot 150 = 120$ bars $\quad ZN_2$ à 120 bars, 30°C = 1,020

On aurait donc

$Z = ZCO_2 \; XCO_2 + ZN_2 \; XN_2 = 0,9843$

VI.3.2.2. Approximations successives pour calculer la pression de chargement du CO_2 et de l'azote

$$P\,CO_2 = 150 \cdot 0,2 \cdot \frac{0,8615}{0,9843} = 25,6 \text{ bars}$$

mais alors Z CO_2 (25,6 bars, 30°C) = 0,865

On recalcule cette pression de chargement

$$P\,CO_2 = 150 \cdot 0,2 \cdot \frac{0,865}{0,9843} = 26,36 \text{ bars}$$

et dans ce cas Z CO_2 (26,36 bars - 30°C) = 0,860

$$P\,CO_2 = 150 \cdot 0,2 \cdot \frac{0,860}{0,9843} = 26,2 \text{ bars}$$

On s'arrêtera ici jugeant que la convergence est suffisante

Même chose pour l'azote

$$P\,N_2 = 150 \cdot 0,8 \cdot \frac{1,07}{0,9843} = 122,35 \text{ bars}$$

Z N_2 (à 122,35 bars, 30°C) = 1,022

$$P\,N_2 = 150 \cdot 0,8 \cdot \frac{1,022}{0,9843} = 122,6 \text{ bars}$$

On s'arrête ici jugeant que la convergence est suffisante.

../..

VI.3.2.3. Calcul du nouveau Z et des pressions à afficher

$Z = 0,2 \cdot 0,36 + 0,8 \cdot 1,022 = 0,9896$

soit les pressions de chargement

$P\ CO_2 = 150.0,2 \cdot \frac{0,860}{0,9896} = 26,1$ bars

$P\ H_2 = 150.0,8 \cdot \frac{1,022}{0,9896} = 123,9$ bars

On constate donc l'écart important par rapport aux pressions partielles calculées suivant la loi des gaz parfaits.

VII - INSTALLATIONS D'ANALYSES

Pour ce chapitre, nous utiliserons le schéma 792 26 524 FA2 et la notice d'utilisation de l'armoire d'analyse.

VII.1. DESCRIPTION GENERALE DE L'APPAREILLAGE

Une armoire d'analyse regroupe tous les appareils " en face avant " à l'exception d'un chromatographe, de l'enregistreur qui lui est lié, d'un appareil d'étalonnage pour les hygromètres.

Cette armoire est également équipée d'un enregistreur et d'une imprimante, l'armoire est implantée dans le laboratoire ainsi que les trois appareils annexes.

Une rampe d'analyse reçoit les bouteilles à analyser, une autre rampe dite d'échantillons reçoit les bouteilles contenant les mélanges nécessaires à l'étalonnage des appareils.

../..

Les connections fluides et électriques sont fixes et permanentes. Noter que l'intérieur de l'armoire est séparé en 3 compartiments ventilés.

En particulier, tous les appareils d'analyse d'hydrogène au niveau du % sont séparés des autres appareils d'analyse.

Le type d'analyse est choisi par un programmateur; par un jeu d'électrovannes, l'enchainement des balayages et analyses est automatique.

Les résultats sont enregistrés en continu, lorsqu'ils sont stabilisés,,ils sont introduits dans une imprimante qui délivre une fiche d'analyse.

La valeur affichée sur l'enregistreur du chromatographe sera également introduite dans l'imprimante.

VII.2. POSSIBILITES D'ANALYSES

Nous allons passer en revue les analyses réalisables par cet ensemble en identifiant chaque appareil noté sur le plan 792 26 52. F/2.

VII.2.1. Détection des impuretés de l'ordre du ppm

VII.2.1.1 Sur l'argon pur et ses mélanges

traces d'H_2O	0....10ppm avec l'hygromètre	QR 9350
traces d'H_2	0....10ppm avec le chromatographe	QR 9351
traces d'O_2	0....10ppm avec l'analyseur	QR 9352

VII.2.1.2. Sur l'azote pur et ses mélanges

traces d'H_2O	0....10ppm avec l'hygromètre	QR 9359
traces d'O_2	0....10ppm avec l'analyseur	QR 9360

../..

VII.2.2. Contrôle des teneurs de l'ordre du %

VII.2.2.1. Pour les différentes mélanges

O_2 dans l'argon	0....30 %	avec l'analyseur	QR 9353
CO_2 dans l'argon	0....30 %	"	QR 9354
H_2 dans l'argon	0....30 %	"	QR 9355
H_2 dans l'azote	0....30 %	"	QR 9363
He dans l'azote	0....60 %	"	QR 9364
He dans l'oxygène	0....100 %	"	QR 9356
CO_2 dans O_2/N_2	0.... 30 %	"	QR 9361
O_2 dans N_2/CO_2	0....100 %	"	QR 9362

VII.2.2.2. Surveillance - sécurité

H_2 dans l'azote	0....1 %	avec l'analyseur	QIA 9300
H_2 dans l'argon	0....1 %	"	QIA 9301
Ambiance laboratoire	H_2/O_2 25% O_2	"	QR 9365

soit en tout, 15 appareils auxquels il y a lieu de rajouter l'appareil permettant l'étalonnage des hygromètres QR 9350 et QR 9359.

VII.3. PRINCIPE SOMMAIRE DES APPAREILS

Finalement, pour toutes les analyses, on utilisera 5 grandes classes d'appareils :

- 2 hygromètres type AQUAMIL
- 1 chromatographe type AIR LIQUIDE 8
- 8 appareils à conductibilité thermique type CALDOS 4 T
- 1 appareil à infrarouge type IRIS 2 T
- 4 appareils thermomagnétiques type MAGNOS 5 T - MAGNOS 3 - Taldy ..

Nous allons essayer de décrire ici, le principe de chacun d'eux. Pour plus de détail, se reporter aux documentations en annexe.

...

VII.3.1. Hygromètre AQUANAL

Dans l'appareil d'étalonnage AQUANAL balayé par un gaz inerte, on introduit des quantités définies d'oxygène et d'hydrogène qui réagissent dans une chambre catalytique pour donner de l'eau.

Le mélange gazeux est conduit vers l'appareil de mesure des traces d'eau AQUANAL. Le gaz rencontre une cellule de mesure (filin électrolytique emprisonnant deux électrodes) l'eau présente dans le gaz est absorbée et décomposée aux électrodes en oxygène et hydrogène. Pour l'étalonnage, l'intensité de courant nécessaire à l'électrolyse est à mettre en parallèle avec les quantités d'eau formées dans l'AQUANAL. Ceci est fait directement par les appareils et indiqué en ppm d'H_2O.

Possibilité de l'appareil

Analyse des concentrations d'eau dans l'air ou d'autres gaz de 5 à 2000 ppm.

Remarques

Les débits et pressions des gaz d'étalonnage ou à analyser doivent rester parfaitement constants.

L'étalonnage est à faire 1 à 2 fois par quinzaine.

VII.3.2. Chromatographe type air

Ce type d'appareil est connu à Air, puisque nous en utilisons un à Réghaïa.

Principe :

Un détecteur soumis à un champ électromagnétique intense est balayé par le gaz porteur (argon haute pureté).

Toute impureté étrangère au gaz initial et traversant la chambre modifie le phénomène de luminescence dans le détecteur.

../..

L'intensité lumineuse de la décharge varie alors et est une fonction stable et continue pour l'impureté introduite.

Pour les différentes fonctions, étalonnages, mise en service, ... se reporter à la notice T.3.T.

VII.3.3. Appareils à conductibilité thermique CATHOS 2 T :

Des chambres en opposition balayées par le gaz porteur et par le gaz à analyser contiennent des résistances qui constituent entre elles un pont de Wheastone. L'introduction d'impuretés différentes de gaz porteur entrainent un déséquilibre du pont, un signal électrique permet après étalonnage de juger des impuretés introduites.

Dans ces appareils, veiller à la constance des débits.

VII.3.4. Appareils à infrarouge UNOR 2 T

Le principe en est le suivant : l'appareil est constitué de deux tubes de mesure dont un contient le gaz de référence, l'autre est balayé par le gaz d'étalonnage ou à analyser, ces tubes sont soumis à un rayonnement infrarouge.

Les gaz dits polyatomiques (CO_2, Hg, Co, H_2O...) présentent à l'inverse de gaz neutres Ar, He une capacité d'absorption de ce rayonnement.

A l'extrémité de ces tubes, se trouve un appareil permettant de mesurer cette absorption qui va se traduire par une différence de rayonnement qui sera traduite en signal électrique. La différence de rayonnement engendre une différence de pression, donc, dans ces appareils, veiller à la constance de la pression.

VII.3.5. Appareils thermomagnétiques

Ces appareils sont basés sur le comportement paramagnétique de l'oxygène utilisé de la manière suivante.

../..

Dans un espace géométrique défini, soumis à un champ magnétique dans des conditions thermodynamiques fixées, il s'établit pour tout gaz neutre, un courant de gaz identique.

Par contre, la présence de molécules d'oxygène, développe des forces qui modifient et accroissent le courant de circulation gazeux.

Deux chambres dont une de référence, contiennent des résistances qui constituent un demi-pont de Wheastone. La présence d'oxygène en modifiant le courant gazeux, refroidit la résistance de la chambre de mesure et engendre un courant électrique proportionnel à la concentration en oxygène.

Pour les appareils Télédyne, la notice trop succinte ne nous permet pas de préjuger du fonctionnement de la cellule, on peut cependant penser qu'il s'agit d'un fonctionnement identique.

Annex J
(1)

DEVELOPMENT OF CHEMICAL REAGENTS

EGYPT

PROJECT

A. DEVELOPMENT OBJECTIVE

To stimulate industrial growth through ensuring an adequate supply in terms of variety, quantity and quality of chemical reagents and fine chemicals. The problem is insufficient know-how for the production of chemical reagents.

B. IMMEDIATE OBJECTIVES

i) Acquiring the necessary know-how for the manufacture of selection of chemical reagents.

ii) Acquiring skills and facilities for modern methods of analysis and testing.

iii) Developing a strong national team of technical personnel in the chemical reagents.

