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

06920

UNITED NATION INDUSTRIAL DEVELOPMENT ORGANIZATION

TECHNICAL ASSISTANCE FOR DEVELOPMENT ADAPTATION AND TRANSFER OF TECHNOLOGY TO INDUSTRIES BASED ON INDIGENOUS NATURAL RESOURCES*

BURMA

(IS/BUR/71/051)

Expert's report: Appraisal of the Central Research Organization

by

Norman Booth, expert in industrial research and development and technology transfer

* This document has been reproduced without formal editing.

id. 76-498

C.O.N.T.E.N.T.S

	PAGE
Summary of Recommendations	1
Introduction	3
Government Objectives	4
Present State of CRO	5
Functions which CRO should perform	6
Factors which need strengthening at CRO	7
(1) Number of Staff	7
(2) Organisation	7
(3) Programme Planning and Evaluation	7
(4) Information Service	8
(5) Instrumental Analysis	9
(6) Instrument Repair and Maintenance	11
(7) Chemical Engineering	11
Other Suggestions.	13
(1) Pilot Plants	13
(2) Extension of Analytical Department's Responsibilities.	14
(3) Location of Engineering Workshop	14
(4) Training of Technicians	14
(5) Publicity and Information	15
(6) Specialised Equipment	15
(7) Unusable Analytical Instruments	15
(8) World Association of Industrial Technological Research Organisations.	16

SUMMARY OF RECOMMENDATIONS

In order to strengthen the Central Research Organization the major recommendations are:

1. The Project should consist of three elements: the supply of Experts, of Equipment and of Fellowships.
2. The principle Expert, who would act as Project Manager, should be an Applied Chemist or Chemical Engineer, to assist in the establishment of a Programme Planning and Evaluation Unit for the systematic selection and review of all Projects based on literature surveys and techno-economic considerations.
3. A second Expert should be a Chemical Engineer to assist in organising the Chemical Engineering Department to train local staff in the techniques of obtaining chemical engineering data through semi-technical scale equipment.
4. A selection of additional semi-technical scale equipment for obtaining chemical engineering data should be ordered.
5. The duties of the Expert in Chemical Engineering should be carried out in two stages. The first will be a short visit to choose the equipment to be ordered. The second longer visit should take place only after the equipment has begun to arrive.
6. The third Expert should advise on the choice and operation of a range of modern general purpose analytical instruments.
7. Fourteen such instruments named in this report should be ordered.
8. The duties of the Expert in Analytical Instrumentation should be carried out in two stages. The first will be the precise selection of instruments. The second will be a visit taking place only after the instruments have begun to arrive.
9. All delicate instruments should be sent to Burma by air and not by sea.
10. An adequate range of spare parts should be ordered along with the analytical instruments.
11. Provision should be made for an air-conditioned room and for constant voltage regulators for appropriate instruments.
12. The fourth Expert would be required to organise an improved instrument repair, maintenance, calibration and design services.
13. To strengthen the usefulness of the present library, a limited amount of equipment for copying, filming etc, should be provided.

14. A small sum should be allocated for special books and patent abridgements suggested by Experts.

15. Fellowships should be made available in connection with instruments repair, chemical engineering procedures, specialised analytical and information services.

16. The Government should undertake in connection with the Project to:

a) Set up a Programme Planning and Evaluation Unit, to be directly responsible to the Director General, and manned by an experienced applied chemist or chemical engineer.

b) Appoint an experienced chemical engineer to take charge of the Chemical Engineering Department (at present named Pilot Plant Department).

c) Provide two highly skilled instrument engineers for further training in instrument repair and maintenance.

d) Provide an a middle floor a room which can be air-conditioned for housing specialised analytical equipment.

e) Greatly increase the number of staff, and especially graduate staff, both scientists and engineers.

17. The Ministry of Industry II should consider some reorganisation of the CRO structure particularly by appointing two or three Deputy Director Generals and by amalgamating some of the existing fourteen Departments.

18. The Government should consider giving CRO the responsibility of setting and checking analytical methods throughout industry.

19. CRO should prepare some literature by way of publicising the services available.

20. CRO should consider setting up a central training scheme for its technicians.

21. The CRO should join the World Association of Industrial Technological Research Organisations (WAITRO).

I N T R O D U C T I O N

The writer came to Burma as an Expert in Industrial Research and Development Management and Technology Transfer. His duties were to analyse the proposed large scale assistance project designed to modernise the Central Research Organization (CRO), define its objectives, draw up a viable work plan and assist in the preparation of the final Project Document, together with a UNIDO staff member.

