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ASSISTANCE TO THE BEIJING INSTITUTE OF CHEMICAL REAGENTS

DP/CPR/85/013

CHINA

Report: Visit to BICR by A. L. Baldock*

Prepared for the Government of China
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of A. L. Baldock
C.T.A.

Backstopping officer: M. Derrough, Industrial Operations Technology Division

United Nations Industrial Development Organization
Vienna

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This report covers a ten working day visit to BICR to assist in the planning, execution, and evaluation of the Project Document DP/CPR/85/013/B/01/37. Priorities for this trip, as discussed with Dr. M. Derrough, were as follows:

1. Complete documentation for Capital Equipment to be purchased by UNIDO for BICR in 1986.
2. Complete job descriptions for experts 11-02, 11-03, 11-04, 11-05 and 11-06.
3. Complete a plan for fellowships in foreign countries by selected BICR personnel.
4. Report on effectiveness of five man study tour by BICR personnel to USA and Japan in August 1986.
5. Evaluate BICR capability in preparation, analysis and packaging of high purity and electronic grade chemical reagents.
6. Prepare a work plan and schedule for action to be taken by UNIDO, BICR and CTA for next 12 months.

The following is a report on the current status and future plans for each of these project categories.

1. Capital Equipment

BICR has completed documentation on the Carlo Erba Elemental Analyzer and has given this information to UNIDO Beijing. After much deliberation BICR has selected an Analect Infrared Spectrophotometer made in Utica, New York.

This instrument will be made and serviced in China by the China No. 1 Optical Company on a joint venture with Analect. One instrument a prototype is in China and is available to BICR at a very large discount. The instrument will

meet the specifications of BICR for high purity analysis. BICR will complete documentation for purchase of this instrument and forward to UNIDO, Beijing by November 7, 1986.

2. Job Descriptions for Experts

CTA completed job descriptions for 5 experts, 11-02, 11-03, 11-04, 11-05 and 11-06. These are the key experts needed to add technology in preparation, analysis, and packaging of electronic chemicals and photo resists. BICR has contacted Dr. Rains of the National Bureau of Standards in Washington, DC who has expressed interest in coming to China. He is an ideal candidate for 11-03. BICR will contact Rains again and forward information to UNIDO who will recruit Rains.

BICR also has contacted Professor Yamaoka of Chiba University an expert in photoresist technology who also is willing to visit China. BICR will forward information on Dr. Yamaoka so that UNIDO can arrange his visit under position 11-05.

CTA Baldock will locate candidates for positions 11-02, 11-03 and 11-06 preparation of photoresists and recommend to UNIDO.

The position guides are shown in Appendix I.

3. Fellowships for BICR Training in Foreign Countries

BICR has selected 5 Fellowship Candidates who have passed the University of Michigans course in English. They are ready for immediate assignment in Japan and USA. BICR, with advice from CTA, have selected the following training locations and will make the necessary contacts for setting up study programs.

National Bureau of Standards U.S.A.

1. Fellowship in trace analysis of high purity chemicals 31-01.
2. Fellowship in information systems 31-10.

Perkin Elmer USA

Fellowship in trace analysis techniques 31-01. Same individual who will go to National Bureau of Standards for Fellowship 31-01.

Chiba University, Chiba Japan

Fellowship in photoresist technology 31-04.

Eastman Kodak Company

Fellowship in organic analysis and packaging of high purity chemicals 31-02.

CTA will locate Fellowship site for preparation photoresists 31-05.

CTA will assist in locating alternate locations for Fellowships if agreement cannot be reached with the above locations. See Appendix II for detailed work plan and schedules for these Fellowships.

4. BICR Study Tour USA Japan, August 1986

Five key scientists from BICR visited 10 locations in the USA and 4 in Japan to discuss high purity reagents and photoresists. A report of this tour is in Appendix III. The tour was successful. BICR established important contacts for future Fellowships, additional experts and continuing exchange of scientific information. They also witnessed first hand the equipment, processes, analytical techniques and facilities needed to produce high purity reagents and photoresists. Another tour to visit other locations, including developing countries such as Mexico, should be scheduled in the next 12-18 months. By that time BICR will be further advanced and the study tour would be very beneficial in technical details problems which will arise as technology at BICR improves.

5. BICR Capability in Chemical Reagents

One of the CTA major objectives was to evaluate BICR capability in high purity reagents compared to state of the art technology. This process involved discussions with BICR scientists and management, inspection of production, laboratory and packaging facilities and a review of product lines and plans for future product research.