C. BACKGROUND

D. OUTPUTS

Process know-how for medium-scale batch production and purification to meet the end-users' specification:

a) Reagents for analysis which can be used for production and quality control of chemical manufacture;

b) Reagents for UV/HPLC which can be used for the analysis involving liquid chromatography of a high efficiency (HPLC) besides those traditional in UV region;

c) Reagents for spectroscopy for analysis involving spectroscopy.

E. INPUTS

1. Government Inputs

a) Staff salaries for 5 engineers "chemical" and their boss, salaries of trainees;

b) Cost of setting up experiments and of renovation of existing labs.

c) Equipment.

2. UNIDO Inputs

a) Experts

b) Training

c) Equipment

SPECIALTY CHEMICALS SUPPLY AND DEMAND FOR MEXICO IN TECHNICAL CO-OPERATION WITH OTHER DEVELOPING COUNTRIES

VIENA, AUSTRIA MAYO 1988.

SPECIALTY PETROCHEMICALS FROM MEXICO

PRODUCTS SUPPLY

BRANCH/ PRODUCT NAME	JOINT VENTURE	SELLING PROD.	TRANSFER TECH.	TECH. ASSIST.
ADHESIVES:				
ACRILAMIDE	OK	NO	NO	OK
P-TERBUTIL PHENOL	OK	OK	OK	OK
ADITIVES FOR OIL AND FUELS				
ORGANIC AMIDES	OK	NO	OK	OK
DETERGENT PHENATES	NO	OK	NO	OK
INHIBID. PHENATES	NO	OK	NO	OK
ETHYL FLUID	NO	OK	NO	OK
LEAD TETRAETHYLE	NO	OK	OK	OK
FOOD ADTICES				
ARSANILIC ACID	OK	OK	NO	OK
SODIUM BENZOATE	OK	NO	OK	OK
COLIN CHLORURE	OK	OK	NO	OK
METIONINE	OK	NO	NO	OK
CALCIUM PANTOTHENATE	OK	NO	OK	OK

BRANCH/PROD NAME	JOINT VENTURE	SELLING PROD.	TRANSFER TECH	TECH. ASSIST.
COLORANTS				
ACETO ACETANILID	OK	OK	OK	OK
METANILIC ACID	OK	OK	NO	OK
2-NAPHTOL 6-SULFONIC AND 6,8-DISULFONIC ACIDS	NO	NO	NO	OK
SULFANILIC ACID	NO	NO	NO	OK
1,5-DIAMINO 4,8-DIHIDROXIANTAQUINONE	NO	OK	NO	OK
1,5-DIPHENOXI ANTRAQUINONE	OK	OK	OK	OK
1,5-DINITRO 4,8-DIPHENOXI	OK	OK	NO	OK
ANTRAQUINONE	OK	NO	OK	OK
SODIUM NAPHTIONATE	NO	NO	OK	NO
SODIUM M-NITROBENZENE SULPHONATE	OK	NO	OK	OK
EXPLOSIVES				
AMONIUM NITRATE	OK	NO	NO	OK

BRANCH/PROD. NAME	JOINT VENTURE	SELLING PROD.	TRANSFER TECH.	TECH. ASSIST.
PHARMOCHEMICALS				
ACETATO DE FENETIDINA	OK	NO	NO	OK
ACIDO ACETILSALICILICO	OK	NO	OK	OK
BENZOATO DE BENCILO	OK	NO	OK	OK
BIFLUORURO DE AMONIO	OK	OK	OK	OK
FURALTADONA	OK	NO	OK	OK
FURAZOLIDONA	OK	OK	OK	OK
P-HIDROXIBENZOATO DE METILO	OK	NO	NO	NO
METRODINAZOL	OK	NO	OK	OK
METILATO DE SODIO	OK	NO	NO	NO
NITROFURAZONA	OK	NO	OK	OK
SALICILATO DE METILO	OK	NO	OK	OK
P-HIDROXIBENZOATO DE PROPILO	OK	NO	NO	NO
RUBBER CHEMICALS				
ACELERADORES	OK	OK	OK	OK
ANTIOXIDANTES, ANTIOZONANTES, ANTIESPUMANTES Y ESTABILIZADORES	NO	OK	NO	OK

Annex K (5)

BRANCH / PROD. NAME	JOINT VENTURE	SELLING. PROD.	TRASFER. TECH.	TECH. ASSIST.
CATALYST STARTS AND [illegible]				
ACIDO P-TOLUENSULFONICO	OK	OK	OK	OK
OCTOATOS METALICOS	OK	NO	NO	OK
PERBENZOATO DE TERBUTILO	OK	OK	OK	OK
PEROXIDOS ORGANICOS	OK	NO	OK	OK
PLAGUICIDES				
AZODRIN	OK	OK	OK	OK
BROMHUIL	OK	OK	OK	OK
DIPTEREX	OK	OK	OK	OK
ENDRIN	NO	NO	OK	OK
FOLIMAT	NO	OK	OK	OK
MALATION	OK	OK	OK	OK
ACIDO 2,4-D	OK	OK	OK	OK
ACIDO 2,4,5-T	OK	OK	OK	OK
PARAQUAT	NO	OK	OK	OK
TRIFLURALINA	OK	OK	OK	OK
SEVIN	OK	OK	OK	OK
MANEB / ZINEB	OK	OK	OK	OK
PENTACLORONITROBENCENO	OK	OK	OK	OK

BRANCH / PROD. NAME	JOINT VENTURE	SELLING PROD.	TRANSFER TECH.	TECH. ASSIST.
PLASTIFICANTS				
DERIVADOS DEL ANH. FTALICO	OK	OK	OK	OK
TRIACETATO DE PROPANOTRIOL	OK	NO	NO	OK
PROPELENTS				
CLOROFLUOROMETANOS	OK	OK	NO	OK
FLAVORS AND FRAGANCES		O		
ACETATO DE BENCILO	OK	OK	OK	OK
ACETATO DE TERPENTILO	OK	OK	OK	OK
ALCOHOL BENCILICO	OK	OK	OK	OK
ALCOHOL FENILETILICO	OK	OK	NO	OK
ALDEHIDO CINAMICO	OK	OK	NO	OK
BENZOATO DE METILO	OK	OK	OK	OK
POLIETILENGLICOL	OK	NO	OK	OK
TENSOACTIVOS	OK	OK	OK	OK

Annex K
(7)

1/3

PRODUCTS ~~DEMAND~~

BRANCH / PROD. NAME	JOINT VENTURE	BUYING PROD	TRANSFER TECH.	TECH. ASSIS
ADHESIVES				
ACRILAMIDE	OK	OK	OK	OK
ADITIVES FOR OIL AND FUELS				
GLIOXAL	OK	OK	OK	OK
FOOD ADITIVES				
METIONINE	OK	OK	OK	OK
COLORANTS				
P-FENETIDINA	OK	OK	OK	OK
M-FENILENDIAMINE	OK	OK	OK	OK
α y β NAPHTOL	OK	OK	NO	OK
P-NITROCLOROBENZINE	OK	OK	OK	OK
O-NITROTOLUENE	OK	OK	OK	OK

PRODUCTS DEMAND

Annex K (8)

BRANCH / PROD. NAME	JOINT VENTURE	BUYING PRODS.	TRANSFER TECH.	TECH. ASSIST
EXPLOSIVES				
NITRATO DE CELULOSA	~~NO~~	OK	OK	OK
TETRANITRATO DE PENTERITRITOL	NO	OK	OK	OK
2,4,6-TRICLORO TRIAZINA	NO	OK	OK	OK
PHARMOCHEMICALS				
AC. ACETILSALICILICO	OK	OK	~~OK~~	OK
FURALTADONA	OK	OK	OK	OK
FORMIATO DE CALCIO	OK	OK	OK	OK
SALICILATO DE METILO	OK	OK	OK	OK
RUBBER CHEMICALS				
ANTIOXIDANTES	OK	OK	OK	OK
DIFENILAMINA	OK	OK	OK	OK
FOSFITO DE TRIMETILO	OK	OK	OK	OK
MORFOLINA	OK	OK	OK	OK
STARTS AND CATALYST				
ACIDO P-TOLUENSULFONICO	OK	OK	OK	OK

PRODUCTS DEMAND

Annex K
(9)

BRANCH/PRODUCT. NAME	JOINT VENTURE	BUYING PRODS	TRANSFER TECH.	TECH. ASSIST
PLAGUICIDES				
ENDOSULFAN	OK	OK	OK	OK
CORAL	OK	OK	OK	OK
GUSATION METILICO	OK	OK	OK	OK
CLORPIRITOS	OK	OK	OK	OK
SEVIN	OK	OK	NO	OK
BROMURO DE METILO	OK	OK	OK	OK
CAPTAN TECNICO	OK	OK	OK	OK
PLASTIFICANTS *	NO	NO	NO	NO
PROPELENTS	OK	OK	NO	OK
CLOROFLUOROMETANES	OK	OK	NO	OK
FLAVOR AND FRAGANCES				
ACIDO 2-ETIL HEXOICO	OK	OK	OK	OK
TENSOACTIVES	OK	OK	OK	OK

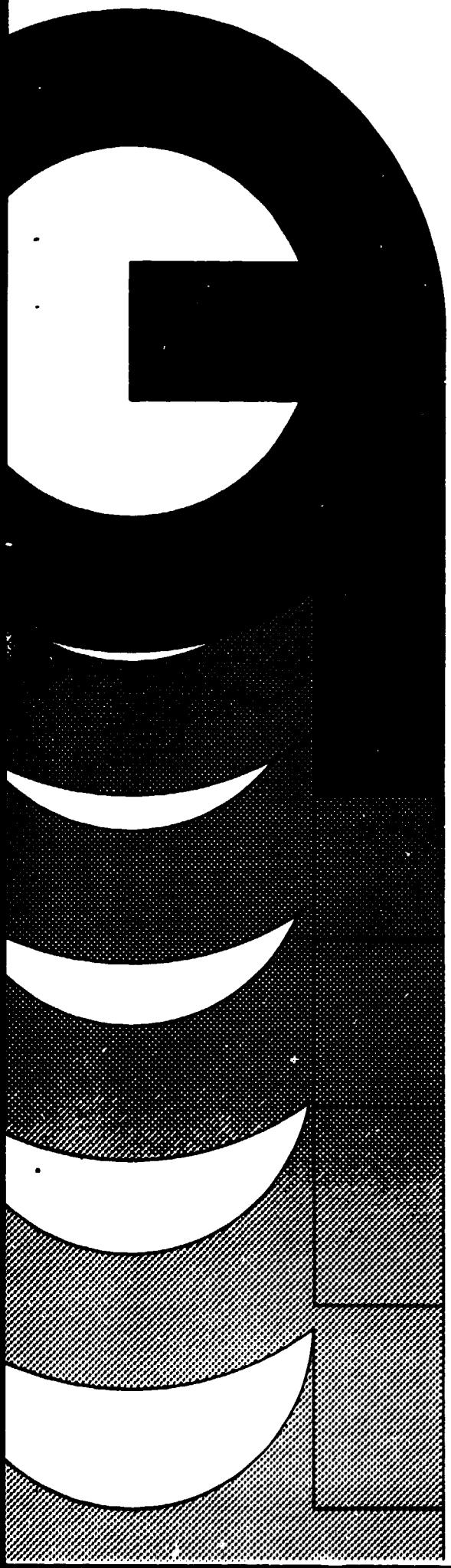
* ONLY SOMETHING ~~DEF~~ RECENT DEVELOPMENT FOR ENG. PLASTICS.

