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IMPROVEMENT OF TEXTILE PROCESS AND PRODUCT  
DEVELOPMENT FACILITIES AT ATIRA<sup>1/</sup>

INDIA

(DP/IND/72/035/37)

Project findings and recommendations

Draft terminal report prepared for the  
Government of India

by

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Organization acting as Executing Agency for the  
United Nations Development Programme

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<sup>1/</sup> The views and opinions expressed in this paper are those of the  
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We regret that some of the pages in the microfiche copy of this report may not be up to the proper legibility standards even though the best possible copy was used for preparing the master fiche

## TABLE OF CONTENTS

	<u>Page</u>
SUMMARY ... ..	1
INTRODUCTION ... ..	5
FINDINGS ... ..	4
RECOMMENDATIONS ... ..	7
1. Current Project ... ..	7
2. Additional Training ... ..	8
3. Equipment ... ..	11
4. Follow-up Projects ... ..	12
APPENDIX I : RESEARCH PROGRAMME ( <u>Separate report</u> )	
APPENDIX II : PROJECT STAFF	
APPENDIX III : FELLOWSHIP AWARDS	
APPENDIX IV : UNDP FINANCED MAJOR EQUIPMENT	
APPENDIX V : MEETING AND LECTURES	

## SUMMARY

This project was approved in August 1974 and was initiated in January 1975. The five-year RESEARCH PROGRAMME has been drawn up and was submitted to UNELO on 27 March 1975. The ATIRA staff contributed substantially to the PROGRAMME through a series of meetings and seminars.

The first of five training programmes abroad commenced on 1 April 1975 and these are expected to be completed by March 1976. Project research work in the areas of cotton fabric easy-care, flame retardancy and soil release will continue in other ATIRA Divisions not directly affected by the training programmes. The research project should be in full operation by February 1976 following installation of the equipment, arrival of two Experts for one-year terms, and return of the staff fellows from training.

Sufficient staffing has been provided to execute the project at a satisfactory level of effort. Training provided by the project is adequate for the initial programme. Additional training within the Chemistry Division is recommended during 1977, together with a study-tour by the Director to become familiar with most-current marketing and legislative trends in Europe and U.S.A.

No additional major equipment is required to undertake the RESEARCH PROGRAMME as described in the 5-year plan. However, seven minor items are described which are either indispensable or can be of enormous value in accelerating the research studies.

Four follow-up projects are identified which suggest methods by which the staff expertise in the use of the new equipment and tangible benefits resulting from the research could be made available to other developing countries.

## INTRODUCTION

Ahmedabad Textile Industry's Research Association (ATIRA) has carried out an extensive amount of research and development on cotton during its twenty-five year history. World-wide research interest with cotton finishing currently lies mainly in the areas of easy-care, flame retardancy and soil release. In recent years, research progress at ATIRA has been impeded by the lack of a scanning electron microscope (SEM) and modern sophisticated infrared spectroscopy (IRS) equipment which have been available for almost a decade. Thus, Project Document IND/72/035/8/01/57 was submitted to UNDP/UNIDO on 7 August 1972.

Acquisition of this new equipment would be meaningful only if training fellowships abroad were provided together with visits to ATIRA by Experts to assist both in formulating the specific research objectives as well as assisting in the use of the equipment. These needs have been provided in the project plan.

Justification for the project and the potential benefits to the cotton textile industry of India were described in the Project Document (page 1-2). Short-term and long-term objectives are also given in the Project Document (page 14).

Authorization for the project was provided on 30 August 1974 and the project was initiated on 29 January 1975.

## FINDINGS

The RESEARCH PROGRAMME for this project (Appendix I) has been drawn up and was submitted to UNIDO on 27 March, 1975. This programme was formulated giving full consideration to ongoing ATIRA research projects. The overall research programme is expected to continue for the next five years, well beyond the two year period of the present UNIDO Project involving equipment procurement, on-site consultation and staff training abroad. The RESEARCH PROGRAMME takes into account projected marketing opportunities for improved cotton textile products in the areas of easy-care, flame retardancy and soil release, both for domestic markets and for exports. It has also been drawn up with considered judgement for the capabilities of ATIRA to meet the programme objectives in the time available.