The following is an evaluation of key technologies versus the standard of producing high quality reagent chemicals rating scale 1-10 with 10 being excellent.

1. Analytical Technology: Rating 7.

   The technology and equipment for doing trace analysis was much further advanced than expected. This function can readily be improved to 9 or 10 by a one month visit by an expert and completion of Fellowships in foreign countries. Additional equipment will be needed and laboratory space must be improved. The latter will be solved when the new laboratory is finished next year.

2. Preparation of High Purity Reagents: Rating 6.

   BICR has good equipment for distillation of solvents and acids but need better clean room facilities and procedures. Products prepared in the laboratory are high in purity but facilities for larger scale production should be upgraded.

3. Packaging of High Purity Reagents: Rating 2.

   Bottles arriving from glass factory are grossly contaminated. Even extensive washing procedures do not eliminate particulate matter. Both containers and filling equipment must be greatly improved before BICR can deliver high quality electronic chemicals to their customers.

CTA made a number of on the spot suggestions for improving bottles facilities, procedures and raw materials to improve performance in each of the above three categories. A work plan to improve operations is shown in Appendix II.

6. Work Plan

CTA prepared a schedule of activities to complete work for the next twelve months (See Appendix IV). If all projects are completed successfully BICR should be able to make and ship quality electronic chemical reagents and photoresists. The procedures, equipment, analytical techniques and packaging capability learned from producing these products will enable BICR to produce a wide variety of high purity reagents. It is important that BICR concentrate its efforts in just two product lines, electronic reagents and photoresists. This will prevent dilution of management time and scientific skills which are at a premium under present conditions.

A work schedule showing activities by CTA while in China is shown in Appendix V.

APPENDIX I

Job descriptions for positions 11-02, 11-03, 11-04, 11-05 and 11-06 were prepared and left with Mr. Sissingh, UNIDO Beijing for typing and review by BICR.

APPENDIX II

DETAILED SHORT RANGE WORK PLAN

TO IMPLEMENT UNIDO - BICR PROJECT

DP/CPR/85/013/B/01/37

PREPARED BY

A. L. BALDOCK, C.T.A.

The following is a detailed work or action plan to be followed over the next twelve months to accomplish the immediate objectives outlined in the project document. The priorities were selected after discussions with M. DERROUGH, UNIDO, VIENNA, A. SISSINGH, UNIDO, BEIJING, and key project management at BICR. Completion dates may vary due to communication problems, however maximum effort will be expended to successfully complete the priority projects which are as follows:

1. Capital equipment budgets
2. Recruitment of Experts
3. Training Fellowships
4. Immediate action to be taken by BICR and CTA to improve technology

Actions to be taken in completing these priority projects is outlined as follows:

1. Capital Equipment Budgets

The project document lists $320,000.00 for new laboratory equipment to be purchased by UNIDO for BICR - an elemental analyzer made by Carlo Erba and an Infrared spectrophotomer made by Analect Instrument Company, Utica, New York, U.S.A. BICR selected this instrument because it will be made and serviced by the China No. 1 Optical Company in a joint venture with Analect.

Action Plan:

A. BICR will complete documentation for Elemental Analyzer and submit to UNIDO by November 10, 1986.

B. BICR will complete documentation for Analect Infrared instrument and submit to UNIDO by November 10, 1986.

2. Recruitment of Experts

The project document lists eight additional experts to be recruited for one month assignments with BICR.

Action Plan:

A. CTA will complete job descriptions for experts 11-02, 11-03, 11-04, 11-05 and 11-06. Completion date - November 15, 1986.

B. BICR will contact Dr. T. C. Rains, National Bureau of Standards, to fill position 11-03. Completion date - November 15, 1986.

C. UNIDO will recruit Dr. Rains, January 1987.

D. BICR will contact Dr. Yamaoka, Chiba University, Japan, to fill position 11-05. Notify UNIDO.

E. UNIDO will recruit Dr. Yamaoka, February 1987.

F. CTA will contact and recommend candidates for 11-02, 11-04 and 11-06 to UNIDO and BICR by January 1987.

G. UNIDO will recruit 11-02 and 11-04, March 1987.

3. Training Fellowships

BICR has five people who have passed the University of Michigan course in English and are prepared for Fellowship assignments as outlined in the project document. The present plan is to send four to the U.S.A. and one to Japan.

Action Plan:

A. BICR will contact Chiba University to arrange Fellowship 31-04 in photoresist technology by November 1986.

B. BICR will contact the National Bureau of Standards to arrange Fellowship 31-01 in analysis of high purity chemicals by November 1986.

