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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 residue analysis training: exploratory mission Bangkok, Thailand*

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 Janice King Jensen,
Pesticide consultant

United Nations Industrial Development Organization
Vienna

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EXECUTIVE SUMMARY

Six pesticide residue laboratories in Bangkok were identified and evaluated as potential training sites for two three-month pesticide residue courses that will be sponsored by UNIDO/World Bank as part of a RENPAP sub-project. Each of the six laboratories were visited and evaluated according to personnel, equipment, program, location, nearby facilities and equipment needs for training.

Three laboratories were identified as having suitable equipment and expertise for such training courses. These were the laboratories at the Department of Agriculture (DOA), Department of Medical Sciences (DMS) and National Environment Board (NEB). The DOA is recommended as being the primary training site for the course.

It was suggested that there be two courses, each for twelve weeks, each for only twelve trainees from RENPAP member countries. A total of 24 chemists would be trained, with the first training course starting in February 1987.

A three week intensive classroom/laboratory course like the one given by RENPAP in 1985 is recommended. The twelve trainees would then be divided into four groups of three people each and rotated at two-week intervals between the laboratories at DOA, DMS and NEB that have responsibilities for routine pesticide residue analyses. A separate course on instrument maintenance,

repair, trouble shooting, sampling and data analysis will be set up at DOA, with three students rotating into that course at a time.

A tentative budget was developed. The whole training program is estimated to cost $176,000. This includes room, board, air-fare for both technical assistance staff required and trainees. Recommendations for the training program were also included.

ACKNOWLEDGEMENTS

The consultant would like to express her special appreciation and gratitude to the following people in Bangkok, without whom this report would have been impossible to complete:

- Mrs Yubon Yingchol, DOA
- Miss Supranee Impithuksa, DOA
- Miss Amara Wongbuddhapitak, DMS
- Mr Paul Jung, UNIDO Consultant

I would also like to thank Khun Jom and Khun Hunny from the Thailand Development Research Institute for the excellent clerical support which they gave for completing this report.

INTRODUCTION

The Regional network of the Production, Marketing and Control of Pesticides in Asia and the Far East (RENPAF) was conceived at a meeting of data collection experts in Chiang Mai, Thailand in 1983. The RENPAF network has nine member countries. The executing agency for RENPAF is UNIDO with the project funds coming from UNDP. Mrs Cecilia Gaston from Manila is the Project Officer for RENPAF.

RENPAF has served as the framework for several sub-projects. As an offshoot from the Chiang Mai meeting, a sub-project on data collection was started. Data from 1980-1982 have been compiled already. Another sub-project is on the harmonization of pesticide registration requirements.

Yet another sub-project is planned in the near future. This will be a training project on pesticide residue and formulation analysis. Thailand was suggested as the site for residue training and India for formulation training.

The purpose of this consultancy was to identify and evaluate the laboratories in Bangkok for this pesticide residue analysis training component, considering such factors as equipment needs, costs, and availability of qualified personnel.

The terms of reference for this consultancy are included in Annex 1. The contacts made during the consultancy are in Annex 2, and the consultant's Curriculum Vitae is in Annex 3.

Mr Paul Jung, who was also hired as a UNIDO consultant but who regularly works for USEPA, went to India in June to evaluate laboratories for formulation analysis. He had similar terms of reference. Mr Jung stopped in Bangkok both before and after his trip to India.

The World Bank has proposed to undertake this project as part of their Pesticide Evaluation and Safety Testing (PEST) project for the Asian region under the framework of the RENPAF network.

The Thailand and India consultancy reports were prepared at this time so that they could be used as decision making tools at the RENPAF Project Management Meeting, which will be held in Manila, Philippines from 16 to 18 July, 1986. It is planned that the entire training proposal will be thoroughly discussed at that meeting, with the aim of arriving at the necessary consensus, so that the training program could be started in the near future.

I. LABORATORIES IDENTIFIED - SUMMARY

There are six pesticide residue laboratories in Bangkok. Ranked in order of number of trained staff and volume of samples analyzed, these are:

DOA Department of Agriculture, Ministry of Agriculture and Cooperatives

DMS Department of Medical Sciences, Ministry of Public Health

NEB National Environment Board

KUB Kasetsart University, Bangkhen campus

KUK Kasetsart University, Kamphaengsan campus

DOAE Department of Agricultural Extension, Ministry of Agriculture and Cooperatives

A detailed description of the equipment, personnel (including potential trainers), program, location, nearby hotels, equipment needs (where applicable) for each of the above laboratories can be found in Section II.

Pesticide residue training could be successfully conducted at any of the following three laboratories : DOA, DMS and NEB.

However, the consultant recommends that the majority of the training be conducted at the DOA laboratory, with on-the-job training for two weeks at each of the other two laboratories. The details of the suggested training program can be found in Section III 3.