The results of this work are for the most part included in the Project Document, but it was felt that it would be helpful to put on record some observations and background not suitable for inclusion in the Project Document. These two documents must therefore be read together.

Discussions were held with the Director General of the CRO and visits paid to examine work going on in all fourteen departments in the CRO. Visits were also paid to the Ministry of Planning, several Departments in the Ministry of Mines, Rangoon Institute of Technology, the Technical Service Corporation and to factories concerned with oil refining, glass manufacture, pharmaceuticals, leather, food and soap production as well as several cottage Industries. Detailed discussions were also held with the UNDP Resident Representative and members of his staff.

Special attention was paid to the part that CRO was expected to play in developing the economy of the country, and to the facilities and responsibilities of any other industrial research organisations in Burma.

GOVERNMENT OBJECTIVES

In the industrial field the government aims to develop its natural resources for three purposes:

1. Replace imports.
2. Upgrade raw materials at present exported, so as to increase their value.
3. Manufacture finished products for sale.

It may be noted that there is currently in progress a major UNDP Project (BUR/72/002) concerned with geological surveying and exploration, and a number of smaller highly specific projects relating to minerals.

The industry in Burma, apart from a few aspects such as agriculture or forest products and very small scale production is entirely controlled by two Ministries called Ministry of Industry I and Ministry of Industry II. These operate through eleven Corporations plus the CRO and the Technical Services Corporation. Some of the Corporations have simple control laboratories and a few are able to undertake trouble shooting or even process and product improvement.

The Technical Service Corporation was set up under Ministry of Industry II in 1975 in order to plan and organise the technical development of industry in Burma. Its work includes feasibility studies, chemical engineering design of pilot and commercial plants, market and economic studies.

The government wishes CRO which is also under the Ministry of Industry II to be manned and equipped so that it can quickly and effectively tackle what-ever problems arise concerned with the industry of the country. The objective of the proposed Project is to assist in strengthening CRO so that it can do this.

It is also a government objective that CRO should charge for work it does and as far as possible, become financially self supporting. This objective is warmly welcomed.

PRESENT STATE OF CRO

CRO has been in existance (under various names) since 1947 but until 1972 its work was confined to laboratory investigations. Nevertheless during that time a number of industrially useful investigations were made, for example in connection with solar salt and with rice bran oil extraction.

Since 1972 more emphasis has been placed on development work and taking investigations to the stage at which all data for immediate industrial application has been obtained. Two examples of the work, which are currently being put into industrial production are [illegible] and a bentonite bleaching agent. In addition a further eight programmes, are said to have reached the stage at which enough data has been collected for the Technical Service Corporation to consider industrial application.

Under its current organization CRO isdivided into fourteen technical departments as follows: Analysis; Applied Chemistry; Metallurgy; Ceramics; Paper; Polymers; Pilot Plant; Physics and Engineering; Atomic Energy; Pharmaceutical; Food; Standards; Instruments; Library. It is also intended to set up a Marine Sciences Department.

While there is room for improvement along the lines of the recommendations later in this report the following good features of CRO should be noted.

1. The present Director General, who was appointed in 1972, is first class. He is knowledgeable, active, cooperative and flexible.
2. The departmental heads are in general, lively and knowledgeable.
3. There are plenty of buildings as well as room on the site for expansion when needed. On the whole the buildings are good, although further air conditioning would be helpful.
4. Most of the work currently in progress is aimed at immediate industrial application in Burma in its present state of development. This can be called "appropriate technology".
5. The organisation of Departments is by technologies rather than sciences.

6. [illegible] but quite insufficient) analytical and semi-technical testing equipment.
7. Close contacts are maintained with the industrial corporations, Ministries, the Universities and Rangoon Institute of Technology. Members of the CRO staff sit on all relevant committees dealing with technical matters in the Country.
8. Recent government reorganization has made the role the CRO is expected to play quite clear. The government are already supporting it in a number of ways mentioned later.

FUNCTIONS WHICH CRO SHOULD PERFORM

As the only industrial scientific and technological establishment with a wide responsibility in Burma CRO will be required to provide the following services:

1. Supply to industry and to government agencies of scientific, technological and techno-commercial information from reference books, periodicals and foreign patents.
2. Undertake appropriate research either on a laboratory or semi-technical scale.
3. Undertake the solution of trouble-shooting problems for industry.
4. Establish standards and specifications.
5. Undertake repair and calibration of instruments for industry.
6. Undertake analysis or testing for industry and government agencies where this is beyond its capability with the relatively simple equipment it possesses.
7. Offer technological advice on contracts or other matters referred to it.