Annex I
(1)

EQUIVALENCE OF ESPECIFICATIONS CHART

GRUPO QUIMICA INDL. LTDA.	Acids, Bases, Salts, Indicators "for Analysis"	Solvents for UV/HPLC	Solvents for Spectroscopy	Solvents fo Pesticide Residue Analysis
MERCK	"Zur Analyse"	Lichrosolv	Uvasol	For Residue Analysis
MONTEDISON CARLO ERBA	For RPE Analysis	-	RS for Spectrophotometry	PS-for the analysis of pesticides residue
J.T. BAKER	Reagent	Baker Analysed HPLC	Photrex	Resi analysed
MALLINCKODT	PA-ACS	-	Spectrar-spectro-photometric grade	Nanograde solvents for gas chro matography
RIEDEL DE HAEN	Reagent ACS	-	Spectranal	Pestanal
EASTMAN KODAK	Reagent ACS	-	Spectro grade	-

Anexo 2
(5)

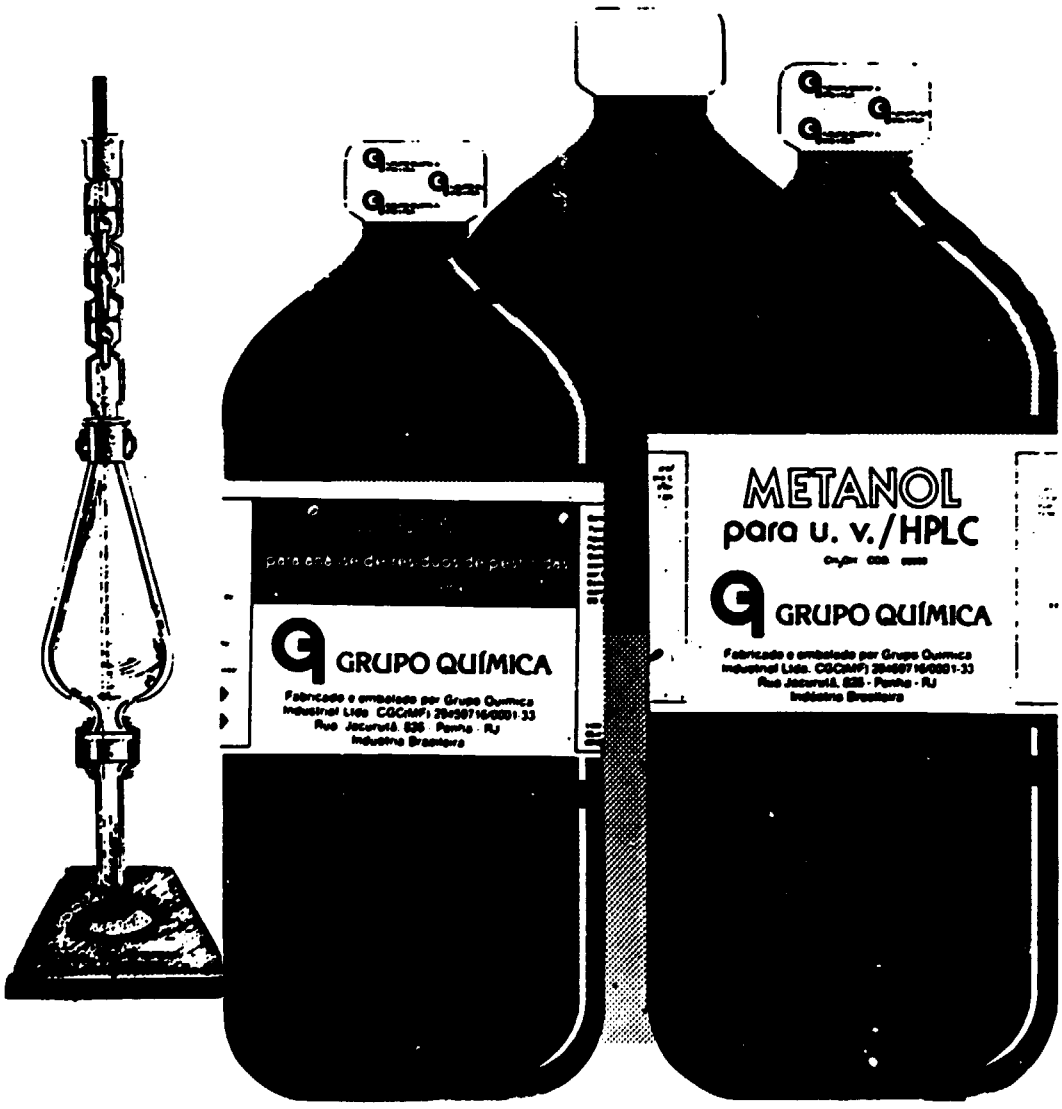


CATÁLOGO DE PRODUTOS

GRUPO QUÍMICA

(2)

GRUPO QUÍMICA INDL. LTDA.



Annex L
(31

- Pioneer in Brazil in Solvent Production for UV/HPLC, Pesticide Residue analysis and Esper' opy.
- Makers wide range of Chemical Reagents (acids, Bases, Salts, Indicators, . . .) and Raw Materials for Chemical and Pharmaceutical Industries.
- Production and quality control supervised by PhD in Chemistry.

- Pionera en Brasil de la Fabricación de Solvientes para UV/HPLC, para análisis de Resíduos de Pesticidas y para Espectroscopia.
- Fabricante de una variada línea de Reagentes para Análisis (Ácidos, Bases, Indicadores, . . .) y Insumos para Indústrias Químicas y Farmaceuticas.
- Producción y control de qualidad supervisionado por PhD en Química.

- Pioneira no Brasil na fabricação de Solventes para UV/HPLC, para análise de Resíduos de Pesticidas e para Espectoscopia.
- Fabricante de uma variada linha de Reagentes para Análise (Ácidos, Sais, Bases, Indicadores, . . .) e Insumos para Indústrias Químicas e Farmacêuticas.
- Produção e controle de qualidade supervisionados por phD em Química.

NOW ALSO EXPORTING TO LATIN AMÉRICA

AHORA TAMBIÉN EXPORTANDO PARA LA AMÉRICA LATINA

AGORA TAMBÉM EXPORTANDO PARA A AMÉRICA LATINA

GRUPO QUÍMICA

PRODUTOS	CÓDIGO	EMBALAGEM (UNIDADE)
A		
Acetato de Amônio PA-ACS	07168.e	500g
Acetato de Butila (iso) (Ver Acetato de Isobutila)		
Acetato de Butila-n para Análise (Acetato de n-Butila)	01128	litro
Acetato de Cádmio 2.H20 para Análise	01469.c	100g
Acetato de Cádmio 2.H20 para Análise	01469.d	250g
Acetato de Cálcio (sêco) para Análise de Solos	09169.e	500g
Acetato de Cobalto II (oso) 4.H20 para Análise	01287.c	100g
Acetato de Cobalto II (oso) 4.H20 para Análise	01287.d	250g
Acetato de Etila para Análise	01013	litro
Acetato de Etila para Análise de Resíduos de Pesticidas	05013	litro
Acetato de Etila para Espectroscopia	02013	litro
Acetato de Etila para UV/HPLC	03013	litro
Acetato de Isobutila para Análise	01371	litro
Acetato de Sódio 3.H20 PA-ACS	07051.e	500g
Acetato de Sódio 3.H20 PA-ACS	07051.f	1000g
Acetona para Análise	01000	litro
Acetona para Análise	01000Bl	5 litros
Acetona para Análise de Resíduos de Pesticidas	05000	litro
Acetona para Espectroscopia	02000	litro
Acetona para UV/HPLC	03000	litro
Acetonitrila para Análise	01019	litro
Acetonitrila para Análise de Resíduos de Pesticidas	05019	litro
Acetonitrila para Espectroscopia	02019	litro
Acetonitrila para UV/HPLC	03019	litro
Ácido Acético Glacial (Adequado para uso com o-Toluidina)	01015.l	litro
Ácido Acético Glacial para Análise	01015	litro
Ácido Acético Glacial para Análise	01015Bl	5 litros
Ácido Acético UV/HPLC	03015	litro
Ácido Aspartico (L) para Análise	01631.b	50g
Ácido Aurintricarbonico, sal de Amônio (Ver Aluminon)		
Ácido Benzoico PA-ACS	07058.e	500g
Ácido Bórico PA-ACS	07044.e	500g
Ácido Bromídrico para Análise	01097	litro
Ácido Cítrico 1.H20 PA-ACS	07059.e	500g
Ácido Cítrico 1.H20 PA-ACS	07059.f	1000g
Ácido Cítrico Anidro PA-ACS	07483.e	500g
Ácido Cítrico Anidro PA-ACS	07483.f	1000g
Ácido Cloridrico com baixo teor de Mercúrio	09023.q	250ml
Ácido Clorídrico para Análise (37%)	01023	litro (1185g)
Ácido Clorídrico para Análise (37%)	01023Bl	5 litros
Ácido Crômico Anidro para Análise	01570.d	250g
Ácido Etilenodiaminotetracetico (Ver EDTA)		
Ácido Fênico (Ver Fenol)		
Ácido Fluorídrico 40% para Análise	01412	litro
Ácido Fluorídrico 48-51% PA-ACS	07025	litro (1150g)
Ácido Fluorídrico 70% (Adequado para uso em Geoquímica)	09429	litro (1200g)
Ácido Fórmico 88% PA-ACS	07157	litro
Ácido Fosfomolibdico PA-ACS	07459.a	25g
Ácido Fosfomolibdico PA-ACS	07459.c	100g
Ácido Fosfórico PA-ACS (85%)	07034	litro (1710g)
Ácido Fosfotungstico para Análise	01506.a	25g
Ácido Fosfotungstico para Análise	01506.c	100g
Ácido Fumárico para Análise	01533.e	500g
Ácido Glutamico(L) Para Análise	01315.c	100g
Ácido Lático para Análise	01159	litro (1200g)
Ácido Nítrico 99,5%	09479	litro
Ácido Nítrico Fumegante (90%)	09771	litro
Ácido Nítrico com baixo teor de Mercúrio	09022.q	250ml
Ácido Nítrico para Análise	01022	litro (1400g)
Ácido Nítrico para Análise (70%)	01125	litro
Ácido Ortofosfórico (Ver Ácido Fosfórico)		
Ácido Oxálico PA-ACS	07073.e	500g
Ácido Pirogálico (Pirogalol)	06399.d	250g
Ácido Succinico Anidro para Análise	01349.d	250g
Ácido Succinico Anidro para Análise	01349.e	500g
Ácido Sulfúrico Fumegante (7%SO3)	09123	litro
Ácido Sulfúrico para Análise	01021	litro (1840g)
Ácido Sulfuroso PA-ACS	07387	litro
Ácido Tartárico PA-ACS	07164.e	500g
Agar Agar Bacteriológico (em pó)	01397.c	100g
Agar Agar Bacteriológico (em pó)	01397.e	500g

