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REGIONAL NETWORK ON PESTICIDES FOR ASIA
AND THE PACIFIC

DP/RAS/85/023

Technical report: Pesticide evaluation and safety testing (PEST)
programme-pesticide formulation analysis training:
exploratory mission to India*

Prepared for the Governments participating in the regional
project by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme,
in collaboration with the World Bank

Based on the work of Paul D. Jung,
Pesticide consultant

United Nations Industrial Development Organization
Vienna

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BACKGROUND:

During the May 1984 meeting of the Regional Network on Pesticides for Asia and the Pacific (RENPAF) at Dhaka, Bangladesh certain recommendations were made concerning laboratories and personnel specifications. One such recommendation was that the Regional Network organize workshops or seminars aimed at upgrading the knowledge and techniques of analytical laboratory personnel. Suggestions were made as to the countries where possible training might be undertaken and, in some respects, the kinds of training materials to be used.

In an effort to standardize methodology within the region, it was envisioned by the experts meeting on Quality Control of Pesticides that specific methods of analysis, to ensure uniformity throughout the region, would be used. The panel of experts, after identifying 15 commonly used pesticides among the participating countries decided that available standardized methods such as CIPAC, FAO, and AOAC, be adopted for the region. As new products entered the region it was further recommended that improved or new methodology be sought by the Regional Coordination Unit and disseminated to the regional network countries. When standardized methodology and specifications are not available it was decided that these organizations would be urged to give immediate consideration to the establishment of specifications and methods of analysis.

It was revealed, during this session, that there is a need for member countries to follow uniform methods of analysis and analytical methodologies, whether physical or chemical, so as to assist each other as the need arises. If each country was using the same technology then it would easier for them to assist other members of the region.

The World Bank proposed an expansion of the project for Pesticide Evaluation and Safety Testing (PEST) Programme for the Asian Region. The justification and rationale behind this PEST program was to allow the countries in RENPAF, through analysis of pesticide products and monitoring of residues in crops, human blood and urine, soils, and water to identify their most critical pesticide related problems.

As was initially envisioned by the project, about 48 chemists (approximately six from each participating country) would be trained in a two year period and kept up-to-date in practices and procedures for assaying pesticides and analyzing their residues in the aforementioned matrices. Included within this training framework, would be theoretical considerations, routine maintenance and simple repairs of equipment.

It is not difficult to understand why a thirteen week course was envisioned to cover all of the aspects of the proposed PEST program. However, within the terms of reference, as outlined by Dr. James A. Lee and dated May 28, 1986, this report will deal with only pesticide formulations and the effort to evaluate laboratories capable of training chemists from RENPAF member countries. The residue capability of laboratories in India will be mentioned only cursorily. An in depth evaluation of pesticide residue laboratories capable of being used in a similar RENPAF project in Thailand is under separate review.

OBJECTIVES:

In connection with this project, candidate laboratories to serve as the formulation analysis training center were to be identified. In addition, the adequacy and availability of existing equipment and personnel, the ability of the laboratory organization to provide general management of the proposed project, and the facilities (including housing, catering, etc.) were to be assessed. For the most promising laboratories additional equipment needs would be enumerated, and an estimated budget for the two year training program prepared. Identification of course instructors, resident in the RENPAF area, would be undertaken if possible.

It was decided, after consultation with Ms. Janice Jensen, UNIDO consultant to evaluate residue laboratories in Thailand and RENPAF Project Officer Mrs. Cecilia Gaston, that certain assumptions had to be made before relevant programs could be developed. The course itself would be two six week periods involving twelve trainees from the RENPAF network countries. Candidates for the course would be experienced bench chemists already working in the field of formulation analysis. It is presumed that the candidates would have, as a minimum, experience in thin layer chromatography and wet chemical analysis.

Selection of the candidate laboratories will be based, in part, on the availability of appropriate equipment, e.g., gas-liquid chromatograph (GLC), infra-red spectrophotometer (IR), or high pressure liquid chromatograph (HPLC) in the Network Member's Laboratory or its plan for securing same.

Where equipment and facilities are unavailable, the National Coordinator would solicit contacts with the pesticide industry for donations or reduced cost purchase opportunities of functional instruments. If equipment cannot be secured in this fashion, the arrangements for utilization of pesticide industry laboratory facilities by the trainees on a regular basis must be established and demonstrated.

