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

DP/ID/SER.A/1640
26 March 1993
ORIGINAL: ENGLISH

20116

REGIONAL NETWORK ON PECTICIDES FOR ASIA AND THE PACIFIC

DP/RAS/88/031

PAKISTAN

Technical report: Findings and recommendations*

Prepared for the Government of Pakistan
by the United Nations Industrial Development Organization,
acting as Executing Agency for the United Nations Development Programme

Based on the work of Erik Kirknel, consultant in eco-toxicology

Backstopping Officer: B. Sugavanam
Chemical Industries Branch

United Nations Industrial Development Organization
Vienna

---

* Mention of firm names and commercial products does not imply the endorsement of the United Nations Industrial Development Organization (UNIDO). This document has not been edited.

V.93 83452

Table of Contents

ABSTRACT

Title: Consultant for setting up Eco-toxicology Laboratory.

Objective: This first mission out of two consist of:
To plan the existing laboratories assigned to ecotoxicology to be designed or rearranged properly. To install analytical equipment, the facilities needed, to protect from dust, voltage fluctuations the type of analytical equipment needed for the work to be carried out. To prepare together with the National Project Director, the planned workshop (second mission) on ecotoxicology in Pakistan.

Conclusions: A plan were set up to rearrange the existing laboratories in order to function as an analytical laboratory working with hazardous organic solvents.

Installation of analytical equipment was absent and could therefore not be installed.

The coming workshop were partly arranged. It was planned to have lectures in the morning and demonstrations in the afternoon. The consultant will participate in both activities.

Recommendations: As fast as possible make agreements about availability of the lab. space needed.

To reevaluate the equipment ordered/purchased (in process).

To rearrange the laboratories.

To start implementing GLP in the lab.

To extend the second mission to one month.

To invite guest speakers to the workshop.

To arrange an education programme for a laboratory technician in pesticide analysis in Denmark for a period of one month. Room will be offered free privately or guest house facilities at the consultants institution.

After September/October or when the laboratory seems to function, arrange an inter calibration program with the consultant as the counterpart, this will within defined limitations be delivered free from the consultant.

ABBREVIATIONS

PARC	Pakistan Agricultural Research Council
NARC	National Agricultural Research Centre
GLP	Good Laboratory Practice
GLC	Gas Liquid Chromatography
HPLC	High Performance Liquid Chromatography
REMPAP	Regional network on Pesticides for Asia and the Pacific.
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization
NPD	Nitrogen phosphorous detector
FPD	Flame photometric detector

I INTRODUCTION

This report is made by Erik Kirknel, Research Centre for Plant Protection, Dept. of Pesticide analysis and Ecotoxicology. Flakkebjerg DK-4200 Slagelse. The job description is reproduced in Annex I.

The first part of the mission took place from the 13th to the 20th of February 1993, see annex II.

The primary objectives were "to advise the National Project Director during the first part of his mission to plan the existing laboratories assigned to ecotoxicology to be designed or rearranged properly, to install analytical equipment, the facilities needed to protect from dust, voltage fluctuations, the type of analytical equipment needed for the work to be carried out and also prepare themselves for the planned workshop on ecotoxicology in Pakistan."

The original objectives were obtained except to install the analytical equipment. The equipment were not available at the time of the mission.

The reports mentioned in Annex III describes the available reports done previous in the project.

II SITUATION AT NARC AT ARRIVAL

A. Status of the laboratories.

At the time of arrival it was not finally decided where the laboratories were going to be placed in Islamabad. There were plans for the ground floor at a newer building at NARC which I was shown. The building was in the middle split up by a hall with labs on one side and offices on the other side. It was not possible the 15th of feb. to take a look on the quality of the labs. The doors were locked and still in use for other purposes. It was noted the building needed a through cleaning and painting before being used as an analytical laboratory. Special attention should be paid to previous schemes of especial pesticide treatments in the building. This was valid not only for ground floor but also first floor because there is open space between the two floors in the hall.