It should be noted that these functions are not as wide as those appropriate in some countries because of the recent establishment of the Technical Service Corporation. This body will act, among other things, as the development wing of CRO, and also a link between CRO and industry, so that industrial problems it is aware of can be routed to CRO. The Corporation for its part expects CRO to provide it with scientific and technological information, chemical

engineering data and analysis, whether or not the project has arisen from CRO or in some other way.

FACTORS WHICH NEED STRENGTHENING AT CRO

A number of factors have been identified which it is essential to strengthen if CRO is to play the part the government require. Some of these the government can do without any help from UNDP, but it is recommended, that they should be included as part of the Government's obligations under the proposed Project. Others are suitable for UNDP assistance.

1. Number of Staff. The present number of staff in total is too small - in some departments too low for much useful work to proceed, bearing in mind the many fields being covered. Out of 320 total there are 70 scientists and engineers and 100 technicians. It is recommended that the total number should be approximately doubled but the number of scientists and engineers should be more than doubled so as to get a better ratio of scientists to other staff.

2. Organization. The organization of CRO should be strengthened by the appointment of (say) two or three deputy Director Generals and the grouping together of some of the 14 Departments. At present too much depends personally on the Director General and he should be given the opportunity to delegate certain aspects of his work.

3. Programme Planning and Evaluation. One of the most important aspects of the work of any industrial research institute is the selection of the projects on which to work. This is a matter which must be personally decided by the Director General but in order to help him make a decision he needs to be provided with as much preliminary information as possible. Important matters to be considered are the objective of the work (in specific terms); the economic and market position; the present state of knowledge (based on a literature survey); the anticipated cost and timing of the work; the possible industrial rewards;

the probability of success; man-power needed for the research; ... for various stages; the specific points to be investigated and methods by which the work will be done.

In order to collect together this information, ensure similarity of treatment for all projects and take care that no important point is overlooked it is recommended that CRO should set up a Programme Planning and Evaluation Unit of three or four people, headed by an experienced industrial chemist or chemical engineer and directly responsible to the Director General. It is further recommended that UNIDO should send an Expert on this subject to spend two years at CRO and also to act as the Project Manager.

It should be emphasized that some of the information the Programme Planning and Evaluation Unit requires may be available within the Technical Service Corporation. This body has given its willingness to provide full cooperation.

As experimental work on a programme proceeds, this Unit should examine the data to see whether the project is still viable.

4. Information Service. The Government intend to set-up on the CRO site a Central Scientific and Technical Library and Information Service for Burma. At one time it was thought that this might form part of the proposed UNDP Project. However, under the Colombo Plan arrangements, the Director of the British Science Reference Library visited Burma in 1974 and made a number of recommendations which have been accepted by the Government. A new building of the sort suitable for the Country's principal Science Library will be erected and a long term expert will be requested under the Colombo Plan. This building will be complete in 1980.

The Government are already starting to allocate considerable annual sums for the purchase of reference books and periodicals. In 1976 for example about $ 15,000 will be spent on books and $ 25,000 on periodicals. There are however, two pieces of assistance UNDP should provide. In order that the improving library facilities can be used to the best advantage by CRO some modern equipment for photocopying, microfilming,

filing, transport of books and projection equipment is required and it is recommended that a small sum should be included in the Project for this purpose. It is also considered desirable to allow a modest sum for additional books and periodical subscriptions recommended by the Project Manager and other WHO Experts when they see what gaps there are in their own special fields.

The best ways of using the present and the new library for CRO's work should be one of the duties of the Project Manager when appointed. This should include methods of making literature surveys and providing an abstracting service not only for CRO but for industry and government agencies.

Fellowships to enable two of the library staff to study overseas methods of information retrieval is desirable.

5. Instrumental Analysis. In any country there should be at least one centre with a broad selection of modern analytical instruments so that a wide range of analysis can be tackled promptly and accurately. Burma is very badly off in this respect. There are a few laboratories, for example in the Ministry of Health, Mines Department, Pharmaceutical Corporation with a few specialised modern instruments. CRO has a wider range of instruments but all are 10 - 15 years old and indeed some are really obsolete. Nevertheless the Analytical Department serves all the Departments in CRO as well as offering its services to industry and other government agencies.