SHIRIRAM INSTITUTE FOR INDUSTRIAL RESEARCH

19, University Road,
Delhi-110 007
Telephone 2521267

During conversations with Mr. Shyamal Ghosh, Joint Secretary, Ministry of Chemicals and Fertilizers, the above named laboratory was mentioned as a possible candidate from the industrial side of the spectrum. The Shiriram Institute For Industrial Research (SRI) facility was toured with Mr. N. S. Birdie and his staff. In particular, the Institute's developing Analytical Research Division was of significance as they currently accept sponsored research projects and have some of the necessary sophisticated instruments that are used for pesticide formulation analysis. Useful for chemical analysis of formulations and on hand for use are:- ultra-violet spectrophotometer (UV), several gas liquid chromatographs (GLC) equipped with thermal conductivity, electron capture flame ionization and nitrogen-phosphorous flame ionization (N-P FID) detectors, and a high pressure liquid chromatograph (HPLC). The institute does not train individuals, per se, in any type of analysis but accepts sponsored research projects from industrial organizations and has done work for UNIDO, WHO, USDA, and others. SRI, in addition, has an excellent library facility as part of its infrastructure with current journal articles listed by subject for review by resident scientists on a quarterly basis.

Currently SRI is involved with heavy metals and pesticide residue monitoring in river waters in an effort to determine point of entry pollutants and polluters. This study will use a plasma type spectrophotometer for the analysis of heavy metals.

DIVISION OF AGRICULTURAL CHEMICALS- INDIAN AGRICULTURAL RESEARCH INSTITUTE

New Delhi-110012

During a visit to the Indian Agricultural Research Institute (IARI) Division of Agricultural Chemicals it was determined that the work of this facility is directed to the analysis of residues of pesticide chemicals. More importantly, the thrust of the research is directed to determinations of residues in plants, soils and water under the agro-climatic conditions found in the region. While touring the facility with Dr. S. K. Mukerjee (recently retired head of the facility) it was noted that the laboratories were well equipped for residue analysis and contained electron capture, flame ionization, and flame photometric (GLC), HPLC equipment, as well as nuclear magnetic resonance equipment for structure elucidation of isolated metabolites. On hand but not in use as of this time was a newly acquired N-P (FID) detector equipped GLC. This laboratory does not train formulation chemists and by its very nature should not handle formulation level chemicals owing to the potential for contamination of glassware and laboratory confines. It could, however, be involved in any type of residue training that could be contemplated.

CENTRAL PLANT PROTECTION TRAINING INSTITUTE

Directorate of Plant Protection, Quarantine and Storage
Department of Agriculture and Cooperation
Rajendranagar, Hyderabad- 500 030

The Central Plant Protection Training Institute (CPPTI) in Hyderabad, under the direction of Dr. C. N. Joshi, was recommended by Dr. R. L. Razak, advisor to Plant Protection Agency, during a brief consultation. Dr. Razak, in addition, suggested that the Central Insecticides Laboratory, in Feridabad, should be dropped from itinerary as the laboratory was not suited to this kind of training program.

The CPPTI facility, as Dr. Razak indicated, is a strong candidate for the formulation analysis facility envisioned by RENPAF. One of the objectives of the institute is to provide training for laboratory personnel who are or will be involved in analytical work on pesticide formulations and residues under the Indian Insecticide Act.

The students who attend this pesticide formulation and or residue analysis training come to this facility for the three month courses. They are allowed free accomodation at the hostel located on the campus about 25km from the city and are required to remain there during the extent of the course. The facility, which was toured with Dr. P. S. Chandurkar, head of the Division of Pesticide Chemistry, and other staff members, also contains an in-house class room with sufficient audio visual aides for lectures, a comprehensive library, and maintains a duplicating facility that enables ready reproduction of notes and course work.

In addition to the two three month courses, which are routinely taught at the facility by the instruction staff from the facility, there is an instumental analysis course with a duration of two weeks. This course is taught to more advanced students.