During the past two-month period in which the RESEARCH PROGRAMME was formulated, numerous meetings were held with those ATIRA staff members concerned with each phase of the research. In each area, ATIRA staff therefore participated in formulation of the specific objectives and also in the choice of methods to reach those objectives. In the area of easy-care, the research is a continuation of a very substantial effort that has already been carried out during the past ten years. On-the-other-hand, flame retardancy and soil release are areas where earlier research effort will be expanded considerably. In all three areas, ATIRA staff concerned have demonstrated enthusiasm for undertaking the research programmes which have been documented.



Staff assignments for carrying out the research are described in Appendix II. No difficulty would be expected in making any staff replacements should this become necessary.

Administratively, ATIRA is entirely capable of carrying out all functions pertaining to the project. It is anticipated that the project objectives can be met within the current projected operating budget and with the level of staffing and staff support which are provided.

The next eight months will be concerned mainly with the training programmes of five staff members in the Physics Division (see Appendix III). This will obviously curtail research work in related programmes at ATIRA. However, project work will commence in the Chemistry and Chemical Technology Departments in three important areas; chemical synthesis, some required equipment modification, and chemical processing studies. On completion of the five training programmes in early 1976, it is expected that considerable progress will have been made in sample preparation within the Chemistry and Chemical Technology Divisions. Therefore as the SEM and IR equipment are installed during September and January, there should be a sufficient amount of new research samples to start serious, in-depth investigations. This also coincides with the arrival of the two Experts.

This project places a heavy emphasis on expanding the research facilities (see Appendix IV), with the necessary training and consultation, within the Physics Division of ATIRA. Ultimately, it may become desirable

for UNIDO to complement the current programme with training programmes and/or visits of experts in the Chemistry and/or Chemical Processing Divisions. This will be considered further under Recommendations.

A series of seminars in the areas of easy-care, flame retardancy and soil release have been undertaken with heavy participation of ATIRA professional staff (see Appendix V).

ATIRA has on-hand most of the necessary equipment and instrumentation to carry out the project. Several items which were found lacking are also described under Recommendations.

On completion of the project as defined, the ATIRA programme would be strengthened by a study tour of four to six weeks duration by ATIRA Director Dr. P.G. Mehta to selected industrial, governmental and academic laboratories in Europe and the U.S.A. Subsequent study tours for Division Heads of Chemistry and Chemical Technology are also recommended. These will be further considered under Recommendations.

## RECOMMENDATIONS

### 1. Current Project

The Government of India has appointed a National Commission for Science and Technology (NCST) which assigns priorities for the Council on Scientific and Industrial Research (CSIR) governing the level of research funding related to different segments of industry. The field of chemical finishing as related to cotton textile developments has been given a high priority by the NCST. Active Government support in this area can be expected in the future.

During the two-year period of this project, sufficient staffing provisions have been made by the Government together with co-operating industrial companies affiliated with ATIRA (on a 50/50 basis). Funds have also been assigned to make all necessary modifications in the buildings to accommodate the new equipment.

When the project is completed, it can be expected that Government/Industry combined expenditures will be continued at a level sufficient to maintain effective use of the equipment and to generate the expected level of high quality research. A requirement for further major expenditures by UNIDO is not anticipated, and effective research can be carried out in the areas of easy-care, soil release and flame retardancy as this project gets underway. Thus, no financial, economic or social

constraints are envisaged which will impede progress in this programme.

## 2. Additional Training

The current research programme should be strengthened by additional training fellowships in the Chemistry Division. Currently, plans are being made for Dr. R.H. Murker of that Division to visit an appropriate U.S. laboratory under the bilateral scientific agreement which led to the INDO-US Exchange Program (N.S.F.-C.S.I.R.). It is hoped that this arrangement can be finalized during 1975.

Dr. Murker will study in the area of fabric flammability. No other training programmes are pending. The duration of this visit may unavoidably be restricted under the programme mentioned so as to be inadequate for the purposes of the present programme. UNIDO should provide for two training fellowships, one each in the areas of soil release and fabric flammability; each should be for six months and the emphasis should be on synthesis of new finishing chemicals.

**Appropriate Laboratories would include:**

### In Flammability:

- 1 Clemson University, Textile Department; Clemson, S.C., U.S.A.
- 2 University of Maryland, Textile Department, College Park, Md. U.S.A.
- 3 Southern Regional Research Center, New Orleans, U.S.A.