Annex L
(5)

GRUPO QUÍMICA

PRODUTOS	CÓDIGO	EMBALAGEM (UNIDADE)
A		
Água oxigenada 30% (Ver Peróxido de Hidrogênio)		
Alaranjado de Metila-Indicador (CI 13025)	07074.a	25g
Alaranjado de Metila-Indicador (CI 13025)	07074.c	100g
Álcool Absoluto (Ver Etanol Absoluto)		
Álcool Amílico (iso) (Ver Álcool Isoamílico)		
Álcool Benzílico para Análise	01166	litro
Álcool Butílico (Iso) (Ver Isobutano)		
Álcool Butílico Normal (Ver Butanol-n)		
Álcool Butílico Terciário (Ver Butanol Terciário)		
Álcool Cetílico para Análise	01296.e	500g
Álcool Etílico Absoluto (Ver Etanol Absoluto)		
Álcool Isoamílico para Análise	01078	litro
Álcool Isobutílico (Ver Isobutanol)		
Álcool Isopropílico (Ver Isopropanol)		
Álcool Metílico (Ver Metanol)		
Álcool Ter. Butílico (Ver Butanol Terciário)		
Aldeído Fórmico (Ver Formaldeído)		
Aluminon	01597.a	25g
Amarelo de Metanila (CI 13065)	07624.b	50g
Amonia (Ver Hidróxido de Amônio)		
Anidrido Acético para Análise	01017	litro (1081g)
Anidrido Crômico (Ver Ácido Crômico)		
Anidrido Ftalico PA-ACS	07145.e	500g
Anilina PA-ACS	07176	litro
Antimônio em Pó para Análise	01276.h	10g
Arginina (L) Cloridrato para Análise	01306.c	100g
Azida de Sódio para Análise	01461.c	100g
Azida de Sódio para Análise	01461.d	250g
Azul de Bromofenol - Indicador	07075.g	5g
Azul de Bromofenol - Indicador	07075.a	25g
Azul de Bromotimol - Indicador	07178.a	25g
Azul de Bromotimol - Indicador	07178.g	5g
Azul de Metileno para Microscopia (CI 42780)	09112.a	25g
Azul de Metileno para Microscopia (CI 42780)	09112.c	100g
Azul de Vitória B para Microscopia (CI 44045)	09673.a	25g
Azur-Eosina-Azul de Metileno seg. Giemsa em pó	07181.a	25g
Azur-Eosina-Azul de Metileno seg. Giemsa em pó	07181.g	5g
B		
Bálsamo do Canadá p/Microscopia (sintético)	09172.c	100g
Benzeno para Análise	01001	litro
Benzeno para Análise de Resíduos de Pesticidas	05001	litro
Benzeno para Espectroscopia	02001	litro
Benzeno para UV/HPLC	03001	litro
Benzina de Petróleo (Ver Eter de Petróleo)		
Benzoato de Benzila para Análise	01529	litro
Benzol (Ver Benzeno)		
Betanaftol para Síntese	06184.e	500g
Betanaftol para Síntese	06184.c	100g
Bicarbonato de Amônio para Análise	01444.e	500g
Bicarbonato de Potássio para Análise	01355.e	500g
Bicarbonato de Potássio para Análise	01355.f	1000g
Bicarbonato de Sódio PA-ACS	07045.e	500g
Bicarbonato de Sódio PA-ACS	07045.f	1000g
Bicarbonato de Potássio (Ver Dicromato de Potássio)		
Biftalato de Potássio PA-ACS	07066.e	500g
Bissulfeto de Carbono (Ver Dissulfeto de Carbono)		
Bissulfito de Sódio PA-ACS	07185.e	500g
Borato de Sódio 10 .H20 PA-ACS	07069.e	500g
Borax (Ver Borato de Sódio)		
Brometo de Etila (Ver Bromo Etano)		
Brometo de Potássio PA-ACS	07042.e	500g
Brometo de n-Butila (Ver Bromo Butano)		
Bromo PA-ACS	07077.w	50ml (155,5g)
Bromobenzeno para Síntese	06542.q	250ml (372,59)
Bromobutano para Síntese	06106.p	100ml (127g)
Bromobutano para Síntese	06106.q	250ml (317,5g)
Bromoetano para Síntese	06105.p	100ml (144g)

GRUPO QUÍMICA

Annex L
(6)

PRODUTOS	CÓDIGO	EMBALAGEM (UNIDADE)
B		
Bromoetano para Síntese	06105.q	250ml (360g)
Butanol Terciário para Análise (Ter. Butanol)	01415	litro
Butanol-n para Análise	01012	litro
Butanol-n para Espectroscopia	02012	litro
Butanol-n para UV/HPLC	03012	litro
Butil Diglicol (Ver Éter Butílico de Dietileno Glicol)		
C		
Cádmio Metálico Granulado para Análise	01464.d	250g
Cal Sodada	06376.e	500g
Carbonato Básico de Chumbo II para Análise	01685.e	500g
Carbonato de Cálcio para Análise	01401.e	500g
Carbonato de Lítio para Análise	01501.d	250g
Carbonato de Potássio Anidro PA-ACS	07057.e	500g
Carbonato de Sódio 1.H20 PA-ACS	07111.e	500g
Carbonato de Sódio Anidro	07047.e	500g
Carvão Ativo	00101.d	250g
Chumbo Metálico para Análise em Pó	01588.c	100g
Chumbo Metálico para Análise em Pó	01588.e	500g
Cianeto de Potássio para Análise	01653.d	250g
Cianeto de Potássio para Análise	01653.e	500g
Cianeto de Sódio para Análise	01408.e	500g
Ciclohexano para Análise	01014	litro
Ciclohexano para Análise	05014	litro
Ciclohexano para Espectroscopia	02014	litro
Ciclohexano para UV/HPLC	03014	litro
Ciclohexanol para Análise	01109	litro
Ciclohexanona para Análise	01136	litro
Cisteina (L) Cloridrato (Anidro) para Análise	01313.a	25g
Cisteina (L) Cloridrato 1.H20 para Análise	01312.a	25g
Cisteina (L) Cloridrato 1.H20 para Análise	01312.c	100g
Cistina (L) para Análise	01621.a	25g
Cistina (L) para Análise	01621.c	100g
Citrato de Sódio 2.H20 (Trissódico) para Análise	01187.e	500g
Citrato de Sódio 2.H20 (Trissódico) para Análise	01187.f	1000g
Cloreto Cobaltoso (Ver Cloreto de Cobalto II)		
Cloreto Estanoso (Ver Cloreto de Estanho II)		
Cloreto Férrico (Ver Cloreto de Ferro III)		
Cloreto Mercuroso (Ver Cloreto de Mercúrio I)		
Cloreto de Amônio PA-ACS	07038.e	500g
Cloreto de Bário 2.H20 PA-ACS	07061.e	500g
Cloreto de Bário 2.H20 PA-ACS	07061.f	1000g
Cloreto de Benzoila para Análise	01564	litro (1210g)
Cloreto de Benzoila para Síntese	06564	litro (1210g)
Cloreto de Cádmio H20 PA-ACS	01297.d	250g
Cloreto de Cálcio 2.H20 (em Pó) para Análise	01522.e	500g
Cloreto de Cálcio Anidro PA-ACS	07029.e	500g
Cloreto de Cálcio para Dessecador (CaCl2.2H20)	09029.e	500g
Cloreto de Cobalto II (oso) (CoCl2.6H20) PA-ACS	07143.c	100g
Cloreto de Cobalto II (oso) (CoCl2.6H20) PA-ACS	07143.d	250g
Cloreto de Estanho II (oso) 2.H20 PA-ACS	07039.e	500g
Cloreto de Ferro III (ico) 6.H20 PA-ACS	07086.d	250g
Cloreto de Hidroxilamonio (Ver Cloridrato de Hidroxilamina)		
Cloreto de Lítio 1.H20 para Análise	01589.c	100g
Cloreto de Lítio 1.H20 para Análise	01589.d	250g
Cloreto de Magnésio 6.H20 PA-ACS	07149.f	1000g
Cloreto de Mercúrio I (oso) PA-ACS	07191.c	100g
Cloreto de Mercúrio I (oso) PA-ACS	07191.e	500g
Cloreto de Metileno (Ver Diclorometano)		
Cloreto de Paládio 2.H20 para Análise	01595.a	1g
Cloreto de Potássio PA-ACS	07028.e	500g
Cloreto de Potássio PA-ACS	07028.f	1000g
Cloreto de Sódio PA-ACS	07027.e	500g
Cloreto de Sódio PA-ACS	07027.f	1000g
Cloreto de Tionila para Análise	01153	litro
Cloreto de Zinco PA-ACS	07090.e	500g
Cloridrato de Hidroxilamina PA-ACS	01402.c	100g
Cloridrato de Hidroxilamina PA-ACS	01402.d	250g