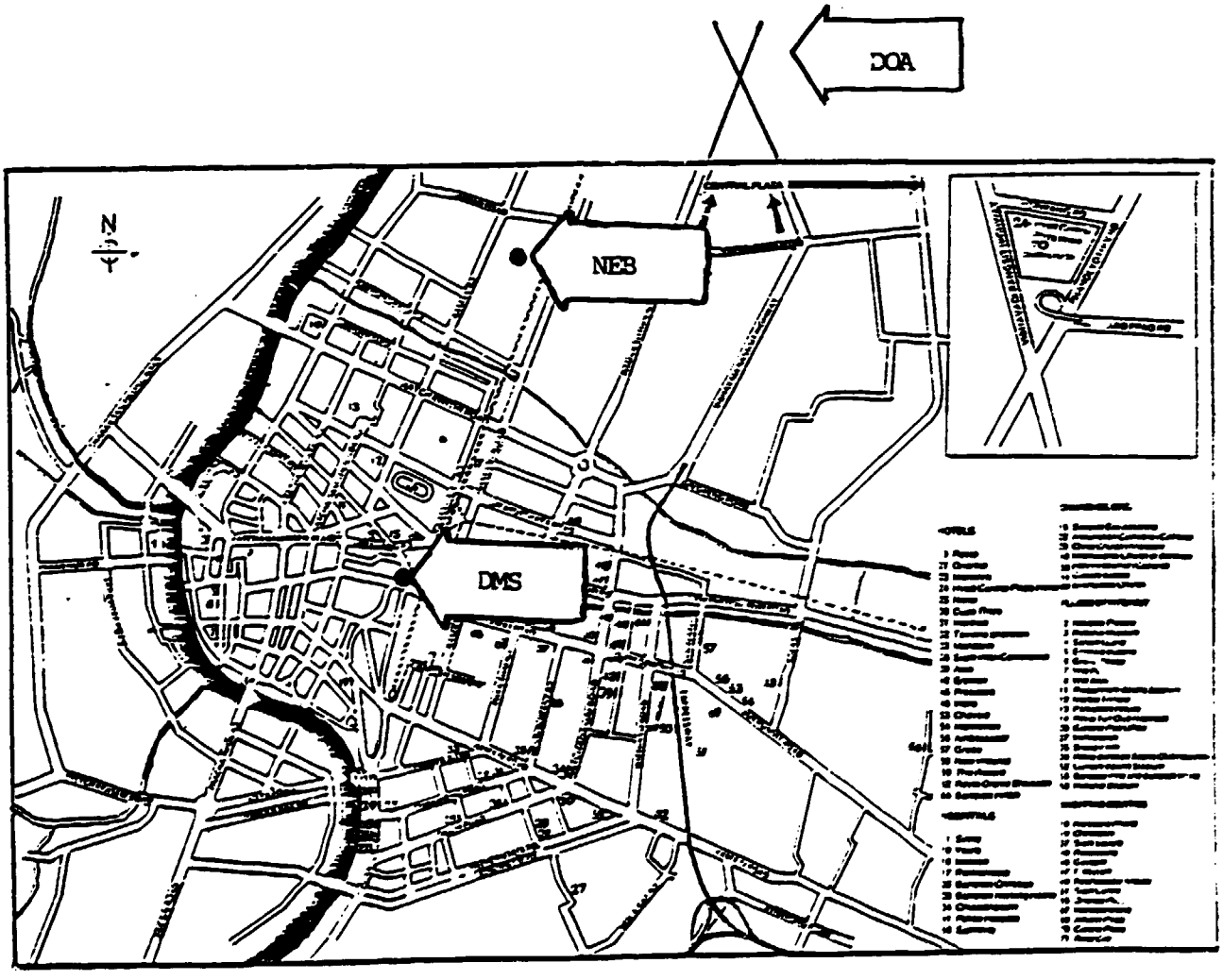
In order to get a perspective on the location of these three laboratories in Bangkok, a map has been included with the location of these laboratories marked.

The Department of Agriculture (DOA) laboratory is clearly the biggest in terms of expertise, equipment and workload. (Please refer to Section II 1 for specific details.) In January 1985, this laboratory hosted the successful two week pesticide residue course that was organized and sponsored by RENPAP/UNIDO/FAO/GIFAP.

There are fifty residue chemists at DOA and seven fully functioning GLCs. The chemists do routine analysis of food crops for export, research work on all types of pesticides and crops, and service work for other organizations in Thailand that do not have facilities to do pesticide residue analyses themselves. There is adequate laboratory and classroom space for training. This laboratory also has four semi-functional (very poor sensitivity) Tracor GLCs that could be used exclusively by the trainees for practice with instrument maintenance and repair. The DOA would make its routine equipment available to the trainees whenever required.

FIGURE 1

Bangkok Map



The DOA has many qualified staff for conducting pesticide residue training. Although there are probably many more, some of the obvious trainers at DOA who are both technically competent and comfortable speaking English are:

Mrs Yubon Yingchol
Mrs Nuansri Tayaputch
Mrs Supra ee Impithuksa
Mrs Chiraporn Sriplachit

The DOA would very much like to be the laboratory selected to host the RENPAP pesticide training. Both management and staff at the DOA were extremely helpful in providing any assistance required during this consultancy. This positive attitude can go a long way in assuring the success of a training program.

The laboratory at the Department of Medical Science (DMS) is also very suitable as a training facility for small numbers of students. Although there are only eight chemists, they analyze about 800 samples a year. (Please refer to Section II 2 for specific details.) These samples are primary foods such as raw fruit, vegetables, meat, eggs and milk, processed foods, and environmental samples such as fish and water. Like DOA, the laboratory at the DMS does research work as well as multiresidue screening of routine samples.