### In Soil Release:

- 1 Gillette Research Laboratory, Maryland, U.S.A.
- 2 Swedish Institute for Textile Research, Gothenburg, Sweden.
- 3 Textile Research Institute, Princeton, U.S.A.

In addition, it is recommended that visits to ATIRA be arranged for experts in the fields of soil release and fabric flammability. These visits should be for at least one and preferably for three months. Time must be allowed for the expert to become thoroughly familiar with past work carried out at ATIRA, to provide detailed advice in synthesis aspects of each programme, and to deliver lectures on the subjects concerned. Hopefully, the expert selected will have experience with fabric application techniques and in instrumental analysis, but the primary emphasis should be given to organic synthesis.

Generally, the expert could be from one of the laboratories listed above as being suitable for training fellowships.

As these recommendations represent an extension of the current project, it will be necessary to advise the government at an early date so that the programmes may be submitted for approval in the current UNDP Country Programme for India. Total cost of the two fellowships and Expert missions should not exceed \$ 80,000. Visits by experts and training fellowships should be staggered so that they do not coincide. For example, the flammability training fellowship could be Spring 1977, visit by the expert in late 1977 while the soil release expert would visit in Spring 1977, fellowship training in late 1977.

Mid-way through the five-year research project, the programme should be further strengthened by a study tour of ATIRA Director Dr. P.C. Nahta to selected principal laboratories and government agencies in Europe and the U.S.A. This should follow in 1977, a few months after the

second visit of the Senior Research Consultant. The research programmes at that time will have been oriented to meet the most up-to-date criteria in way of marketing opportunities, and in the case of flammable fabrics, to comply with objectives consistent with the latest legislative action. However, with the project completed, this study tour will afford the Director an opportunity to have in depth discussions with many key personnel directly involved with day-to-day decisions which relate to manufacture and marketing of easy-care, soil release and flame retardant fabrics. As the programme continues for an additional three years, the Director will be in a better position to assure that the objectives are modified continuously to be consistent with rapidly changing demands from the market place. For full effectiveness, the tour will require approximately six weeks.

Laboratories which should be visited might include:

In U.S.A.

- National Bureau of Standards
- Textile Research Institute, U.S.A.
- Burlington Industries, U.S.A.
- Springs Mills
- Southern Regional Research Laboratories
- Gillette Research Center
- Fabric Research Laboratories
- Principle Detergent Manufacturers  
Procter and Gamble, Colgate or Lever Bros
- Clba Geigy

- DuPont Co
- Monsanto
- Celanese
- Cotton, Inc.
- Am. Ass'n. Textile Chemists and Colorists
- Research Triangle Institute
- North Carolina State University

In U.K.

- Shirley Institute
- University of Manchester
- Leeds University

Appropriate laboratories in France and Germany should also be included.

Study tours for Division Heads in Chemistry and Chemical Technology or their designated officers would also be advisable following completion of the Director's tour. The tours should include laboratories recognized for their excellence in easy-care, flame retardancy and soil release research. Exact locations could be decided from the experience gained in the Director's tour. These tours would require six to eight weeks.

**3. Equipment**

The need for additional major equipment to carry out the current project is not envisaged. Several items representing minor investments which are very important to the project were listed, together

with justification, in the first report dated 10 February 1975.

These are -

1. Oxygen Index Analyzer
2. Flame-spread Tester
3. Static Decay Instrument
4. Dry Spilling Tester
5. Tergometer

In addition, two other pieces of equipment are required in order to carryout effective research in flame retardancy.

Meaningful research in studies of the rate of flame spread and measurement of flame temperature and heat generated is best accomplished using the TRI Flammability Analyzer. (Ref. my letter to Dr. Stalios Arghyros dated 20 March 1975). This should be procured. There is a sole supplier in the U.S.A.

ATIRA does not have standard equipment which measures fabric air permeability. Because this basic fabric property has an important influence on burning properties, the equipment should be provided. Estimated cost is \$ 4000 and a suggested supplier is Shirley Developments, Ltd, U.K.

These seven items should be acquired in time for use when the project gets in full operation in January 1976.