GRUPO QUÍMICA

PRODUTOS	CÓDIGO	EMBALAGEM (UNIDADE)
C		
Clorobenzeno (Ver Monoclorobenzeno)		
Clorofórmio para Análise	01002	litro (1482g)
Clorofórmio para Análise (Adequado para uso com Ditizona)	01002.l	litro (1482g)
Clorofórmio para Análise de Resíduos de Pesticidas	05002	litro
Clorofórmio para Espectroscopia	02002	litro
Clorofórmio para UV/HPLC	03002	litro
Clorotene (ver 1,1,1 - Tricloroetano)		
Cobaltonitrito de Sódio (Ver Hexanitricobaltato de Sódio)		
Cobre Metálico (em pó) para Análise	01278.d	250g
Cromo Metálico para Análise (granulado)	01339.c	100g
D		
Detergente Alcalino GQLab	08386	litro
Dextrose (Ver Glicose Anidra)		
Diclorobenzeno-p	06388.e	500g
Dicloroetano 1.2 PA-ACS	07196	litro (1241g)
Diclorometano para Análise	01003	litro (1326g)
Diclorometano para Análise de Resíduos de Pesticidas	05003	litro
Diclorometano para Espectroscopia	02003	litro
Diclorometano para UV/HPLC	03003	litro
Dicromato de Potássio PA-ACS	07056.e	500g
Dicromato de Sódio para Análise	01197.e	500g
Dietil Éter (Ver Éter Etílico)		
Dietilenoglicol Monobutileter Éter Butílico Dietilenoglicol)		
Dihidroxibenzeno, 1.3 (Ver Resorcina)		
Dimetilformamida-N,N para Análise	01050	litro
Dimetilformamida-N,N para UV/HPLC	03050	litro
Dimetilsulfóxido para Análise	01093	litro
Dimetilsulfóxido para UV/HPLC	03093	litro
Dioxana para Análise	01063	litro
Dioxana para UV/HPLC	03063	litro
Dissulfeto de Carbono para Análise	01340	litro
Dissulfeto de Carbono para Espectroscopia	02340	litro
E		
EDTA, Sal Dipotássico para Análise	01460.c	100g
EDTA, Sal Dissódico PA-ACS	07133.b	50g
EDTA, Sal Dissódico PA-ACS	07133.e	500g
EDTA, Sal Dissódico PA-ACS	07133.f	1000g
Enxofre Puro	07095.e	500g
Eosina Amarela (CI 45380)	06114.a	25g
Eosina Amarela (CI 45380)	06114.c	100g
Eosina-Azul de Metileno, seg. May-Gruwald em pó	07204.a	25g
Eosina-Azul de Metileno, seg May-Gruwald em pó	07204.g	5g
Eosina-Azul de Metileno, seg. Wright em pó	07206.a	25g
Eosina-Azul de Metileno, seg. Wright em pó	07206.g	5g
Estanho Metálico Granulado PA-ACS	07079.c	100g
Estanho Metálico Granulado PA-ACS	07079.d	250g
Etanol Absoluto para Análise	01254	litro
Etanol Absoluto para Análise	01254BI	5 litros
Etanol 95% para Análise	01004	litro
Etanol 95% para Análise	01004BI	5 litros
Etanol para Análise de Resíduos de Pesticidas	05004	litro
Etanol para Espectroscopia	02004	litro
Etanol para UV/HPLC	03004	litro
Éter Butílico de Dietileno Glicol para Análise	01489	litro
Éter Etílico PA-ACS	07005	litro
Éter Etílico para Análise (Anidro, máx. 0,1% de água)	01005	litro
Éter Etílico para Análise de Resíduos de Pesticidas	05005	litro
Éter Etílico para Espectroscopia	02005	litro
Éter Etílico para UV/HPLC	03005	litro
Éter Metílico do Etilenoglicol (Etilenoglicol Monometileter)		
Éter Sulfúrico (Ver Éter Etílico)		
Éter de Petróleo 30-60°C p/Análise	01018	litro

PRODUTOS	CÓDIGO	EMBALAGEM UNIDADE
E		
Éter de Petróleo 30-60°C p/Análise de Resid. de Pesticidas	05018	litro
Éter de Petróleo 30-60°C p/UV/HPLC	03018	litro
Éter de Petróleo 60-110°C para Análise	01208	litro
Etilbenzeno para Análise	01370	litro
Etilenoglicol para Análise	01290	litro
Etilenoglicol Monoetileter para Análise	01405	litro
Etilenoglicol Monometileter (2-Metoxietanol) para Análise	01119	litro
Etilglicol (Ver Etilenoglicol Monoetileter)		
F		
Fenol PA-ACS	07081.e	500g
Fenolftaleína PA-ACS (Indicador)	07065.c	100g
Ferricianeto de Potássio PA-ACS	07068.e	500g
Ferro em Pó (Reduzido por H2) para Análise	01209.e	500g
Ferrocianeto de Potássio PA-ACS	07210.e	500g
Fluoresceína (ácida) para Análise (CI 45350)	01104.d	250g
Fluoresceína (ácida) para Análise (CI 45350)	01104.b	50g
Fluoreto de Potássio para Análise	01289.e	500g
Fluoreto de Potássio para Análise	01289.f	1000g
Fluoreto de Sódio PA-ACS	07091.e	500g
Formaldeído PA-ACS (37%)	07046	litro
Formaldeído PA-ACS (37%)	07046BI	5 litros
Formol (Ver Formaldeído)		
Fosfato de Potássio Bibásico Anidro PA-ACS	07138.e	500g
Fosfato de Potássio Monobásico Anidro PA-ACS	07213.e	500g
Fosfato de Sódio Bibásico 7.H20 PA-ACS	07214.e	500g
Fosfato de Sódio Bibásico 2.H20 para Análise	01560.e	500g
Fosfato de Sódio Bibásico 2.H20 para Análise	01560.f	1000g
Fosfato de Sódio Monobásico 1.H20 PA-ACS	07052.e	500g
Fosfato de Sódio Tribásico PA-ACS	07215.e	500g
Fósforo Vermelho	07146.e	500g
Ftalato Ácido de Potássio (Ver Biftalato de Potássio)		
Fucsina Básica para Microscopia (CI 42510)	09218.a	25g
Fucsina Básica para Microscopia (CI 42510)	09218.c	100g
Furfurol para Análise	01692.q	250ml
Furfurol para Análise	06692	litro
G		
Glicerina PA-ACS	07035	litro (1260g)
Glicerol (Ver Glicerina)		
Glicina para Análise	01317.c	100g
Glicina para Análise	01317.d	250g
Glicocola (Ver Glicina)		
Glicose Anidra para Análise	01219.e	500g
Gluconato de Sódio para Análise	01687.c	500g
Glucose (Ver Glicose Anidra)		
Glutamato (L) de Sódio Monobásico 1.H20 para Análise	01400.e	500g
H		
Heptamolibdato de Amônio (Ver Molibdato de Amônio)		
Heptano para Análise 99%	01286	litro
Heptano para Análise (96-100°C)	01006	litro
Heptano para Análise de Resíduos de Pesticidas	05006	litro
Heptano para Espectroscopia	02006	litro
Heptano para UV/HPLC	03006	litro
Hexametilenotetramina para Síntese	06221.e	500g
Hexanitricobaltato de Sódio PA-ACS	07363.a	25g
Hexanitricobaltato de Sódio PA-ACS	07363.c	100g
Hexano para Análise 99%	01285	
Hexano para Análise (66-70gr C)	01007	litro
Hexano para Análise de Resíduos de Pesticidas	05007	litro
Hexano para Espectroscopia	02007	litro
Hexano para UV/HPLC	03007	litro
Hidroquinona para Síntese	06222.e	500g
Hidróxido de Amônio para Análise	01020BI	5 litros