Miss Amara Vongbuddhapitak from the DMS would be a very capable trainer for a pesticide residue course.

The National Environment Board (NEB) definitely has an up and coming laboratory. (Please refer to Section II 3 for specific details.) The Japanese government has provided both equipment and technical assistance to NEB. Multiresidue analysis of environmental samples for organochlorines appears to be the strength of the NEB laboratory. Mrs Monthip Tabucanon from NEB would be a very capable trainer for the proposed residue training course.

It is worth noting that it is a long term objective of NEB to become a regional training center. To support this objective, Mr Sirithan from NEB has suggested that trainees from the pesticide residue course join the NEB team when they go on their routine farmer pesticide surveys. They go out for five days and survey from 10-15 farmers and collect environmental (soil, water, agricultural produce) samples for residue analysis. Trainees would then get practical experience in conducting farmer surveys and also learn how to collect samples. The trainees could then analyze these samples in the laboratory.

Although well equipped, the laboratory at Kasetsart University at Bangkhen only has two chemists. (Please refer to Section II 4 for specific details.) They are currently only doing research work on carbamate residues on mushrooms and jasmine flowers. This laboratory was eliminated as a possible candidate for hosting a regional training course.

At the Kasetsart University laboratory at Kamphaengsan, only research on organophosphate decay curves on lettuce is being

conducted. (Please see Section II 5 for specific details.) Although they only have one GLC, it is likely the three trained chemists there could train one or two students in GLC analysis. However, this laboratory lacked sufficient equipment and trained staff to host the regional training proposed by RENPAF.

The Department of Agriculture Extension (DOAE) is just currently starting up its laboratory (Please see Section II 6 for details.) It has one GLC and no trained chemists. Therefore, it was eliminated as a candidate laboratory.

In summary, there are three viable laboratories for hosting the RENPAF training project : the DOA, DMS and NEB. The DOA is the largest in terms of chemists, equipment and workload and has the most experience with regional training of this sort. The DMS laboratory is a smaller, but very well run laboratory that offers a variety of multiresidue analysis that could be useful for training purposes. The NEB laboratory has extensive experience in environmental sampling and analysis of organochlorines.

II. LABORATORIES IDENTIFIED - DETAILS

II.1 Department of Agriculture (DOA)

Ministry of Agriculture and Cooperatives
Agricultural Toxic Substances Division
Bangkhen, Bangkok 10900
telephone 579-3577

CONTACTS

Mr Adul Worawisitthumron, Division Chief
* Mrs Yubon Yingchol, Chief, Pesticide Residue Laboratory
* Mrs Nuansri Tayaputch, Chemist
* Mrs Supranee Impithuksa, Chemist
* Mrs Chiraporn Sriplachit, Chief, Pesticide Formulation Laboratory

EQUIPMENT AND PERSONNEL

There are two laboratories in this Division, both located in the same building at Bangkhen outside Bangkok. In the formulation laboratory, there are seven chemists (four BS and three MS) and three technicians. The laboratory is equipped with

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* very capable to assist with the training program

two Tracor GLCs, both with FID detectors and one Tracor HPLC. There is one IR, but it needs repair. In the pesticide residue laboratory at Bangkhen, there are fifty chemists (forty BS and ten MS) and eighteen technicians. Although they have eleven GLCs (six Tracor Model 222/2 with U shaped columns, four Tracor Model 565 with coiled columns, and one Shimadzu Model 7AG), four of the older Tracors need repair. For the two Model 222 Tracors that work, one has an ECD and one has a FPD. For the four Tracor 565s, one has both FID/FPD and the others have Nickel 63 ECDs. The Shimadzu has four detectors : ECD, FPD, FID, FTD. There is no service for Tracor equipment in Bangkok.

The residue laboratory has other large instruments including a Tracor HPLC Model 985 (but it needs repair), a Hewlett Packard 8451A Diode Array Spectrophotometer, and a Bosch and Lomb Spectrophotometer.

Regarding glassware, all general glassware is available. This includes beakers, pipettes, TLC tanks, Erlenmayer flasks, volumetric flasks, separatory funnels and cylinders. The laboratory has plenty of general laboratory supplies like Soxhlet extractors, blendors, etc.

General and pesticide (not HPLC or spectroscopic) grade reagents like acetone, hexane, dichloromethane, petroleum ether, diethyl ether, ethyl acetate, chloroform, methanol and 2-propanol are available and additional supplies can easily be purchased in Bangkok. Supplies such as florisil, silica gel, aluminum oxide, anhydrous sodium sulphate are also available.

The laboratory has a wide variety of standard precoated column packing material for pesticide residue analysis. Except for a few types of specialized packing (1.5% SP225/1.95% SP2401, DEXSIL 300, DEXSIL 400, OV-225 and OV-105), the laboratory has an adequate supply.

The pesticide residue laboratory is run by Mrs. Yubon Yingchol. They do both routine and research work. They analyze about 2500 samples a year on export crops like rice, corn, sorghum, mungbean, coffee and tapioca to certify that they have pesticide residues below FAO tolerance levels. Less than 1% exceed FAO tolerance levels.

This laboratory also analyzes samples for research work. For 1986, this section has 102 different pesticide research projects. It is estimated that they will analyze at least 2,000 samples in 1986 for research purposes.