C. BICR will contact National Bureau of Standards, Washington, U.S.A. for Fellowship 31-10 in information collecting by November 1986.

D. BICR will contact Perkin - Elmer Company, U.S.A., for Fellowship 31-01 for trace analysis techniques by November 1986. The same person as in B. will go to both NBS and Perkin Elmer.

E. BICR will contact Eastman Kodak Company to arrange Fellowship 31-02 for preparation, packaging and analysis of high purity chemicals.

F. CTA is to assist in Fellowships in the U.S.A. on an ongoing basis.

4. Immediate Action to be Taken by BICR and CTA to Improve Technology

A number of items were discussed in meetings with BICR personnel regarding the preparation, analysis and packaging of high purity reagents. The major problem is in packaging.

Glass bottles are shipped to BICR in very dirty condition. Even after thorough washing, particles in high purity reagents remains a problem.

In ranking BICR technological capability, analysis is in excellent shape. Preparation is good, however container condition and filling operations need improvement to reach minimal requirements.

The following actions will be taken to improve operating technology:

1. CTA will send BICR latest USA specifications on electronic chemicals by November 1986.
2. CTA will send BICR analytical methods used in manufacture of electronic chemicals by November 1986.
3. CTA will send BICR specifications on photoresist products by December 1986.
4. CTA will send BICR specifications and equipment types used in particle analysis by December 1986.
5. BICR will meet with bottle manufacturer to improve quality and cleanliness of high purity bottles by December 1986.
6. CTA will send BICR information on types of glass bottles used to package electronic acids and solvents by December 1986.
7. BICR should do a thorough cleaning of rooms and equipment used in packaging high purity chemicals in November 1986.

8. CTA will send BICR specifications on optical fibre grade phosphorous oxitrichloride and dichlorsulfoxide by December 1986.

THE STUDY TOUR REPORT OF BEIJING CHEMICAL REAGENT RESEARCH INSTITUTE IN THE UNITED STATES AND JAPAN

1. PURPOSE : A study program for Beijing Chemical Reagent Development Center supported by the UNIDO (project NO. DP/CPR/85/013).
   The main points of study are photoresists, high purity reagents, colorcoupler, fine chemical products, their development, technology, standards for quality control, testing methods, analysis, bottle washing and packing.
   Inviting experts for work in our institute and choose companies for sending people form our institute to study there.
2. DATE OF TOUR :
   26th July 1986 -- 22nd Aug. 1986 in USA
   23rd Aug 1986 -- 3rd Sep. 1986 in Japan
3. MENBERS : Sun Shi-ming (the head of the delegation)
   Fan Ban-di, Da Ming-hui, Li Jia-mao, Hu Xia-zheng.
4. ROUTE : Beijing - New York - St. Louse - Akron Oheo - Rochester - New York - Norwalk - Washington D.C - Philadelphia - New York - San Jose - San Francisco - Tokyo - Chiba - Tokyo - Beijing.
5. THE VISITED COMPANIES:

   in the US part

   SIGMA CHEMICAL COMPANY
   LIQUID CRISTAL INSTITUTE (KENT STATE UNIVERSITY)
   THE DEPARTMENT OF CHEMISTRY , KENT STATE UNIVERSITY
   PERKIN - ELMER COMPANY
   NATIONAL BUREAU OF STANDARDS (NBS)
   THE DEPARTMENT OF CHEMISTRY , CATHOLIC UNIVERSITY , WASHINGTON D.C
   AMERICAN SOCIETY FOR TESTING ANG MATERIALS (ASTM)

KTI CHEMICAL COMPANY

SEMICONDUCTOR EQUIPMENT AND MATERIAL INSTITUTE (SEMI)

EASTMAN KODAK COMPANY

in Japan part

MILLIPORE COMPANY

DEPARTMENT OF POLYMER CHEMISTRY , TOKYO INSTITUTE OF TECHNOLOGY

DEPARTMENT OF PHOTO APPLICATION , CHIBA UNIVERSITY

SAGAMI PLAMT . TOKYO OHKA KOGYO CO . LTD .

6. THE CONTENT OF VISITING :

in the US part

** EASTMAN CODAK COMPANY

There are about 4000 people in that company , producing 35000 products , 2000 of organic , 200 of inorganic , and 7 of acids . We visited organic research lab. workshop . analysis and testing lab. and library . Company is very strong in analytical and testing methods , equipted with IR , NMR , organic MS , GC , LC , and functional testing equipment .

Company has a development center , they can follow costomer's requirments to do some research work , develope and produce fine chemicals.