PRODUTOS	CÓDIGO	EMBALAGEM / UNIDADE
H		
Hidróxido de Amônio para Análise (min. 25%)	01020	litro
Hidróxido de Litio 1.H20 para Análise	01635.c	100g
Hidróxido de Litio 1.H20 para Análise	01635.d	250g
Hidróxido de Litio 1.H20 para Análise	01635.f	1000g
Hidróxido de Litio 1.H20 para Síntese	06635.e	500g
Hidróxido de Potássio PA-ACS (lentilhas)	07031.e	500g
Hidróxido de Potássio PA-ACS (lentilhas)	07031.f	1000g
Hidróxido de Sódio PA-ACS (lentilhas)	07030.e	500g
Hidróxido de Sódio PA-ACS (lentilhas)	07030.f	1000g
Hidroxilamina Cloridrato (Ver Cloridrato de Hidroxilamina)		
I		
Iodato de Potássio PA-ACS	07223.c	100g
Iodeto de Etila (Ver Iodo Etano)		
Iodeto de Mercúrio II (Vermelho) PA-ACS	07224.c	100g
Iodeto de Metila (Ver Iodo Metano)		
Iodeto de Potássio PA-ACS	07048.c	100g
Iodeto de Potássio PA-ACS	07048.e	500g
Iodo Etano para Síntese (para separação de minerais)	06360.p	100ml (193g)
Iodo Metálico (Ver Iodo Ressublimado)		
Iodo Metano para Síntese	06107.p	100ml (226g)
Iodo Metano para Síntese	06107.q	250ml
Iodo Ressublimado PA-ACS	07064.c	100g
Iodo Ressublimado PA-ACS	07064.e	500g
Isobutanol para Análise	01100	litro
Isobutanol para UV/HPLC	03100	litro
Iso-octano para Análise	01116	litro
Iso-octano para Análise de Resíduos de Pesticidas	05116	litro
Iso-octano para UV/HPLC	03116	litro
Isopropanol para Análise	01008	litro
Isopropanol para Análise	01008BI	5 litros
Isopropanol para Análise de Resíduos de Pesticidas	05008	litro
Isopropanol para Espectroscopia	02008	litro
Isopropanol para UV/HPLC	03008	litro
L		
Leucina (L) para Análise	01321.b	50g
Ligroina (Ver Éter de Petróleo)		
Lisina (L) Cloridrato para Análise	01323.e	25g
Litargírio (Ver Óxido de Chumbo)		
M		
Magnésio em Pó para Análise	01277.c	100g
Magnésio em Pó para Análise	01277.e	500g
Manita (Ver Manitol)		
Manitol PA-ACS	07227.e	500g
Mercúrio Bidestilado PA-ACS	07033.c	100g
Mercúrio Bidestilado PA-ACS	07033.e	500g
Metabissulfito de Sódio PA-ACS	07230.e	500g
Metanol para Análise (Anidro, adequado para Karl Fisher)	01009	litro
Metanol para Análise (Anidro, adequado para Karl Fisher)	01009BI	5 litros
Metanol para Análise de Resíduos de Pesticidas	05009	litro
Metanol para Espectroscopia	02009	litro
Metanol para UV/HPLC	03009	litro
Metilcelussolve (Ver Etilenoglicol Monometileter)		
Metilclorofórmio (ver 1,1,1 - Tricloroetano)		
Metiletilcetona para Análise	01082	litro
Metilglicol (Ver Etilenoglicol Monometileter)		
Metilisobutilcetona para Análise	01083	litro
Metoxietanol-2 (Ver Etilenoglicol Monometileter)		
Molibdato de Amônio PA-ACS	07043.d	250g
Molibdato de Amônio PA-ACS	07043.e	500g
Molibdato de Sódio PA-ACS	07032.d	250g
Molibdato de Sódio PA-ACS	07032.e	500g

PRODUTOS	CÓDIGO	EMBALAGEM UNIDADE
M		
Monoclorobenzeno para Análise	*01094*	*litro*
Monóxido de Chumbo (Ver Óxido de Chumbo II)		
N		
N,N-Dimetilformamida (Ver Dimetilformamida-N,N)		
N-Butanol (Ver Butanol-n)		
N-Propanol (Ver Propanol-n)		
Naftaleno Puro Sublimado	*06284.f*	*1000g*
Naftaleno Puro Sublimado	*06284.e*	*500g*
Naftaleno, 2 Hidroxi (Ver Betanaftol)		
Naftol (Ver Betanaftol)		
Negro de Eriocromo T (Ver Preto de Eriocromo T)		
Níquel Metálico em pó para Análise	*01467.c*	*100g*
Nitrato de Magnésio 6.H20 para Análise	*01636.e*	*500g*
Nitrato de Níquel 6.H20 para Análise	*01714.e*	*500g*
Nitrato de Prata PA-ACS	*07026.a*	*25g*
Nitrato de Prata PA-ACS	*07026.c*	*100g*
Nitrito de Sódio PA-ACS	*07084.e*	*500g*
Nitrobenzeno PA-ACS	*07231*	*litro (1240g)*
O		
O-Toluidina (Ver Toluidina-o)		
O-Xileno (Ver Xileno-o)		
Orange II (Ver Tropaeolina 000 N.2)		
Oxalato de Potássio PA-ACS	*07067.e*	*500g*
Óxido de Chumbo II (Monóxido) para Análise	*01350.e*	*500g*
Óxido de Cobre II (ico) em pó para Análise	*01418.d*	*250g*
Óxido de Lantanio (III) 99% para Análise	*01301.c*	*100g*
Óxido de Zinco para Análise	*01234.e*	*500g*
P		
P-Diclorobenzeno (Ver Diclorobenzeno-p)		
P-Xileno (Ver Xileno-p)		
Pardo de Bismarck Y (G) (CI 21000) (Ver Vesuvina padrão)		
Pentano 2,2,4-Trimetil (Ver Iso-octano)		
Pentano para Análise	*01024*	*litro*
Pentano para Análise de Resíduos de Pesticidas	*05024*	*litro*
Pentano para Espectroscopia	*02024*	*litro*
Pentano para UV/HPLC	*03024*	*litro*
Percloroetileno (Ver Tetracloroetileno)		
Permanganato de Potássio PA-ACS	*07037.c*	*100g*
Permanganato de Potássio PA-ACS	*07037.e*	*500g*
Peróxido de Hidrogênio 30% PA-ACS	*07036*	*litro (1422g)*
Persulfato de Amônio Cristalizado PA-ACS	*07053.e*	*500g*
Persulfato de Amônio Cristalizado PA-ACS	*07053.f*	*1000g*
Piridina PA-ACS	*07062*	*litro*
Pirogalol (Ver Ácido Pirogalico)		
Preto Amido 10B (CI 20470)	*09242.a*	*25g*
Preto Amido 10B (CI 20470)	*09242.c*	*100g*
Preto Azulado de Naftol (Ver Preto Amido 10B)		
Preto Sudam B (CI 26150)	*09674.a*	*25g*
Preto de Cromogeneo (Ver Preto de Eriocromo T)		
Preto de Eriocromo T (Indicador p/titular metais) (CI 14645)	*07610.a*	*25g*
Preto de Eriocromo T (Indicador p/titular metais) (CI 14645)	*07610.c*	*100g*
Propanol-2 (Ver Isopropanol)		
Propanol-n para Análise (Anidro)	*01087*	*litro*
R		
Resorcina para Análise	*01453.c*	*100g*
Resorcina para Análise	*01453.d*	*250g*
Resorcinol (Ver Resorcina)		
Rodamina B (CI 45170)	*01244.a*	*25g*
S		
Sacarose Cristalizada PA-ACS	*07245.e*	*500g*
Sal de Mohr (Ver Sulfato Ferroso Amoniacal)		
Sal de Rochele (Ver Tartarato de Sódio e Potássio)		
Sal de Seignette (Ver Tartarato de Sódio e Potássio)		

nex L

GRUPO QUÍMICA

PRODUTOS	CÓDIGO	EMBALAGEM (UNIDADE)
S		
Selenio em Pó para Análise	01279.c	100g
Silica Gel Azul (c/ Indicador de Umidade)	07040.e	500g
Silica Gel Branca PA-ACS	07280.e	500g
Silica Gel Branca c/30% de Sílica Gel Azul como Ind. Umidade	07120.e	500g
Sulfato Ferroso Amoniacal (Ver Sulfato Ferro II (oso) e Amônio)		
Sulfato de Cádmio H20 para Análise	01701.c	100g
Sulfato de Cádmio H20 para Análise	01701.e	500g
Sulfato de Cálcio PA-ACS	07250.e	500g
Sulfato de Cobalto II (oso) 7.H20 para Análise	01288.c	100g
Sulfato de Cobalto II (oso) 7.H20 para Análise	01288.d	250g
Sulfato de Cobalto II (oso) 7.H20 para Síntese	06288.e	500g
Sulfato de Cobre Anidro para Análise	01741.d	250g
Sulfato de Cobre Anidro para Análise	01741.e	500g
Sulfato de Cobre II (ico) PA-ACS	07251.e	500g
Sulfato de Ferro II (oso) e Amônio PA-ACS	07055.e	500g
Sulfato de Ferro II (oso) 7.H20 PA-ACS	07150.e	500g
Sulfato de Magnésio 7.H20 PA-ACS	07099.e	500g
Sulfato de Magnésio Anidro PA-ACS	07060.e	500g
Sulfato de Prata PA-ACS	07049.a	25g
Sulfato de Prata PA-ACS	07049.c	100g
Sulfato de Sódio Anidro PA-ACS	07070.e	500g
Sulfato de Sódio Anidro PA-ACS	07070.f	1000g
Sulfato de Sódio P/Análise de Resíduos de Pest. (Granulado)	05070.e	500g
Sulfato de Zinco PA-ACS	07259.e	500g
Sulfito de Sódio PA-ACS (Anidro)	07089.e	500g
T		
Tartarato de Sódio e Potássio PA-ACS	07262.e	500g
Tetraborato de Sódio (Ver Borato de Sódio)		
Tetracloreto de Carbono p/Análise	01010	litro (1594g)
Tetracloreto de Carbono p/Análise (Adequado p/uso c/Ditizona	01010	litro
Tetracloreto de Carbono p/Análise de Resíduos de Pesticidas	05010	litro
Tetracloreto de Carbono p/Espectroscopia	02010	litro
Tetracloreto de Carbono p/UV/HPLC	03010	litro
Tetracloroetileno para Análise	01144	litro (1620g)
Tetrahidrofurano para Análise	01092	litro
Tetrahidrofurano para UV/HPLC	03092	litro
Timol para Análise	01462.c	100g
Tiocianato de Amônio PA-ACS	07076.e	500g
Tiossulfato de Sódio PA-ACS	07054.e	500g
Tioureia para Análise	01264.c	100g
Tioureia para Análise	01264.d	250g
Tolueno para Análise	01011	litro
Tolueno para Análise de Resíduos de Pesticidas	05011	litro
Tolueno para Espectroscopia	02011	litro
Tolueno para UV/HPLC	03011	litro
Toluidina-o	06413.r	500ml
Toluol (Ver Tolueno)		
Tricloroetano-1,1,1 para Análise	01098	litro
Tricloroetileno para Análise	01096	litro (1464g)
Trietanolamina para Análise	01135	litro
Trietilamina para Síntese	06602	litro
Trimetil Pentano-2,2,4 (Ver Isoctano)		
Tropeolina 000 N. 2 (Alaranjado II) (CI 15510) para Micros.	09623.a	25g
Tropeolina 000 N. 2 (Alaranjado II) (CI 15510) para Micros.	09623.c	100g
Tungstato de Sódio pó PA-ACS	07266.a	100g
Tungstato de Sódio pó PA-ACS	07266.d	250g
U		
Uréia PA-ACS	07267.e	500g
V		
Vaselina Líquida	08414	litro
Vaselina Sólida	08088.e	500g