#### 4. Follow-up Projects

Completion of the present project at ATIRA will provide the basis for future UNIDO projects involving other developing countries.



These can fall in to four categories.

- (a) When the SEM and IRS equipment are in full operation, and training programmes have been completed, courses can be arranged for training in the use of the equipment of technical personnel from other developing countries. These programmes could cover a range of subjects and are not necessarily restricted to cotton textiles.
- (b) Conferences can be arranged for technical staff from other laboratories in India or in other developing countries which would be devoted to use of the equipment and to interpretation of the results of research.
- (c) The services of ATIRA staff can be made available for consultation in the use of the equipment in laboratories of other developing countries.
- (d) Technologies developed can be made available for licence on a royalty basis to industries in other developing countries. The terms of licence would probably be similar to those operative between ATIRA and the Indian textile industry.

5. Senior Research Consultant

The Project Document notes a four-month programme for the Senior Research Consultant at the end of 1976. This coincides with closure of the project and the purpose is to revise the Research Programme and prepare a final report.

The project would be substantially strengthened by splitting the four months into two portions. It is proposed that a two-month visit be scheduled in early 1976, the second two-months in early 1977. The purpose of the early 1976 visit is to work with the other two experts who will be commencing their tours of duty, and to perfect the work which had been on-going in the Chemistry and Chemical Technology Divisions from April 1975 to January 1976. The purpose of the final visit in early 1977 remains unchanged, and it is expected that two months will allow sufficient time for the work required.

Use in Equipment

It is recommended that a UNIDO staff member visit, together with J.K. Shah, the ATIRA maintenance engineer, the manufacturers of the chosen SEM and the IRS equipment. This will help assure that equipment specifications are met and that all aspects of after-purchase service are co-ordinated between ATIRA and the manufacturers.

**APPENDIX II**  
**(IND/72/035/37)**

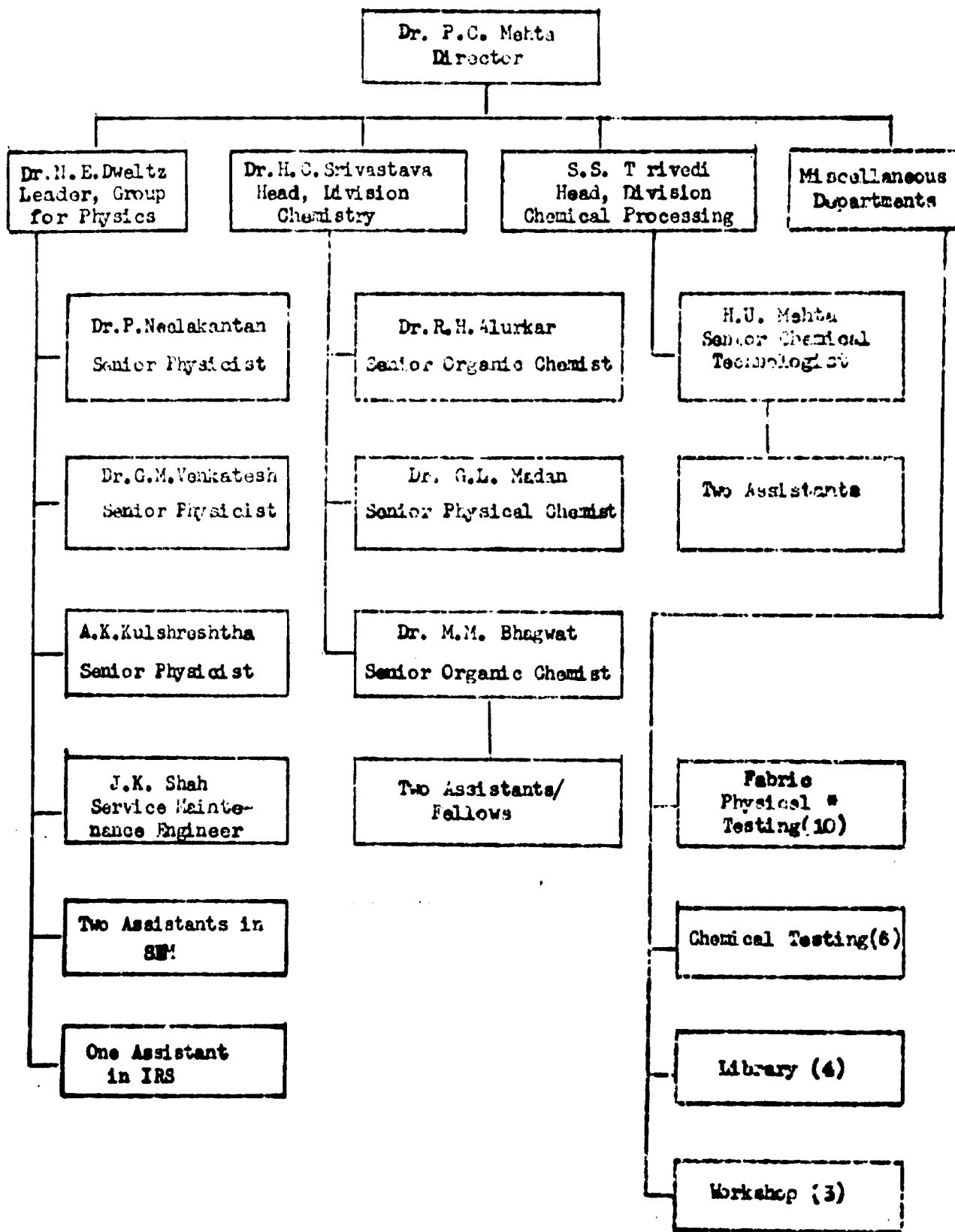
Experts assigned to the project by UNIDO are the following:

1. Dr. John J. Willard, Senior Research Consultant  
January 20 - March 19, 1975           ...           (3 months)  
September - January, 1976           ...           (4 months)
2. Dr. John Sparrow, SEM Expert (Tentative)  
September 1975 - September 1976   ...           (1 year )
3. To be named - IRS Expert  
(January 1976 - January 1977)      ...           (1 year )

Counterpart Project Staff assigned to the project are shown in the Organisational Chart attached.

Specific staff assignments relative to the three research areas were noted in the Report on Initial Observations dated 10 February 1975.

The four staff members undertaking training fellowships will each acquire expertise in the use of both the SEM and the IRS equipment by the time the project is completed. This will assure continuity of maximum effective use of the equipment in the event staff replacements are required.



\* Number in parentheses indicates staff available to project.

ATRRA ORGANIZATIONAL CHART  
RELATIVE TO PROJECT

**APPENDIX III**

**(IND/72/035/87)**

**FELLOWSHIP AWARDS**

The following fellowship training programmes have been awarded or approved:

1. Dr. G.M. Venkatesh - IRS  
Southern Regional Research Centre,  
New Orleans, La. U.S.A.  
April 1 - September 30, 1975
2. Dr. P. Neelakantan - SEM  
(Place and time to be established)
3. Dr. H.E. Deolts - SEM  
(Place and time to be established)
4. Mr. A.K. Kulshrestha - IRS  
(Place and time to be established)
5. Mr. J.K. Shah  
(Candidature awaiting approval)

APPENDIX IV

(IND/72/035/37)

UNDP - FINANCED EQUIPMENT

MAJOR ITEMS

Negotiations are proceeding at the present time for procurement of the following major equipment:

1. Scanning Electron Microscope with vacuum coating unit and other accessories.

The Autoscan RI and the Stereoscan 84-10 have been recommended.

2. Ultramicrotome

The Ultratome III and the Reichart Om U2 have been recommended.

3. Infrared Spectrophotometer and accessories.

The Perkin-Elmer Model 180 appears to be the only suitable model available.