I was informed by Mr. Baloch after the meeting the 18th at UNIDO, that Mr. Holten was planning a meeting with the director of PARC to clarify the laboratory space matter.

B. The status of analytical instrumentation.

No analytical instrumentation was available, and Mr. Baloch did not know any date of arrival or, if anything was ordered, when it would arrive and the equipment selected by UNIDO. A request was send to UNIDO/Vienna on these matters.

But Mr. Baloch did have the original offers from the companies on GLC, HPLC and spectrophotometers. These offers were not comparable because they offered different analytical equipment.

It was not possible to see from the offers precise what kind of analytical equipment we are talking about. Some detectors mentioned (TCD) is not applicable at all in pesticide analysis, some GC's are missing the most important ones, some offers are with capillary systems, some with packed columns only, gas purification systems are not mentioned in more than one offer, wrong and missing columns and so on. However, it was found that UNIDO was already negotiating with Perkin Elmer for a modified offer with necessary requirements and I also suggested a few modifications, annex III.

As a start we are going to analyze for OP-compounds and synthetic pyrethroids. FPD would be an enormous advantage for several reasons. This detector is not mentioned at all. This FPD is rather specific to phosphorous as the NPD, but has the advantage in the P-mode not to be sensitive to nitrogen containing molecules. This will reduce the clean-up procedures and hereby the consumption of organic solvents.

On the 18th of February UNIDO/Islamabad received a fax from UNIDO/Vienna, informing that analytical instruments will be purchased from Perkin Elmer. Further consultations with UNIDO headquarters it was agreed to include FPD for one GLC instead of NPD and LC295 UV detector for HPLC instead of LC290. UNIDO is waiting for final cost from Perkin Elmer for the changes.

C. Glassware, chemicals and small type equipments.

The consultant will deliver a list of glassware, chemicals and small type of equipment as fast as possible, hopefully within 2-3 weeks. The list will be forwarded to UNIDO/ Vienna. The consultant will be available in ordering these items if desired.

III REARRANGING THE ANALYTICAL LABORATORIES

At least three laboratories at the ground floor at a newer building at NARC was selected to be the location for the pesticide analytical laboratory.

The laboratories were apparently not available at the moment for this purpose and locked up when we visited the building. But a similar room on the same floor was demonstrated to me.

The room was equipped with tables covered with a Formica type of laminate, underneath with drawers and cabinets. I will presume the laminate is resistant against organic solvents and will therefore be, not ideally but, acceptable if covered with lab. paper at the more sensitive areas such as where they handle standards, samples for analysis etc.

The ground floor is definitely going to be thoroughly cleaned on walls, ceilings and floors, repaired where necessary and painted, preferably white, before any equipment enters the house.

The consultant has, in rough draft, constructed fume hoods because it was a desire to let them make by local craftsmen. I accept this solution because i think they will be more fitted for the purpose than most commercial types and only cost a fraction.

We agreed making 3 fume hoods with forced ventilation at a working height of the slide window of 35 cm with a calculated wind speed of no less than 0.5 m/sec.

I must emphasize this point because we are dealing with toxic organic substances which could have toxic symptoms effect on human health.

One fume hood will be equipped with tap water and sink, all with sufficient encapsulated illumination. There will absolutely not be any electrical switches creating any kind of sparks in, on or under the fume hood!

All laboratories and the hall will be equipped with fire blankets and carbon dioxide fire extinguisher. It will be clearly indicated where these items are hanging.

There will be one eye wash bottle and a shower in each laboratory just before leaving the room. The shower will be easily activated by the patient himself, even with closed eyes. There do not need to be drain in the floor.

Each lab. will be equipped with one sink with tap water. One of the rooms will be installed with waterproof tables on both sides of the sink in order to be able to wash and dry used glass wares. It is assumed all cleaning of glassware will be performed by the hand.

All chemicals will be stored in a separate room with its own ventilation. The room will be equipped with open simple shelves and a household type of fridge. No illumination should exist in the fridge (sparks). Electric switches is not allowed in this room.