PRODUTOS	CÓDIGO	EMBALAGEM (UNIDADE)
V		
Verde Brilhante (CI 42040) para Microscopia	*09268.a*	*25g*
Verde Brilhante (CI 42040) para Microscopia	*09268.c*	*100g*
Verde Malaquita para Microscopia (CI 42000)	*09269.a*	*25g*
Verde Malaquita para Microscopia (CI 42000)	*09269.c*	*100g*
Verde de Bromocresol-Indicador	*07072.g*	*5g*
Vermelho Congo-Indicador (CI 22120)	*07572.a*	*25g*
Vermelho Congo-Indicador (CI 22120)	*07572.c*	*100g*
Vermelho Fenol-Indicador	*07272.g*	*5g*
Vermelho Fenol-Indicador	*07272.a*	*25g*
Vermelho de Metila - Indicador (CI 13020)	*07273.a*	*25g*
Vermelho de Metila - Indicador (CI 13020)	*07273.c*	*100g*
Vesuvina Padrão para Microscopia (CI 21000)	*09622.c*	*100g*
Violeta Básica N 1 (Ver Violeta Genciana)		
Violeta Cristal-Indicador para Microscopia (CI 42555)	*09274.a*	*25g*
Violeta Cristal-Indicador para Microscopia (CI 42555)	*09274.c*	*100g*
Violeta Genciana (CI 42535)	*07275.a*	*25g*
Violeta Genciana (CI 42535)	*07275.c*	*100g*
Violeta de Metila 2B (Ver Violeta Genciana)		
X		
Xileno puro, para Microscopia	*09016*	*litro*
Xileno para Análise	*01016*	*litro*
Xileno-o para Análise (99%)	*01352*	*litro*
Xileno-p para Análise (99%)	*01140*	*litro*
Xilol (Ver Xileno)		
Z		
Zinco Granulado 2-5 Mesh (3-8mm) PA-ACS	*07411.d*	*250g*
Zinco Granulado 2-5 Mesh (3-8mm) PA-ACS	*07411.e*	*500g*
Zinco Granulado 20 Mesh (0,8mm) PA-ACS	*07403.d*	*250g*
Zinco Granulado 20 Mesh (0,8mm) PA-ACS	*07403.e*	*500g*
Zinco em Pó (300 Mesh) PA-ACS	*07080.e*	*500g*

GRUPO QUÍMICA INDUSTRIAL LTDA.

Sede: Rio de Janeiro: Rua Jacurutá, 826 - Penha - CEP 21020 - Tel.: (021) (KS) 280-9040 - Telex: (021) 34091 QGRJ-BR

Filial: São Paulo: Rua Dronsfield, 421 - 1º andar s/13 - CEP 05074 - Tel.: (011) 260-7908 - (011) 832-2047

Representantes: Rio Grande do Sul: Av. Auxiliadora, 210 - Auxiliadora - CEP 90450 - Porto Alegre - Tel.: (0512) 433029

Bahia: Jardim Joana d'Arc, Quadra D nº 16 - Jardim das Quintas - CEP 40320 - Salvador - Tel.: (071) 241-0420

Maranhão: Rua 10 casa 51 - Cohatrac II - CEP 65000 - São Luis - Tel.: (098) 225-4507

Santa Catarina: Rua Herminio Milles, 10 - Bom Abrigo - CEP 88085 - Florianópolis - Tel.: (0482) 550175

Minas Gerais: Av. Afonso Pena, 952 s/701 - Centro - CEP 30130 - Belo Horizonte - Tel.: (031) 221-8318/337-0769

Paraná: Rua República Argentina, 880 - Água Verde - CEP 80310 - Curitiba - Tel.: (041) 243-6703

Rio Grande do Norte: Rua Segundo Wanderlei, 537 - Lagoa Seca - CEP 59030 - Natal - Tel.: (084) 222-5088

Mato Grosso do Sul: Rua Eng. Alírio de Matos, 839 - Jardim Jacy - CEP 79065 - Campo Grande - Tel.: (067) 386-4391

Pernambuco/Paraíba: Rua Costa Sepulveda, 719 - Cidade Universitária - CEP 50730 - Recife - Tel.: (081) 271-3988

Annex M
(1)

CHEMICAL REAGENTS AND INDUSTRIAL CHEMICALS IN THE PHILIPPINES

INTRODUCTION

The existing Philippine chemical manufacturing industry of the Philippines is basically import-substituting. It is heavy on the manufacture of consumer or downstream products and rather light in the basics and intermediates. There are several reasons for this orientation, foremeost of which is the absence of an adequate domestic market base to ensure the viability of economic-size plants for the manufacture of basic and intermediate chemicals.

Inasmuch as the economic size units for the consumer/downstream products are much smaller, there is a proliferation of enterprise in plastics fabrication, rubber processing, in the blending, formulation and compounding of pharmaceuticals, agrochemicals (pesticides), paints, inks, adhesives, etc.

With such a set-up, the industry is therfore heavily dependent on imported inputs. Together with the non-labor intensiveness of chemical manufacturing (which negates the labor advantage of the country) and the capital intensiveness of chemical plants, the industry finds difficulty in veering towards an export orientation as well as competing with import substitutes.

PERFORMANCE OF THE INDUSTRY

In 1984-1986, the chemical industry contributed an average of P1.7 billion (US$85,000) per year in value added at constant prices., This represents about 7.5% of total value added in manufacturing. The chemical industry is the third largest sector in manufacturing, surpassed only by food manufacturing which contributed a little over 40% and, electrical machinery with 8.7% share of total value added in manufacturing.

A large component of the industry is in terms of basic and intermediate chemical [illegible] within the chemical and allied industries as well is [illegible] of P[illegible] billion (US$[illegible]

Imports by the chemical sector at M$[illegible] million per annum for the period 1981 1984, is four times the direct exports for the same period of approximately M$[illegible] million per annum.

Imports of chemicals grew at 4% in 1985 and 21% in 1986, while total merchandise imports declined 22% in 1985 and grew by 2% in 1986.

BASIC CHEMICALS

The basic chemicals industry may be divided into the manufacture of the following:

1. Inorganic chemicals
2. Fermentation products
3. Industrial carbon
4. Coco-chemicals

Inorganic chemicals include the chlor-alkali products, chlorine and caustic soda, salt, nitric, sulfuric, phosphoric and hydrochloric acids, zinc oxide, polyphosphates, etc. There are approximately 20 firms under this category.

There are around seven (7) firms engaged in the manufacture of chlor-alkali products 5 of which installed such facilities to support their main activity such as the manufacture of polyvinyl chloride resin, pulp and paper, and monosodium glutamate.

Anhydrous ammonia, sulfuric acid, ammonium sulfate are produced by fertilizer plants.

Fermentation products in the country include ethyl alcohol, monosodium glutamate and acetic acid. Ethyl alcohol or ethanol production is most often integrated with sugar milling operations.

There are 21 alcohol distilleries in the country although only 10 are active which have an aggregate capacity of 446,000 liters per day.

The sole manufacturer of monosodium glutamate has a capacity of 16,000 MTPY.

Acetic acid (vinegar) is produced in the country on a cottage industry level out of sugar cane juice, coconut water, nipa sap or pineapple wastes. The size of the industry, however, could not be determined since such operations are rarely registered with any

government agency.

Industrial carbons produced in the country are activated carbon, acetylene black and carbon black.

There are five (5) activated carbon manufacturers in the country with a total capacity of around 25,000 MTPY, directing around 95 % of their products to the export market. Coconut shell charcoal is the raw material in the manufacture of activated carbon.

Only one (1) firm is manufacturing carbon black which is mainly used by the rubber industry as pigment and filler.

Acetylene black is supplied to dry cell battery manufacturers by only one (1) firm now as the other one ceased operations due to technical problems. Capacity is 720 MTPY.

The manufacture of coco-chemicals in the country started in 1965 when the National Investment and Development Corporation implemented its plasticizer plant. Now, there are 5 firms engaged in the manufacture of methyl ester, refined as well as crude glycerine, fatty alcohols, fractionated methyl esters and fatty alcohols, and alkanolamides from coconut oil. Other products soon to be produced are monoalkyl phosphate, fatty alcohol sulfates and surfactants.

The cocochemicals produced in the country today are exported for processing into intermediates which are raw materials in the production of soap and detergents, shampoos, cosmetics, plasticizers and lubricants for plastic fabrication, softeners for synthetic leather, base for ointments, metal rolling agents, etc.

Total capacities are as follows:

Methyl Esters	53,000 MTPY
Glycerine	14,500 MTPY
Fatty Alcohols	82,000 MTPY
Ethanolamides	8,400 MTPY
Fractionated ME/FA	2,000 MTPY

Local firms produce the following industrial and medical gases:

1) Oxygen
2) Nitrogen
3) Argon
4) Acetylene

At present, some parties would like to expand the nitrogen gas production capacity to meet the increasing needs of the local electronics industry. Instead of the usual supply in cylinders, nitrogen will delivered through pipelines.

Plant Location

Plants manufacturing basic chemicals are dispersed throughout the country. The inorganic chemical plants which are often integrated with other operations, are found in Metro Manila, Bulacan, Bataan, Mindanao, and, in the Visayas. Ethanol plants are located with the sugar centrals, while the sole monosodium glutamate manufacturing plant is in Pasig. Activated carbon plants are located close to coconut areas: Mindanao, Cebu, and Quezon. The carbon black plant is in Bataan while the acetylene black plant is in Iligan City.

The coco-chemical plants are located in Quezon, Metro Manila, Misamis Oriental and Batangas.

Technical Aspects

Many of the basic industrial chemical plants were established in the 1950's and 1960's. However, the carbon black and activated carbon projects were implemented in the 1970's and 1980's. Cocochemical plants, except for the NIDC project were erected in the late 1970's until the 1980's.