Such instruments are just as essential to a modern laboratory as test tubes used to be or as books are today. It happens that they are expensive and take a long time to procure and to become familiar with. At the same time analysts may be tempted to ask for instruments without definite ideas on the purposes for which they are likely to be used. Special attention has therefore been given to suggestions made by CRO and careful scrutiny made, removing all instruments which might involve duplication or are not likely to be frequently used. The residual list of 14 items is strongly recommended. The best use for these instruments will only be made if a) adequate spare parts are ordered at the time of purchase b) an air-

[illegible] provided e) constant voltage regulators [illegible] for 5 or 6 of the instruments. Further, experience [illegible] instruments like those, arrive with [illegible] if sent by air rather than sea.

[illegible] titles of the fourteen instruments recommended are [illegible] precise scientific definition has been agreed [illegible] but is omitted here for the sake of brevity.

	Use
i) [illegible] Absorption Spectrophotometer	Analysis of indigenous minerals.
ii) [illegible] Analyser	Evaluation ceramic raw materials.
iii) [illegible] Analyser	Pesticide residues in food.
iv) [illegible] Analyser	Food stuff analysis
v) [illegible] Sulphur Determinator	C & S in steels & ore.
vi) [illegible] Spectrometer	Analysis rare earth metals
vii) [illegible]	Solutions and non volatile compounds.
viii) [illegible]	Quality control Analysis
ix) [illegible] Hydrogen, Nitrogen Analyser	Analysis organic materials
x) [illegible] Chromatograph	Analysis sugars, alkaloids etc.
xi) Polarimeter	Sugar Analysis
xii) Polarograph	Trace elements
xiii) Dilatometer	Physical examination of Clays
xiv) Mass Spectrograph	Structure of dyestuffs, pharmaceuticals, perfumes essential oils, natural products.

It is further recommended that an Expert in the use of analytical instruments should be allocated to the CRO as part of the Project. Since analytical instruments of the type defined above will take 6-12 months to obtain it is considered that the Experts' duties should be in two stages. Firstly selection of the precise instruments to be purchased, and secondly instruction in the use of the instruments. With regard to the first, it may be possible for the Expert to do this without a visit to Burma, although some correspondence would no doubt

be needed. The titles of the items only are given above but no further items should be needed to be added. If a visit is regarded as necessary one month overall should be adequate. For the second stage which would only take place when the instruments had been delivered a visit of 6 months as a shortterm Expert within the framework of the Project should suffice.

One or two Fellowships are appropriate in this field preferably in an industrial environment but the details can only be decided when the Expert in Analytical Instrumentation arrives in Burma.

6. Instrument Repair and Maintenance. There is at CRO a reasonably good Instrument Department which is responsible for instrument repair, calibration and maintenance both within CRO and as a service to industry generally and also hospitals. Nevertheless, about half the instruments in the CRO are out of action often because they are so old that it is no longer possible to obtain spare parts. This emphasises the importance of ordering adequate spares when purchasing instruments and reordering spares as they are used up.

With the purchase of the various analytical instruments mentioned above, and the increasing extent of service work for industry, it is felt that the Instrument Department should be strengthened by two actions. Firstly as part of the Project UNIDO should send for a period of 12 months an Expert to advise the Department on improving its work. Secondly the CRO should allocate two good senior instrument engineers to specialise in the analytical instruments and go for training in appropriate companies overseas under the Fellowship part of the Project.

7. Chemical Engineering. CRO is essentially an applied research organisation. Consequently, the data is needed to collect and supply to industry, through the Technical Service Corporation, is not only laboratory information but also chemical engineering data which can only be obtained in large scale equipment. Very often it is not necessary to build a complete miniature plant, so the term pilot plant implies, but it is necessary to get data

for certain parts of the complete operation in semi-technical scale equipment.

The technique for doing this are rather specialised and it is considered that the very keen and knowledgeable young chemical engineers would greatly benefit from a visit by an Expert in such studies coming for a period of twelve months. Preparatory to his visit two things should be done. Firstly CRO should appoint an experienced senior chemical engineer to head its Chemical Engineering Department (a name much preferable to the so-called Pilot Plant Department). This man would be the Counterpart to the Expert.

Secondly a certain number of items suitable for obtaining semi-technical data should be ordered as part of the Project. This semi-technical equipment needs to be carefully considered and defined by the Expert before being ordered. For this purpose a visit of say two months by the Expert is recommended to be followed by ordering and procurement of the equipment. When procured the Expert should return for a further 12 months within the framework of the Project.