It should be checked that power supply to the labs is sufficient. Current drop-out occurs sometimes. This event should be accepted, because it will be too costly to ensure continuous electric supply. But voltage stabilizers will be installed. This depends mainly on requirements from the manufactures. Will be investigated when the lab. is running.

All three laboratories should be equipped with a reasonable amount (8-10 pieces, 220 v + ground) of electrical outlets along the walls, but especially at the table in the middle of the room. The analytical instruments will preferably be situated on this table in order to being able to service the instrument from behind.

We have a problem with waste chemicals. Especially the chlorinated organic solvents. Dichloro methane is a commonly used, and very efficient solvent when extracting pesticides from aqueous samples. Solid extraction may in some instances solve the problem. Until a public waste combustion (1200°C) is working in the area, low temperature combustion of the solvents should be done instead of dumping.

There must be found a solution for obsolete and waste chemicals. One proposal is to keep track of type and amount of chemicals, and spray them out on grassland fields. The type of chemicals used in this type of laboratory is normally nontoxic.

IV THE WORKSHOP FALL 1993

A. Structure of the workshop.

The workshop in September/October 1993 will last one week. The effective time available for lectures and demonstrations will be four full days. It was decided by the director, staff members and the consultant to have lectures before noon, approximately four hours per day and demonstrations in the afternoon.

The final program was naturally not ready but the staff and the consultant were starting to prepare themselves to the lectures they intend to keep.

The consultant had a couple of suggestions mentioned below

Basic concepts in pesticide analysis

The lecture will inform the participants step by step in the principles of pesticide analysis with emphasis on OP-compounds and synthetic pyrethroids. Extraction from plant material, water soil and air. The analytical equipment involved, its function and limitations. Calibration curves and problems around limit of detection. Calculations of confidence intervals.

Quality assurance in pesticide analysis, GLP.

The lecture will inform the participants of the spirit of Good Laboratory Practice (GLP) and practical implementation in pesticide analysis and ecotoxicology. The lecture will head at getting the scientists interested in introducing at least the spirit of GLP in their research programmes in order to obtain more reliable and reproducible results.

Leaching of pesticides in soil using lysimeters and radioactive labelled pesticides.

The lecture will discus the problem of pesticides leaching through the soil and show the technique using lysimeters. Kd values and Gus-index will be discussed.

Wind drift of pesticides when spraying.

The lecture will discus the parameters important for occurrence of wind drift, its magnitude and importance especially near aquatic environments. The lecture will go through simple analytical techniques to be used to demonstrate the degree of wind drift.

Principles for testing the effect of pesticides on beneficial arthropods, developed by IOBC (The international Organization for Biological Control).

The lecture will introduce the participants in the fundamental principles in testing the effect of pesticides on beneficial arthropods. The work was started in the mid seventies in Germany and developed into a working group of test methods among other european countries. The German authorities only accept results produced by using these standardized test methods.
The basic principle is to measure the beneficial capacity of the arthropods after exposure to pesticides instead of mortality.

Other items will be decided between the consultant and the Director of the project.

The demonstrations will be field trips, where the concepts of ecology will be demonstrated, demonstration of the analytical lab. hopefully functioning! etc.

V CONCLUSIONS

The most important problem was to make arrangements of availability of laboratory space. This should be done immediately. It takes some time to rearrange and rebuild the laboratories, especially the fume hoods.

Plans for rearranging the three labs. are made.

There should be no compromise and deviation in the planned reconstruction of the labs. A compromise using the old tables and cabinets have been made.

A time plan for implementing the analytical instruments should be made.

It was concluded to emphasize the analysis of OP-compounds and synthetic pyrethroids as a start.

It should be mentioned now that equipment necessary for modern leaching experiments (radioactive tracers) is not available. This type of investigations will very soon be needed. Training in tracer technique could be offered in consultants lab.

Introducing GLP on this stage of development in the laboratory will not introduce extra costs but make things develop in a more structured direction.

VI RECOMMENDATIONS

It is strongly recommended to make contractual agreements with the direction on the availability of not only the lab. space for the chemical analytical activities, but for the whole laboratory of ecotoxicology.