PROGRAMS

The pesticide formulation laboratory is run by Mrs. Sriplakich. She and her staff analyze about 1,300 formulation samples a year. These samples originate from various sources : 500 from the extension department (DOAE); 300 from the regulatory division (RD); 100 from research and 100 from the market place. Mrs. Sriplakich said that she is having problems with her own analytical quality control. In one collaborative study she did with GTZ, her results were about 10% higher than those of GTZ.

LOCATION AND HOTELS

This laboratory is located at Bangkhen, which is outside (about 15 kms) of Bangkok proper, on the Kasetsart University Campus. Please see the Bangkok map in Section I. It is located just off the main highway that goes to Don Muang airport. There is adequate and unexpensive bus transportation (both with and without A/C) between Bangkok and Bangkhen. A round trip taxi costs about 150 baht (or $6).

Actually located on the Kasetsart Campus and about a three minute walk from the laboratory, is an ASEAN student dormitory with 48 private rooms, each with an attached bathroom. The rooms are plain but clean, and very unexpensive. (See photos on the next two pages.) A single non-airconditioned room costs 1,200 baht ($46) a month. The hot season in Bangkok is from March through June. An airconditioned room during that time is almost essential. For other months of the year, however, a fan is sufficient. For a single air conditioned room, the price jumps considerably, up to 300 baht ($11) per day, or 9,000 baht ($342) per month. A double room costs 700 baht ($15.25) per day, or 12,000 baht ($750) per month. No special monthly rate is available for the A/Ced rooms. There is an ASEAN canteen right across from the dormitory with relatively inexpensive Thai food.

Alternatively, there is the Golden Dragon Hotel which is located at 20/11-13 Ngarm Wongwarn Road. Although convenient in actual distance (about 2 km), it is not particularly convenient

in terms of time (about 30 minutes) to commute between the hotel and the laboratory because of the ever problematic Bangkok traffic. Public transportation is, however, readily available.

FIGURE 2

ASEAN Dormitory at Bangkhen

ASEAN Canteen

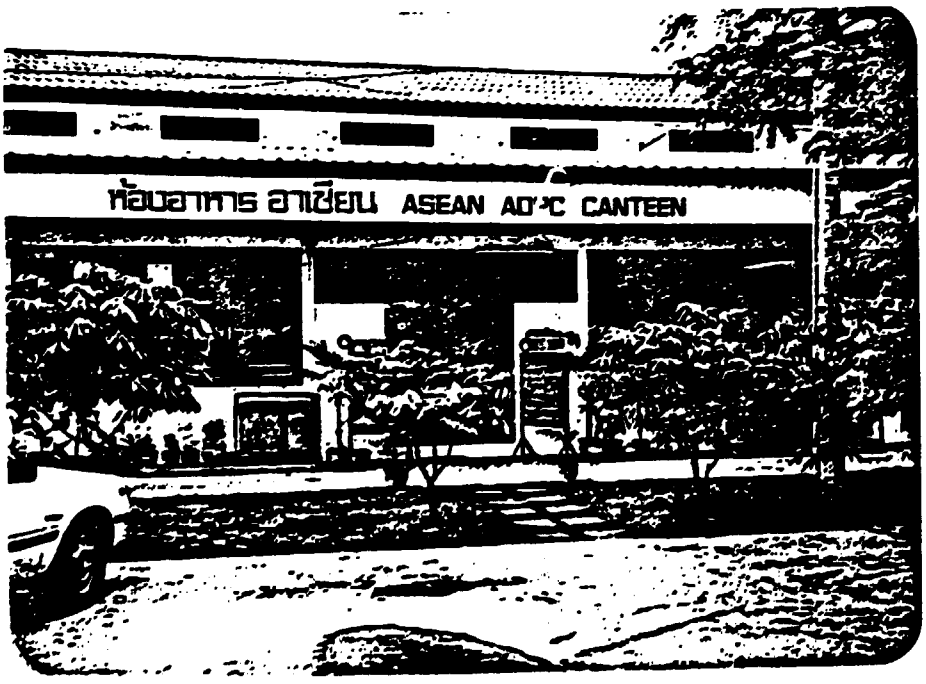
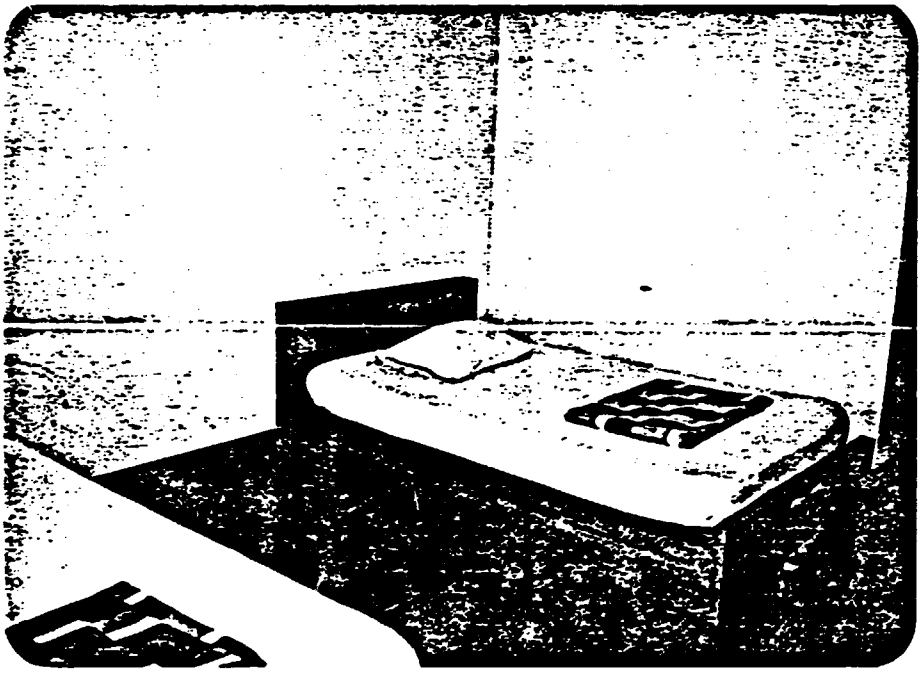
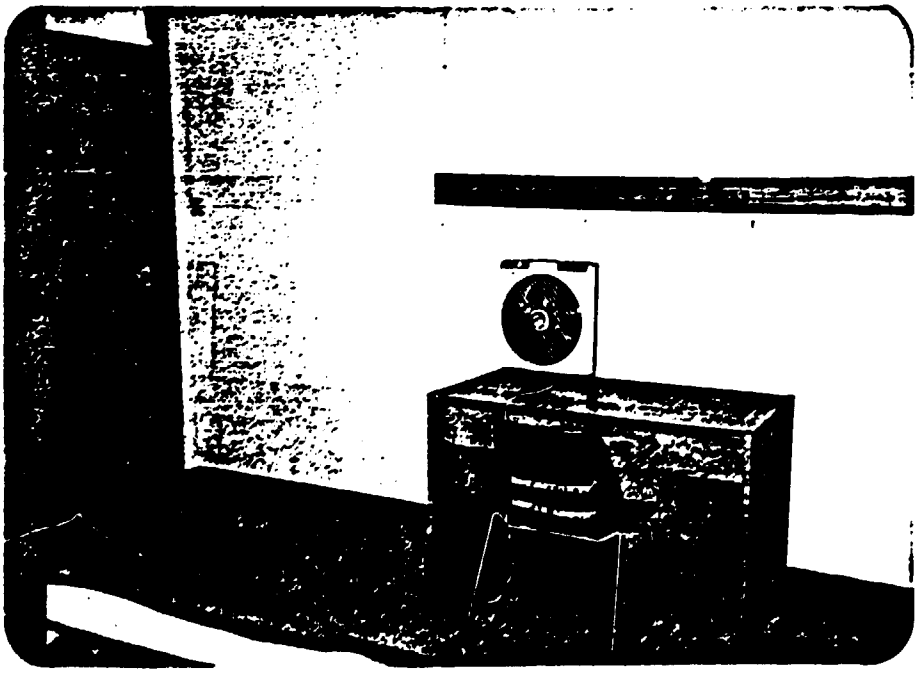