It is recommended that two Fellowships should be made available for six months and to enable two young chemical engineers to work in Chemical Engineering Research Department of a large western industrial Corporation to obtain direct experience of how they conduct their work.

It should be noted that under a Bilateral Aid Agreement with India CRO expect to obtain help in improving their engineering workshop and also ten small pilot plants for quite specific projects. These will be most useful in providing some chemical engineering equipment which can later be used for other purposes. The same remark applies also to the UNDP Project (IND/72/007) on the establishment of the Applied Polymer Research Laboratory.

However, even when useful items coming in under the above arrangements are removed from a complete list of what is needed, there is still a wide gap to be filled. Some of this

can be done by purchasing a carefully selected range of "Quick-Fit" equipment such as reaction vessels, distillation units, liquid extraction units etc. The purchase of these interchangeable assembly units is strongly recommended. Other items outside this range which should be purchased include vacuum pump, refrigerator, gas compressor, evaporator, crystalliser, autoclave, filter press, homogeniser, centrifuge, liquid pumps, flowmeters, carrying tanks, solvent recovery units, rotary calcinator. Details of these requirements have been discussed but are not included here since they would need to be studied in depth by the proposed Expert, who would in addition examine all the other items coming in under other aid programmes so as to ensure that there is no unnecessary duplication.

OTHER SUGGESTIONS

In addition to the subjects discussed above a number of other points have been noted which it may be useful to discuss briefly.

1. Pilot Plants.

The words "Pilot Plant" are being used in Burma in two different senses. In one sense it is a small production unit which should preferably be erected on an industrial site. In the other sense it means some larger than laboratory scale equipment on which to collect data useful to chemical engineers in designing pilot or larger commercial plants. To avoid this confusion it is suggested that CRO refer to their data collecting equipment as "Semi-technical Scale Equipment" rather than "Pilot Plant".

It is also suggested that the Pilot Plant Department be renamed Chemical Engineering Department, partly to avoid the confusion over the words pilot plant and partly to stress its real function which is to apply their special chemical engineering expertise to projects. They should not regard themselves merely as the operators of "Pilot Plant". Indeed in some cases it may be desirable for the collection of data on semi-technical scale equipment to be carried out by the

Department which did the preceding laboratory research.

2. Extension of Analytical Department's responsibilities.

It has been mentioned earlier that some sectors of industry can carry out simple quality control, and that CRO has the responsibility of undertaking analysis or testing where this is beyond the capability of industry.

CRO would be providing a useful industrial service if it were given the responsibility of acting as an analytical reference and auditing authority for the whole of industry. It would, for example, examine the test methods being used by industry and recommend improvements. It would also check that agreed methods are being properly conducted.

This extension of CRO's responsibilities is recommended.

3. Location of Engineering Workshops.

It might be worth considering placing the new Engineering Workshops under the Physics and Engineering Department rather than Instruments.

4. Training of Technicians.

One of the problems in an industrial research establishment is the training of technicians. However thorough their training at college they still need some additional training within the establishment. At the moment this is done within each Department at CRO. It would be worth considering setting-up a central technician training scheme, not only for new-comers but also for refresher courses for older staff.

5. Publicity and Information.

At the moment CRO produces no literature either by way of an annual report, or publicising its services or disseminating literature information.

a) A detailed annual report is probably unnecessary but a brief report, listing work in progress might be helpful in indicating the role CRO is playing.

b) While many people in Burmese government and industry have some knowledge of what CRO can do, it may be advisable with the strengthening of the facilities and staff, to produce a hand-out of say eight pages indicating the facilities available and thee services which can be provided. This may encourage some industrial units to request assistance.

c) When the Library and Information Service is fully established it is recommended that CRO issue quarterly information bulletins in a number of selected industrial fields. These bulletins will draw to the attention of the reader new information, whether technical or commercial, that has come to light during the quarter.

6. Specialised Equipment.

In addition the general purpose equipment described in a previous section of this report, and the specialized equipment already being obtained under the UNDP Polymer Project or Bilateral Aid, it is inevitable that other specialised equipment will be required from time to time. Two examples which exist at present are equipment to modernize the Food Department laboratory (perhaps $ 50,000 cost) and equipment required by the Metallurgy Department to examine the separation of beach sands and zinc and zinc oxide production (perhaps $ 35,000).

These items and others require techno-economic justifications and should be considered by the Project Manager. It is just possible of course that some of them could be purchased by the country or obtained through Bilateral Aid.