A reevaluation of the three main type of analytical instruments. GC, HPLC and spectrophotometers. The offers are comparable to each other because they describe different type of instruments (This activity is in progress after return of mission). However, UNIDO has already looked into it and only minor modifications were needed for the Perkin Elmer offer, see annex III.

It is of uttermost importance to start rearrange and rebuilding of the laboratories in order to assure the laboratories to function within 6 months or before the second mission takes place.

GLP in this type of laboratory is a must if authorities are going to consider the results produced. Great economic interests, human and environmental health are involved. The demand for GLP in western countries in this type of investigations, will soon be natural also in other countries. It is a very convenient time to introduce GLP in the lab. because it will tend to develop the activities with no further cost, but be introduced as a habit from the start.

It has been planned to let the second part of the mission last two weeks. This is not enough time, if the consultant are participating in the planned workshop together with starting up the analytical activities in the lab. A one month period is recommended. The consultant will be available for this period in September/October.

Guest speakers should be invited to make speeches at the workshop at their own expenses. Funds are normally available if the workshop is announced at an early stage.

To arrange an education program for a technician in pesticide analysis in Denmark for a period of one month. It is recommended the technician being trained in the most basic skills before the training program. Room will be offered free privately from the consultant. Or guest house facilities at the consultants institution.

After September/October or when the laboratory seems to function, arrange an intercalibration program with the consultant as the counterpart, this will within defined limitations be delivered free from the consultant.

ANNEX I

JOB DESCRIPTION

Purpose of proj. To assist the Asia Region in the safe development and management of pesticides especially with respect to assisting Pakistan to improve its capacity to study the ecological aspects related to pesticide production and use.

Duration: 1 week in february and 2 weeks in sept./oct. 1993.

Duty station: Islamabad, Pakistan with possible travel within Peshawar.

Duties: The consultant is expected to advise the National Project Director during the first part of his mission (one week in february 1993) to plan the existing laboratories assigned to ecotoxicology to be designed or rearranged properly to install analytical equipment, the facilities needed to protect from dust, voltage fluctuation, the type of analytical equipment needed for the work to be carried cut and also prepare themselves for the planned workshop on ecotoxicology in Pakistan.

Following this he is expected to take his second mission along with another consultant to assist in the workshop by setting up necessary demonstration, lectures for the benefit of the participants coming from different Asian countries.

He is expected to submit a report after his first mission with his findings and recommendations.

Background information: Asia region is going through an accelerated industrial growth during the last 10-15 years and the both per capita chemical production and the use have risen enormous. Unfortunately the corresponding awareness and actions to deal with the chemical contamination in the environment has been every limited in many countries due to lack of facilities and expertise. UNDP in association with UNIDO has established RENPAP to promote safe development and management of pesticides. In the network there are 14 member countries covering almost half of the worlds population. Some selected countries have taken up specific areas to provide assistance to the region and UNIDO is providing technical assistance to increase the capacity of these countries in the chosen topics by linking with other national projects. The following topics are covered:

Formulation technology:	India
Quality control:	Rep. of Korea
Bio-botanical pesticides and Residue analysis:	Thailand
Occupational safety:	Philippines
Operational safety, Waste management and Environment safety:	Thailand
Application technology:	Malaysia
Data collec./Dissemination:	India
Ecotoxicology:	Pakistan

At present UNIDO is providing adequate support to Pakistan to establish an ecotoxicology centre which should provide the necessary assistance not only to Pakistan but also to the region. With this it is planned to have a workshop in 1993 in Pakistan on ecotoxicology for the benefit of the Asia region. This regional project is intended to assist Pakistan in organizing the workshop and handle topics relevant to the region especially with regards to pesticides.

ANNEX II

ITINERARY OF ERIK KIRKNEL, CONSULTANT IN PESTICIDE ANALYSIS.

Sat 13/02 Departure from Copenhagen airport 16.20.