FIGURE 3

Single Room at ASEAN Dormatory





A single at the Golden Dragon cost 7,500 baht ($285) per month, a double 8,500 baht ($323) per month. It is a clean 3 star hotel, with all 114 rooms air conditioned, several resturants that can serve Moslem and vegetarian dishes, and a swimming pool.

EQUIPMENT NEEDS

This laboratory needs another GLC, equipped with ECD and FPD detectors. Both Perkin Elmer and Shimadzu have representatives in Bangkok. A simple Perkin Elmer Sigma 300 or Shimadzu GC - 9A with a plain recorder would be good for training purposes. Either of these could be purchased locally for duty free price of about $25,000 or less. Please see Annex 4 for an exact quotation. For this price, accessories like pressure gauges, gas tanks, and hook up tubing could be included.

Other items which the laboratory would need in order to do training are:

1. A complete set of flash evaporators.
2. Gel permeation, GPC autoprep.
3. Empty glass columns, short ones for the Shimadzu, coiled ones for the Tracor.
4. Specialized packing material (see last paragraph of Equipment and Personnel Section).
5. Two HPLC syringes, 25 u each.

6. One 10 u syringe for each student or a total of 24.
7. Fresh analytical standards, which would be defined later.
8. Repair the HPLC.
9. Although separation chromatographic columns and round bottom flasks (200, 300, 500 and 1,000 ml T24/40) are available, the laboratory could use more, preferably six of each.

II. LABORATORIES IDENTIFIED - DETAILS

II.2 **Department of Medical Science (DMS)**

Division of Food Analysis
Ministry of Public Health
Yod-se, Bumrungmueng Road
Bangkok 10100
telephone 223-1444 ext 265, 223-9873

CONTACTS

Mrs Chaweewon Halilamian, Division Chief

* Miss Amara Vongbuddhapitak, Chief, Pesticide Residue Analysis Laboratory

EQUIPMENT AND PERSONNEL

The Medical Science Laboratory is well equipped. The laboratory has four GLCs (Varian Model 2700 AFID/ECD, Hewlett Packard Model 5880A ECD/FPD, Hewlett Packard Model 5[illegible]0 capillary ECD, and Shimadzu GC-7AG with TEA Model 543 Analyzer), two HPLCs (Varian Model 8500 and Hewlett Packard/Spectra Physics combination), a new GC-Mass Spectrometer (Hewlett Packard Model

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* very capable to assist with the training program.