The laboratory is equipped with GLC's fitted with thermal conductivity and flame ionization detectors, a ultra-violet/visible (UV/VIS) spectrophotometer, IR, and HPLC. These instruments are used for the the determination of formulation level pesticides while a different GLC similarly equipped is used exclusively for determinations of residue levels of pesticides.

CPPTI acts as a referee laboratory for India in legal disputes between manufacturers and the regulatory authorities using Indian Standard Institute (ISI) methods.

While a class of eight would be preferred, a class of twelve could be accommodated. Dr. Joshi and Dr. Chandurkar were both very interested in having CPPTI involved in the training process of the RENPAF chemists.

HINDUSTAN INSECTICIDES LIMITED

PDPI Centre, HIL R&D Complex
Udyog Vihar,
Gurgaon-122 016, Haryana
Telephone 22319

The laboratory facility is located at a distance of 7 km from Indira Gandhi International Airport and about 25 km from Delhi proper. Hindustan Insecticides Ltd. (HIL) is involved with the Pesticides Development Programme in India, a UNDP/UNIDO assisted project having objectives of strengthening the pesticide industry in India, at the site in Gurgaon.

There is an adequate array of equipment for use in the proposed training session and includes, in addition to balances and other ancillary equipment, IR, UV, and atomic absorption spectrophotometers, as well as GLC and HPLC chromatographs. The GLC instruments are equipped with thermal conductivity and flame ionization detectors while the HPLC contains the standard UV/VIS variable wavelength detector.

Dr. S. P. Dhua, chairman and managing director, and Dr. S. K. Khetan, research and development manager and head of this government of India Enterprise were both keenly enthusiastic about the potential for such a pesticide formulation analysis course. HIL has provided a course, in November 1985, directed to the training of individuals in Pesticide Formulation Technology. From that programme, it is anticipated, that the six week training session for experienced pesticide formulation chemists will be drawn. At the time of the visit most of the HIL staff was on holiday, however, judging from the staff on hand at the time of the visit and the readiness of the analytical instruments, HIL is capable of holding the proposed programme.

It is anticipated, since HIL does not have a meeting room associated with the Centre, that any participants would have to be housed in a facility which contained meeting room capability. Additionally, participants would have to be transported, daily, from the laboratory facility to their housing

area after the first week of instruction.

The laboratory, used principally for the analysis of formulation level pesticides, is spacious and will easily contain the anticipated participants. HIL is also well equipped to undertake a variety of other physical testing procedures normally associated with quality control testing of formulations.

EXPENSES ASSOCIATED WITH HOLDING THE COURSE AT CPPTI

<u>FIXED COSTS</u> (based on 12 students/session)	<u>DOLLARS</u>
Laboratory Safety equipment for participants	250
Replacement Chemicals and glassware	1,000
Transportation from housing to laboratory facility	1,600
Communication, telex, etc.	500
Paper, copying, books, etc.	1,200
Faculty (2), honorarium, air travel, per diem	1,000
Support staff, including internal faculty	1,000
Miscellaneous	2,000

LODGING COSTS

Using the CPPTI hostel (\$100/student/6wks)	1,200
Lodging at Hotel in Hyderabad (\$672/student/6wks)	8,100
Food allowance (\$420/student/6wks)	5,040

AIRFARE COSTS

For all RENPAF participants combined	8,500
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INSTRUMENT PURCHASE (one time expense)

HPLC instrument	25,000
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CONCLUSIONS

TOTAL COST*

With participants lodged at CPPTI hostel	23,300
With participants lodged at hotel in Hyderabad	30,250

Cost of conduction program would be exactly double these values for two sessions.

* Does not include the cost of the one time instrument purchase.

EXPENSES ASSOCIATED WITH HOLDING THE COURSE AT HIL

<u>FIXED COSTS</u> (based on 12 students/session)	<u>DOLLARS</u>
Power generation	800
Laboratory safety equipment for participants	250
Replacement chemicals and glassware	1,000
Transportation from housing to laboratory facility	1,600
Communication, telex, etc.	500
Paper, copying, books, etc.	1,200
Faculty (2), honorarium, air travel, per diem	1,000
Support staff, including internal faculty	1,000
Miscellaneous	2,000

LODGING COSTS

Using India International Centre (\$1450/student/6wks)	17,400
Using UNDP hotel such as Claridges (\$2050/student/6wks)	24,600
Using Management Development Institute (\$100/student/6wks)	1,200
Food Allowance (\$420/student/6wks)	5,040

AIRFARE COSTS

For all RENPAF participants combined	8,500
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INSTRUMENT PURCHASE (one time expense)

HPLC instrument	25,000
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CONCLUSIONS

TOTAL COST*

With participants staying at India International Centre	40,290
With participants staying at Claridges or similar UNDP hotel	47,490
With participants staying at Management Development Institute	24,090

Cost of conducting program would be exactly double these values for two sessions.