**APPENDIX V**

**(IND/72/035/57)**

**MEETINGS AND LECTURES HELD DURING  
INITIAL ASSIGNMENT**

**January 29 - April 12, 1975**

1. Divisional review meetings : Research results for the past year and the research plans for the next year were critically reviewed before panels of external experts on the following dates:

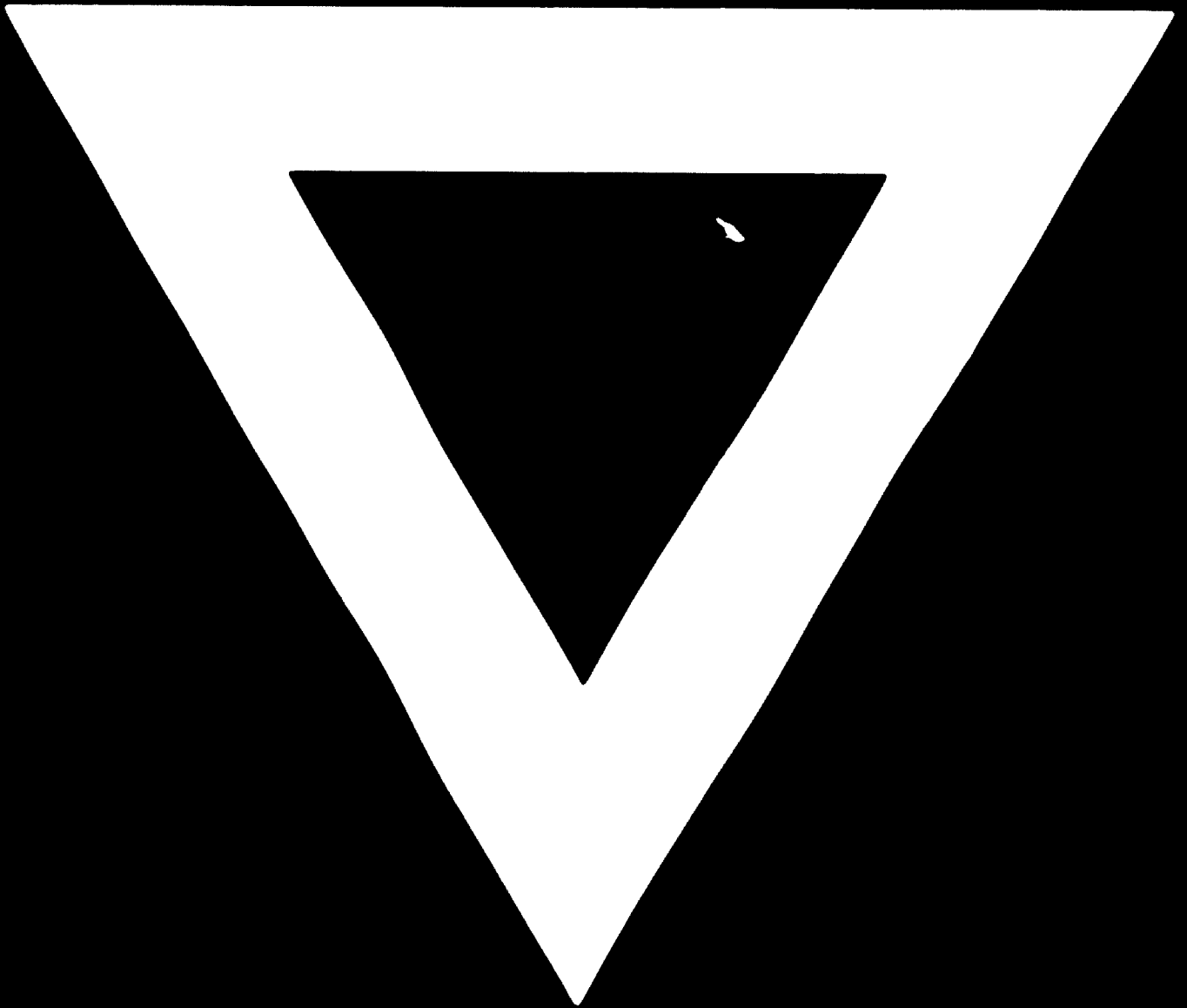
Physics Division : 30 January 1975  
Chemistry Division : 3,4 February 1975  
Chemical Technology  
Division : 24,25 February 1975

2. Overall "Report on Current Research Projects" including those of the three Divisions above was reviewed before a Research and Liaison Advisory Committee (15 members) on 4 and 5 April 1975.

3. The following seminars were presented to the AHIRA Staff by J.J. Willard, UNIDO Consultant.

Easy-Care Cotton - Part I : 26 March 1975  
Easy-Care Cotton - Part II: 1 April 1975  
Flame Retardancy : 7 April 1975  
Soil Release : 9 April 1975





**76.01.13**