5988A), one AA (Perkin Elmer Model 403), and several spectrophotometers. There are eight chemists in this lab, all with a bachelor's degree or above.

In October 1986, the pesticide research activities will be moved to a new facility being built near Bangkhen by the Japan International Cooperation Agency (JICA), as part of a 400 million baht Japanese grant aid project to the MOPH. As part of that project, the Japanese are providing the following additional all-Hitachi brand equipment for pesticide research: two GLCs (one ECD/FPD and one ECD/FID), two HPLCs Model 655, one AA Model 180, one IR Model 270, one MNR Model R600, one large spectrophotometer Model 557 and several smaller spectrophotometers.

This laboratory has sufficient glassware and big equipment for training small numbers (up to 5) chemists at any one time.

PROGRAM

This division is mandated to do routine analysis and research on food, beverages, water, food containers, food additives and contaminants to ensure consumer safety. This includes pesticide residues in food.

For routine survey work, chemists from this laboratory analyze primary and processed food, both for domestic consumption and export. The samples are collected at the wholesale and retail level by MOPH inspectors. All types of primary food (for

example, fruit, vegetables, milk, eggs, etc.) are collected. In 1986, a total of 120 samples will be collected. Each year, a class of primary food is chosen for more intensive analysis of pesticide residues. In 1985, pulse crops were focused. This year it is vegetables.

In 1985, of the 200 samples of primary food that were analyzed, 70% were contaminated with detectable levels of pesticide residues, but all were lower than the maximum residue limit set by the Thai MOPH. Of the 40 samples of paddy and polished rice analyzed for organophosphate and organocarbamate (not for organochlorine) residues, none had detectable residues.

In 1984, 200 samples of primary food were analyzed. Again, about 65-70% of the samples were contaminated with pesticide residues, with only about 3% of the samples exceeding Thai maximum residue limits. The results from the last five years are currently being compiled and will be completed by January 1987.

As part of their research program, this division has done several interesting studies. In the area of fish contamination, marine fauna from the Gulf of Thailand were monitored for organochlorine residues. In salt water, 62% of the samples had low level DDT residues, in addition to dieldrin (8%) and BHC (2%). In fresh water, shrimp, water and sediment from farm pond and canal water were detected in shrimp (68%), water (11%) and sediment (76%).

In 1980, Miss Amara from this division did the only pesticide residue total diet study yet done in Thailand. Daily meals were collected (including water and beverages) served to 20

year old males in Bangkok for 30 consecutive days. Actual intake of residues was calculated, and it was found that dieldrin intake was near the WHO-ADI (acceptable daily intake), DDT and endrin were 3 and 6 times lower than the ADI, while chlordane and heptachlor were very low. Whole blood residue levels were also determined for these 20 year old males. Total DDT was calculated to be 11.7 - 45.7 mean 25.5 $\pm$ SD 8.1 ppb.

LOCATION

The DMS laboratory is located in down town Bangkok (See the map of Bangkok in Section I). There are plenty of acceptable hotels within walking distance of this lab that cost about 9,000 baht (S345) per month under a long term lease arrangement.

II. LABORATORIES IDENTIFIED - DETAILS

II.3 National Environment Board (NEB)

Environmental Qualtity Standards Division
Soi Pracha-Sampan 4, Rama 6 Road, Bangkok 10400.
telephone 279-7180

CONTACTS

Dr Jarupong Boon-Long, Chief, Toxic and Hazardous Substance Section

Mr Sirithan Pairoj-Boriboon, Division Director

* Mrs Monthip tabucanon, Chief, Laboratory and Research Section

EQUIPMENT AND PERSONNEL

NEB, through the help of the Japanese International Cooperation Agency (JICA), is starting to get an impressive laboratory for doing pesticide residue analyses. They have three GLCs (Varian 3700, Shimadzu 8A-F10, Shimadzu 7A) with all the standard detectors, three spectrophotometers (Hitachi 200-10, Jasco UNIDEC-340, and Cecil CE 343 for field use), one very new HPLC (Shimadzu RF 530), two atomic absorptions (Perkin Elmer 372 and 2380), one infrared (Shimadzu 435), one total organic carbon

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* very capable to assist with training program.

computational system (Beckman 915B), three mobile labs (a trailer, a bus and a boat) for water sampling and two mobile labs (trailers) for air sampling.

For training small numbers (up to three) of chemists at one time in organochlorine extraction and analysis, they have sufficient glassware and equipment at this time.

PROGRAM

Mrs Monthip and experts from JICA have been doing a lot of work analyzing organochlorine pesticides in the Chao Phraya River and Bangkok canals (klongs). In April (dry season) and October (wet season) 1984, water and sediment samples were collected from 33 sites located from 10-333 kms from Bangkok and analyzed for pollution levels of detergents, phenols, pesticides (organochlorines and organophosphorus compounds) and PCB's. Background levels of heavy metals were also established. Dry season organochlorine residue levels in water were 3-10 times higher than levels in the rainy season. Interestingly, aldrin (supportedly banned in Thailand) showed up in 100% of the water samples, ranging from 0.002-0.284 ppb. And sediment samples contained residue levels that were 10-100 times higher than water residue levels. Accumulation in the order of 10 times is not unusual, but in the order of 100 times could cause a long term negative impact on aquatic organisms.