7. Unusable Analytical Instruments.

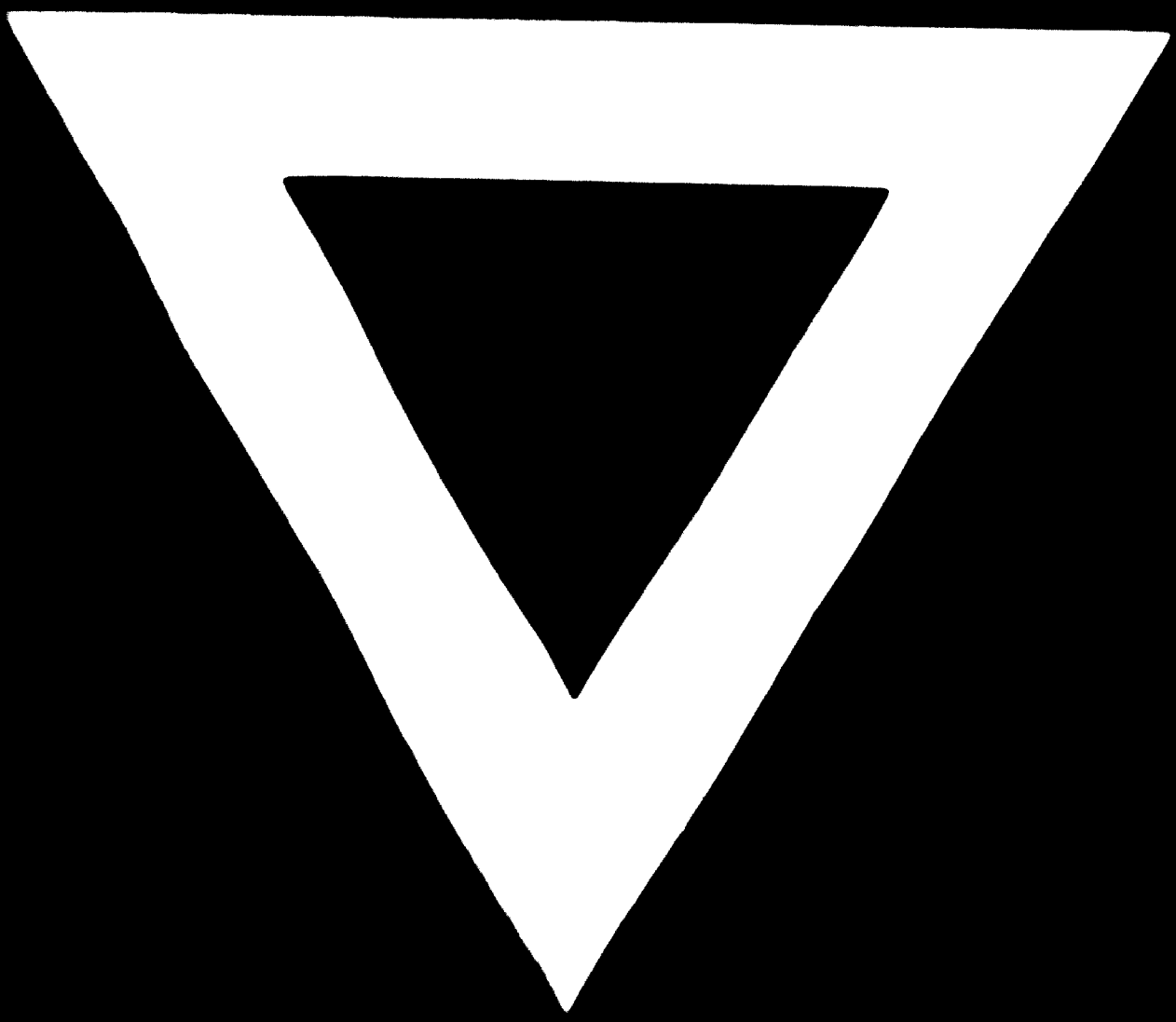
There are several examples of analytical instruments which are not fully usable or even usable at all because of lack of spares. One example is the X-ray diffractometer which requires a new H.T. transformer and cable. Another is the emission spectrograph which requires a new minor source unit. It is recommended that this type of problem is carefully examined by the Expert in Instrumental Analysis as part of

the Project

8. W.A.I.T.R.O.

This international organization, which denotes World Association of Industrial Technological Research Organizations was founded about six years ago. It offers opportunities for Collaboration, exchange and discussions of mutual problems. The industrial research organizations of most of the developing countries are members and it is recommended that CRO should apply for membership.

[redacted]



76 05.04