Sun 14/02 Arrival at Islamabad airport 03.20.
Contacted J. Holten, UNIDO.
Stay at Shawnze Hotel

Meeting at NARC with:
Dr. Muhammad Abdul Matin
Mr. Muhammad Mutaz
Dr. Yousaf Hyat Khan.

Mon 15/02 With Mr. Muhammad Mutaz at PARC.

Tue 16/02 Meeting with Mr. Umar Khan Baloch.

Wed 17/02 Meeting with Mr. Umar Khan Baloch at PARC and with Dr. Muhammad Abdul Matin,Mr. Muhammad Mutaz,Dr. Yousaf Hyat Khan, Mr Tahir Anwar, Mr Ather Rafi and Mr. Umar Khan Baloch at NARC.

Thu 18/02 Meeting with Mr. J. Holten UNIDO in the morning.
Meeting with Mr. Umar Khan Baloch in the morning at PARC.
Meeting with Mr. John Holten and Mr Umar Khan Baloch at UNIDO.

Fri 19/02 Writing part of report in the morning.
Meeting with Mr. Umar Khan Baloch in the afternoon.

Sat 20/02 Departure from Islamabad Airport at 09.50.
Arrival in Copenhagen Airport 14.20

United Nations Development Organization 22/02/1993
P.O. Box 300
A-1400 Vienna

Department of Industrial Operation

Concerning DP/RAS/88/031/11-73.

GC:
If 2 GC's are to be purchased:
First GC: ECD + NPD
Second: ECD + FPD
Split/splitless and packed injector to each GC.
4 piece empty glass columns 6', 2 mm inside diam.
One capillary 25 m wide bore (HP-5 type or SE 30)
Oxygen and moisture filter to gasses, please tell me if they are regenerably or cartridge-type of filters!!
No steel col.

HPLC:
UV/VIS LC 295 detector, programmable wavelength.

Lambda 3B OK.

Integrators or PC to GC and HPLC:
I would suggest a PC solution with a TURBO CHROM software, one PC to 15 instruments !!
This program is driven by Windows with a 486 computer 16 mb ram and preferably 120 mb Hard disk. PC-Price in Denmark: 10 000 Dkr.
Interface boxes to 2 GC's and 2 HPLC's.
This instead of integrators 1020.
Probably the same price as 2 integrators.
I have talked with Perkin-Elmer Denmark, suggest this as the best solution for the future. With Windows we have a multi purpose instrument with centralized data collection.
Talk to the Perkin-Elmer people.

Generators:
Be sure there are gases enough, especially for the FPD!!

Report:
Almost done, exept the list of glass ware, chemicals, small instruments as pumps an so on.

Final comments:
Please send me a complete list of what Perkin-Elmer deliver. They should deliver evrything to make the instruments ready for analysis.

Sincerely Erik Kirknel

REFERENCES AND REPORTS CONSULTED

1. **CALDERBANK, A.**
Unido report on environmental toxicology related to pesticides in Pakistan. DP/RAS/85/023. 1988.

2. **CALDERBANK, A.**
Unido report on an Ecotoxicology Research Centre in Pakistan. DP/RAS/85/023. 1990.

3. **FLETCHER, K.**
Unido report on Establishment of an Ecotoxicology Centre. US/PAK/90/294. 1992.

UNIDO COMMENTS

The consultant's short visit was mainly intended to look into the facilities that are to be set up in Pakistan to embark on a new venture into setting up of an eco-toxicology laboratory. Due to delays in getting the laboratory space allotted for the ecotoxicology centre and the analytical equipment delivered, the consultant could only provide advisory services as to how the laboratory should be set up and the preparations needed to organize the proposed workshop on 'ecotoxicology' for the Asia region during autumn 1993. The preliminary programme given in the report will be included in the final programme.

The recommendations of the consultant to certain modifications in the analytical equipment are being taken care of.

It is very important for the counterparts and the PARC (Pakistan Agricultural Research Centre) Management to make necessary arrangements for the laboratories to be made ready according to requirements. In case of any delay, the planned workshop on ecotoxicology will be seriously hampered.