LOCATION AND HOTELS

NEB is also located downtown (see map in Section 1). The President House (telephone 279-2379) is within walking distance, and is where most NEB consultants stay. A single room costs 7,000 baht ($266) per month and a double room costs 11,000 baht ($418) per month.

II. LABORATORIES IDENTIFIED - DETAILS

II.4 and 5. **Kasetsart University**
Faculty of Agriculture,
Bangkhen, Bangkok 10900
telephone 579-8536

CONTACTS

Dr Prasan Yingchol, Dean

* Mrs Patana Anurakpongsatorn, Pesticide Laboratory, Bangkhen

Dr Neungpanich Sinchaisri, Insect Toxicologist, telephone 570-3720, 579-7571

Dr Vichai Korpraditskul, Health of Central Laboratory and Greenhouse Complex, telephone 579-0113 ext. 323

EQUIPMENT, PERSONNEL, PROGRAM - BANGKHEN

The Bangkhen campus has one central laboratory facility for analyzing pesticide residues. All the residue work is for research work only, and mainly on carbamates. Currently, decay curves for methomyl and carbaryl residues on jasmine flowers and mushrooms are being studied.

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* could be a trainer for the training course

The laboratory equipment at Bangkhen consists of two GLCs (Perkin Elmer Model 910 with 2 FID, and Pye Unicam with 2 FID), one HPLC (Du Pont Model 860 with UV detector), one AA (Perkin Elmer Model 360), one IR (Beckman Model 4250, one UV (Beckman ACTA), and one double beam spectrophotometer (Hitachi Model 200-20). There are only two chemists working in the pesticide laboratory.

EQUIPMENT, PERSONNEL, PROGRAM - KAMPAENGSAEN

There is another pesticide research laboratory at the Central Laboratory and Greenhouse Complex at the Kamphaengsaen Campus, 80 kms. from Bangkok. In this lab, decay curves for malathion and mevinphos in lettuce are being studied. No routine work is done. This lab is equipped with one Shimadzu GLC, with FID/TCD detectors. The three laboratory chemists have access to two HPLCs (Jasco Model 100) and a UV spectrophotometer (Hitachi Model 100-20) located the biochemistry laboratory.

LOCATION AND HOTELS

The Kasetsart University laboratory at Bangkhen is a 10 minute walk from the DOA laboratory, so the information regarding the ASEAN student quarters and the Golden Dragon Hotel would also be applicable here.

The Kamphaengsan campus is 80 km. from Bangkok. There are

rooms available on campus, with the cost depending on the luxury required. Class "A" single is 400 baht ($15) per night. Class "B" double costs 250 baht ($10) per night. Both classes have rooms with A/C.

II. LABORATORIES IDENTIFIED - DETAILS

II.6 Department of Agricultural Extension (DOAE)

Plant Protection Service Division
Ministry of Agriculture and Cooperatives
Bangkhen, Bangkok 10900
telephone 579-3008

CONTACTS

Mr Udom Dechmani, Division Director
Miss Orapin Thirawat

EQUIPMENT AND PERSONNEL

DOAE is just starting up this laboratory and only has one Shimadzu gas chromatograph. However, DOAE has requested that USAID assist them with the purchase of more equipment. This laboratory, when fully operational, would also be a service laboratory for samples collected by extension agents.

There are no trained residue chemists working in this lab.

This laboratory, from both an equipment and trained personnel point of view, was inadequate for serious consideration as a training site.

PROGRAM

DOAE has a policy of giving away pesticides free of charge when a widespread pest outbreak occurs. A whole range of pesticides are warehoused at Bangkhen. Specific orders for pesticides are placed by the plant protection units in the regions for distribution in their areas.

DOAE is trying to set up a pesticide residue laboratory so that they can monitor crops, etc that their "giveaway" pesticides have been used on.

III. SUGGESTED PROGRAM

Before equipment needs and technical staff could be identified and a budget developed, a specific training program needed to be defined.

1. RENPAF Guidelines

Based on a draft RENPAF project document which was received from UNDP in April 1986, the consultant had the following guidelines for the regional training:

1. The pesticide residue course should be thirteen weeks.
2. The course should include residue analysis of blood, urine, biological tissues, soils, water, and (presumably) agricultural commodities.
3. The program should include equipment theory, maintains and repair.
4. Quality control should be emphasized.

2. Assumptions

Based on discussions with Thai government officials, RENPAF Project Officier Mrs Cecilia Gaston, Mr Paul Jung, UNIDO consultant to evaluate laboratories in India, certain assumptions had to be made before a relevant program could be developed. These assumptions were:

1. Number of students

Each residue course would have about twelve trainees from the RENPAF network countries.

2. Number of courses

Two thirteen week courses would be given over a two year period.

3. Trainee background

A trainee would be an experienced bench chemist, already working in the field of pesticide residue analysis.

4. Trainee selection

Trainees would be screened by the national RENPAF coordinator or some other appropriately designated person or group, and selection would be based on the job and equipment the trainee will return to in his/her home country.

5. Benchmark equipment

The standard equipment for pesticide residue analysis in the region is gas liquid chromatography (GLC), with some knowledge and experience with thin layer chromatography.