Raw materials for the inorganic chemicals are mostly imported. Carbon black is also manufactured out of imported petroleum. Coco-chemicals, activated carbon and fermentation products are derived from indigenous raw materials, coconut oil, coconut shell charcoal, sugar juice/molasses and pineapple wastes.

Markets

The inorganic chemical and carbon black are sold mainly to local industries, the fermentation products partly to exports, while the activated carbon and cocochemicals mostly to exports.

At present, the country earns around US$ 20.0 million out of our exports of cocochemicals, another US$ 20.0 million from activated carbon, US$ 5.0 million from alcohol, and US$ 1.5 million from monosodium glutamate.

Government Programs/Policies

Among the basic industrial chemicals included in the Investment Priorities Plan are the following:

1. Salt
2. Activated Carbon
3. Sucro-chemicals
4. Coco-chemicals
5. Ethanol
6. Caustic Soda
7. Acetylene Black
8. Di-octyl Phthalate
9. Sodium Sulfate
10. Soda Ash

As such, firms proposing to engage in the manufacture of these products may avail themselves of fiscal and non-fiscal incentives under the Omnibus Investments Code through the Board of Investments. These incentives include:

1. Tax and duty free importation of capital equipment.
2. Tax credit on locally manufactured equipment.

3. Income tax holiday: 6 years for new pioneer enterprises and 4 years for non-pioneers.

4. Tax credit for taxes and duties paid on raw materials/supplies used on an exported product.

5. Employment of foreign nationals.

6. Access to bonded trading/manufacturing warehouse facilities.

Problems of the Industry

The power intensive basic industrial chemical manufacturers like carbon black and chloro-alkali manufacturers complain about the high cost of power.

Users of agro-based raw materials such as the coco-chemical and activated carbon manufacturers are faced with the uncertainty of supply of raw materials. Changes in climatic conditions greatly affect the yield of coconut trees thus, the availability of coconut oil and coconut shell charcoal.

Competition from imports has also been a problem of the basic industrial chemical sector. High cost of production due to economies of scale as well as high cost of raw materials and power is the major reason why local manufacturers cannot offer more attractive prices than their foreign counterparts.

The specific tax on petroleum products is imposed on imported organic solvents which is the complaint of chemical manufacturers who use these as raw materials. While the tax law says that only solvents produced out of the fractionation of petroleum oil is subject to a specific tax, the BIR imposes the tax on all solvents.

Outlook

Among the subsectors of the industry, coco-chemicals have the greatest potential here and in foreign markets.

Annex M
(8)

With the manufacture of coco-chemicals, we are getting more out of the coconut by exporting the higher value products than our traditional exports, coconut oil and copra.

Coco-chemical manufacturers plan to go farther downstream. At present, our coco-chemicals are exported to Japan and other countries for processing into intermediates. We, in turn, import these intermediates for the manufacture of soap, detergents, shampoos, cosmetics, pharmaceutical products, etc. Our local industry is now slowly moving towards the manufacture of these intermediates. As one coco-chemical firm says, the Philippines shall soon be the coco-chemical center of the world.

The government is currently conducting a study on sucro-chemicals. With the depressed world market on cane sugar, we have to seek other means by which we can derive income for the sugar industry, on which as we all know, many derive their livelihood. Among the sucrochemicals we envision to manufacture here are citric acid, amino acids for animal feeds, etc.

The national alcohol program, which involves the replacement of tetraethyl lead in gasoline with anhydrous alcohol, shall create a demand for ethanol. The ethanol requirement of the program is expected to reach 140 million liters per year.

FOOD PROCESSING INDUSTRY

Composition

The food processing industry is composed mainly of the manufacture of the following:

1. Processed Meat
2. Processed Seaweeds
3. Processed Fruits
4. Processed Shrimps and Prawns
5. Canned Fish
6. Dehydrated Fruits
7. Ethnic Food Products

It is estimated that the large processors of meat produce around 54,000 MT annually. Outside of this, there are a number of the cottage-size processors with an aggregate capacity of 300 MTPY.

The six (6) BOI-registered seaweed processors/exporters have a combined capacity of 8,630 MTPY. These are the firms who have the facilities to produce export quality seaweeds. Five of these manufacture the powdered form while the one other produces the dried seaweed.

Processed fruits include purees, pastes, concentrates and juices. Total industry capacity is approximately 32,000 MTPY covering five (5) firms in fuit puree processing, 2 in tomato paste, and 1 in pineapple concentrates.

The existing processed shrimps and prawns industry is estimated to have a capacity of 24,000 MTPY.

estimated capacity of 38,000 MTPY.

Dehydrated fruits include banana chips, dried mangoes, papayas and pineapples. The subsector is composed of small or cottage-type operations requiring minimum equipment outlays, thus their aggregate capacity is difficult to determine.

Ethnic food products may sound foreign to you but this group simply include bagoong, patis, various sauces like that for lechon, kare-kare, etc. Again, the group is composed of small units, which we have no means of determining capacity or even number of processors.

Plant Location

The major meat processors are located in Metro Manila, where the bulk of the market is. Small ones may be found in the other urban centers of the country.

Other food products are processed in areas where the material is abundant, such as Cebu and Bicol for seaweeds, Mindanao, Visayas and Northern Luzon for fruits, Visayas and Mindanao for fish, prawns and shrimps.

Technology

With the industry eyeing foreign markets, more modern processing facilities are being installed. The most modern, though, are found among the large firms especially those with licensing agreements with foreign companies for the use of their international brand names, which at the same time provide technical assistance and technological advances.

To meet international quality standards, which is a must if one intends to tap foreign markets, many have quality control equipment. Perhaps you have heared of many Philippine food products being rejected by the US Fodd and Drug Administration in the past. Now, Philippine food processors would not like such losses, thus they are more conscious of quality.

Market

The domestic consumers are still the prime market of food processors. However, more and more are aiming for foreign sales.

Processed meat have been exported to Hongkong, Singapore, Indonesia, the US and Bahrain. In 1980-1982, exports averaged around US$300,000 per year. This, however dropped in the succeding years to barely US$40,000 per year. This drop is generally due to the high cost of the major inputs, meat, packaging materials (tin cans) and supplies.

The Philippines and Chile are the largest producer/exporters of processed seaweeds among the developing countries. In 1985, we exported 23,750 MT valued at US$ 20,000. Importers of this are the US, Australia, the United Kingdom, Denmark, Japan Canada and Spain, with 30 to 40 percent to Denmark.

During the past five (5) years, there was no growth observed in our export of fruit puree. Exports remained at a steady average of 1,800 MTPY valued at around US$1,800. Exports of pineapple concentrates on the other hand, showed an average annual growth of 20% such that 24,500 MT or US$14,000 were exported in 1985.

Pineapple juice contributed to 95% of our export of juices in 1981-1985 with the US and Canada as the major markets. During the period, average annual exports is 25,000 MT.

Tomato paste production is geared only for the local market. The only 2 producers manufacture around 1,700 MTPY.

Our exports of shrimps and prawns grows steadily at the rate of 18% annually. Japan absorbs 72% of our exports, the US 22 % and Guam, Honkong, Canada and Saudi Arabia the remaining 6%.

Exports of canned tuna grew at the rate of 10 % yearly during the past 5 years and is expected to continue at this rate. US has been the biggest importer with 1.6 million cases purchased from Philippine canners in 1985 while Canada, Netherlands and Switzerland a total of 750,000 cases.

In 1985, the country exports around 10,000 MT of dehydrated fruits valued at US$12,000, with the US as the major importer. Japan's rate of importation of banana chips, however, showed the highest average growth.

Chemical Requirements

Chemicals used by food processors include the following:

1. For Freezing

   Freon
   Liquid Ammonia
   Liquid Nitrogen

2. Aseptic Processing

   Citric Acid
   Ascorbic Acid
   Chlorine

3. Dehydration

   Calcium Chloride
   Sodium Bisulfide
   Citric Acid

4. Candy/Confectionary

   Gum Arabic
   Synthetic Flavors
   Flavoring Extracts
   Citric Acid
   Maleic Acid

5. Canning/bottling

   Sodium Benzoate
   Food coloring
   Acetic Acid
   Citric Acid

6. Carageenan/seaweeds

   Potassium hydroxide
   Potassium chloride
   Calcium Chloride

7. Fats/oils

Caustic soda
Bleaching clay

8. Flour milling
Benzol peroxide
Vitamins

Government Programs

Research and development as well as quality control services are available for the indutry at the Food and Nutrition Institute, NSTA, and Food Development Center, FTI which also offer refrigerated storage facilities.

The Central Bank supervised credits under rural banks and the Technology Resource Center offer various loan programs to agri-business projects.

The Omnibus Investments Code offers various incentives to export and domestic processors of various food products.

Problems of the Industry

The canners of meat and fish operate below their rated capacities mainly due to the high cost of major inputs like meat or fish, tin cans and supplies.

To lower the costs of fresh meat, the industry believes that it might be necessary to extend financial assistance at low interest rates to livestock raisers and to set lower tariff rates for feeds.

Tin cans may be available at lower prices if only the existing facilities for tin can fabrication are upgraded and the tariff on tin plates are adjusted downwards.

Besides sharing the tin can problem, fruit processors are often faced with shortage of raw materials. It might be necessary for fruit processors to [illegible] contract buying with

organized farm producers to be assured of a steady supply of materials. This will, however, require financing.

Fruit puree processors also bear the burden of the high cost of imported asceptic bags.

Capacity underutilization due to raw material under supply and quality is a problem of shrimp and prawn processors. Backward integration might also be necessary for a steady supply of good quality materials.

Manufacturers of dried fruits require sugar. Although we are a sugar producing country, processors complain that sugar prices here are more expensive that world market prices.

Outlook

Food processors are optimistic that they can garner a sizeable sum in exports with an increased effort to promote our products abroad.

It is hoped that the Philippine meat processors can get a share of the meat imports of Japan, Honkong and Singapore.

Seaweed exports are predicted to grow at the rate of 8 % annually. Prawns and shrimp exports shall maintain the 18 % annual growth rate. Based on past performance, exports of fruit puree shall increase by 30 % annually, pineapple concentrates at the rat of 20 %, and pineapple juice 39%. .pa