** KTI CHEMICAL COMPANY

It was founded in 1922 for the development of IC chips , in 1977 it became an affiliated company of union carbide , now it's main products are positive and negative photoresists and their series products , company also produce electronic beam and ultra violet photoresists.

** NBS

NBS is the abbreviate of National Bureau of Standards, it has 3000 staffs, half of them have doctor's degree, there are also 41 chinese work there. It publishs all kinds of standards and offers 1000 standard samples all over the world.

We visited their high purity analytical lab., we are very interested in the flame spectrometer, made by themselves, it has very high sensitivity, another instrument that impressing us very much is the combination of D.C plasma and ion chromatograph, it is very powerful in solving some specific problems.

** LIQUID CRYSTAL INSTITUTE and KENT STATE UNIVERSITY

We visited their synthetic, application and analytical lab, a director gave us a presentation of a new kind of liquid crystal and a display device made from that kind of liquid crystal.

** SIGIMA CHEMICAL COMPANY

There are more then 1100 staffs and workers in that company, producing 10000 products and 600 kinds of enzymes. We visited their sells department, warehouse and administrative division, we are very impressed by the use of computer in their office work, which greatly enhances their efficiency.

** PERKIN-ELMER COMPANY

P-E COMPANY is one of the famous instrument manufactural company in the world, we visited their FTRI, GC, LC and ICP lab., discussed some technical problems with their experts.

** ASTM and SEMI

Both of them are non official and no profit organizations, offer technical informations and publish standards. Directors of the two

orgnizations gave us a report abort their work, we found their publishs are very helpful for us in the feilds of fine chemicals and semiconductor's reagents.

in Japan part

** TOKYO OHKA KOGYO CO.LTD

It was founded in 1936, their main products are positive and negative photoresists, printing materials and electronic chemicals. We visited photoresist producing, filtering, washing and packing workshops, and analytical and functional lab. TOKYO OHKA develope a new way of using photosensitive plastic film instead of ordinary aluminium printing plate.

** MILLIPORE COMPANY

Their main products are filtering mambranes and filtering equipment which are the main equipment in the production of photoresists. We visited their workshop and lab.

** CHIBA UNIVERSITY

We visited their photo application department, analytical testing center and libratory.

** TOKYO INSTITUTE OF TECHNOLOGY

We visited the department of polymer chemistry, professor's lab and some organic instruments.

7. PERSONAL EXCHANGE AND TECHNICAL TRAINING

** CHIBA UNIVERSITY

The Professor YAMAOKA of photo application department accepted our invitation, he will come to work in our institute at certain time conveniet for both of us, and he also agree to accept our

people to study in their university.

** NBS

Doctor T.C.Rains is an expert in flame and atom absorbtion spectr-scopy, he is also very experienced in the high purity analysis, he accepted our invitation as an expert in high purity analysis to work in our institute for a short term.

NBS agree to accept our people to work in their lab.

** KODAK COMPANY

Now it is in considering of accept our people to be trained in their company in the field of organic analysis.

** ASTM

They said, if we want to invite information experts, they will be delighted to accept our invitation.

** PERKIN-ELMER COMPANY

They agree to accept our people to be trained in instrument analysis.

BEIJING CHEMICAL REAGENT RESEARCH INSTITUTE

ASSOCIATED DIRECTOR SUN SHI-MING

孙世铭 85.10.1.

APPENDIX IV

Chief Technical Advisor Work Schedule in China

October 25	Arrival	
October 26	Discussions with BICR Management	
October 27	Meeting with Sissingh, UNIDO	AM
	Tour Analytical Labs BICR evening meeting with Project Management	PM
October 28	Lecture on Chemical Reagents Historical Trends	AM
	Discussion Chemical Reagents with BICR and BCW Management	PM
October 29	Prepare Lecture BICR Holiday	
October 30	Lecture on Future of High Purity Reagents in USA	AM
	Discussion of Regents with BICR and BCW Management	PM
October 31	Detailed Discussion of Project	AM & PM
November 1	Detailed Discussion of Project	AM & PM
November 2	Discussion Project	AM
	Inspection of High Purity Chemical Facilities	PM
November 3	Discussions and suggestions by CTA for improving high purity facilities and procedures	AM PM
November 4	Prepared Work Plan for BICR and Job Descriptions for five experts	AM PM
November 5	Holiday	
November 6	Reviewed plans with BICR	AM
	Review trip with Sissingh, UNIDO	PM
November 7	Depart for USA	AM
November 8	Arrived home base 10:30 P.M.	