* Does not include the cost of the one time instrument purchase.

RECOMMENDATIONS

1. Training should be held between October and April to avail the participants of the best weather possible for travel and convenience.
2. The National Coordinator of the participating country should provide the names of candidates, in consultation with the respective laboratories associated with pesticide formulation analysis, to the management organization providing the training. The number of chemists to be trained over the two year period would have to be chosen by RENPAF as the number 48 was to include residue chemists as well. For the sake of simplicity, it is assumed that the total number of chemists to take formulation training will be 24. It would seem prudent to train representative numbers of chemists from each RENPAF country and not serve as a training facility for a single country.
3. Travel and housing arrangements should be made by UNDP/UNIDO for students and visiting experts to ensure the quality dictated by an international program sponsored by both.
4. The management organization should make available to participants all materials in English prior to a class session. Most participants are capable of reading technical material but some would find the spoken proceedings in English to be difficult if not impossible. Early release of lecture material would overcome this situation.
5. As a means of enhancing the formulation capability of the laboratory, and to provide a further instruction instrument, it is strongly recommended that a multi-component HPLC system, if possible, be purchased. Such a system would be the simple ternary pumping system offered by Spectre Physics, a Shoefel UV/VIS detector, and a Hewlett Packard Model 3390A integrator for data reduction of the detector output signal.

6. India is capable of hosting both the pesticide formulation and pesticide residue training sessions as broadly outlined by RENPAF. The formulation portion should be held in one facility and any needed RENPAF experts brought in to assist with instruction. The residue training could be organized by one facility, but it would be expected that the participants would spend more time, than the six weeks considered for the formulation training, learning at the laboratories of the array of individuals conducting pesticide residue analysis and pesticide residue research in India. It should be noted that all the laboratories involved with residue analysis, per se, were not visited.
7. Any formulation expertise, as directed by earlier RENPAF guidance, be obtained from the RENPAF countries and those chosen be fluent in the language of the written course work and lectures.
8. Efforts be made, by the management organization of the training session, to obtain a list of the fifteen most commonly used pesticides in each of the RENPAF countries so that the training may include the most up-to-date instrumental methods available for a representative group. As the course is repeated, the original fifteen compounds should be examined to determine if they need to be changed to reflect the use in the countries.
9. Once the materials of analysis are chosen, the United States Environmental Protection Agency Laboratories at Beltsville, Maryland be petitioned to provide, if possible, the standard and secondary (technical) materials required.

10. Possible course instructors outside of those from CPPTI and RIL should include Ms. Thelma Antazo from the Bureau of Plant Industry of Manila - Philippines. While little time has been spent attempting to locate potential instructors, Ms. Antazo has conducted similar training in the past.

CONCLUSIONS

Both CPPTI and HIL have the facilities to undertake the formulation training envisioned by RENPAP and subject to the assumptions made earlier.

If the sessions are to be the training for beginning chemists, and not for the experienced bench chemists considered in the assumptions then the hostel or the Management Development Institute lodging would be appropriate. On the other hand, it would seem appropriate to offer the more experienced chemist more than the barest of necessities.

What has been presented is the best estimate of the costs that might be expected to be incurred in the presentation of such a program at each facility. It would appear, however, that the best financial arrangement for the formulation training would be at CPPTI. If on the other hand the Management Development Institute is used as the lodging and catering facility, then the two are equivalent and either could be used comfortably as the managing authority.

CPPTI has been presenting this type of program for quite some time as the consultant was shown data to indicate that both a basic pesticide formulation analysis as well as instrumental methods course are presented more than twice a year for more than five years.

Both laboratories will need further instrumental equipment to enable participants to have access to the kind of equipment envisioned by RENPAP.