6. Ratio lecture versus laboratory

About 90% laboratory and 10% lecture is desirable.

7. Sample collection/data analysis

Standardized sample collection methodology and data evaluation would be taught that would be considered valid in a court of law.

8. Industry assistance

If the training course is held outside of the peak residue season (August through mid January) in Europe and America, then industry would be willing to provide some short-term technical assistance for the training course.

9. Instrument maintains and repair

This topic should be focused. Students should be given practical instruction with plenty of "hands on" time with the equipment. Trouble shooting should also be taught.

10. Flexibility of program

The program should be flexible to meet the specific needs of the trainees. For instance, if a trainee expects to return to his home country and only analysis agricultural produce, then the training he receives should be focused primarily on that subject. A twelve or thirteen week course should only be a guideline. If a person is adequately trained in a specific technique or only has a specific time window he can be away from his home country, then he should be allowed to return home early.

11. Internationally recognized standard methods

CIPAC, PAN, AOAC, WHO or FAO as acceptable standard methods should be taught.

12. Analyses of most common RENPAF pesticides

Based on data collected by RENPAF, the analysis of the most commonly used pesticides in the region should be taught. These are diazinon, carbaryl, paraquat, parathion, monocrotophos, carbofuran, 2,4-D, butachlor, endosulfan and mancozeb. (This was the assumption made in the 1985 RENPAF course which seems a very reasonable approach.)

III.3 PROGRAM

As the 1985 RENPAF pesticide residue course was such a success and was based on analytical needs in the region, it seems reasonable to suggest that this type of "classroom/ laboratory" program be repeated at DOA, with about two months of on-the-job training added on. The program in 1985 is included as Annex 5. It is worth noting that the trainers for this course (Dr Kopish from FAO, Dr Greve from the Netherlands and Dr Bolygo from Hungary) were excellent and every effort should be made to get these instructors back for three weeks per course.

If the number of students is kept small (to about twelve per course), then they could be divided in to four groups of three trainees each. Each group could rotate on a two or three week basis between the laboratories at DOA, DMS, and NEB for practical hands-on training, and to a separate classroom/laboratory set up for a course in instrument maintenance, repair, trouble shooting, sampling techniques and data analysis. As mentioned in Section I, NEB has suggested that the trainees join their NEB team when they go on their routine five day field surveys to interview farmers on pesticide use and to collect samples for residue analysis. The consultant has gone on one of these NEB survey trips and found it to be an educational, fun and interesting experience.

The rotation between laboratories is strongly recommended for the following reasons:

1. The trainee will get exposed to a broader variety of equipment, procedures, and expertise, and everyday problems associated with routine residue work.

2. There really is a tremendous amount of talent in the various laboratories in Bangkok. A rotation would expose the trainees to this expertise. This is a major advantage of having the training in Bangkok.

It is hopeful that the trainees, because only three would be at any one laboratory at any one time, could assist the staff at the different laboratories and serve as extra pairs of hands, rather than be a burden on the staff's time.

All three laboratories have agreed to this rotational training proposal. However, personnel at each lab thought thirteen weeks was just too long a time period to have their routine work interrupted, so a twelve week course was reluctantly agreed to as an alternate proposal. An on-site manager who will take care of all the very time consuming details involved with such long-term training is needed. If this person doubles as a trainer, then it will surely be a full-time job for at least two months before, three months during, and one month after each course is given.

IV.1

PESTICIDE RESIDUE TRAINING
BANGKOK, THAILAND
1987 - 1988*

Tentative Budget

	US Dollars
Technical Assistance (4m/m)[1]	
transportation	10,000
per diem	9,000
honorarium	12,000
on-site prject coordinator/trainer (6m/m)[2]	24,000
misc honorariums	5,000
Trainee Costs (24 students for 3 months)	
transportation[3]	12,000
subsistence[4]	22,000
hotel[5]	20,000
Misc Expenses	
paper, books, xerox, printing	7,000
telex, telephone, postage, etc.	2,000
transportation	3,000
misc for inflation, etc.	10,000
Laboratory Expenses	
chemicals[6]	12,000
misc glassware for DOA lab	3,000
GLC for DOA Laboratory	25,000
Costs for training 24 chemists for 12 weeks each	$176,000

* Two twelve week courses over a two year period

Footnotes :

1 Prefer P.A. Greve and E.Bolygo to come, each for four weeks for each month course.
2 Would be responsible project management and student logistics, would interface with DOA, DMS, NEB.
3 Assumes cheap Asian airfares.
4 Assumes $ 10 per day, not UN per diem.
5 RENPAF pays hotel costs.
6 Replaces chemicals used in training.

IV.2 Notes on Budget Numbers

Communication : Telephone, telex, postage, etc.
$ 2,000

Technical Assistance :
2 Trainers (Greve and Bolygo) = honorarium for 8 weeks
= @ 150/day
2 x 20 days (4 weeks) x 2 courses x $150/day = $12,000
airfare = $2,500 x 2 = $ 5,000
per diem = 2 x 28 days x 2 courses x 77/day = $ 8,624

Transportation Cost :
to/fm airport, misc taxi costs, petrol, drivers = $ 3,000
(strictly guess = $10/week/student)

Roundtrip Air Fares :
$12,000 for 3 trainees each from RENPAP countries
by cheap Asian fares
$19,000 for 3 trainees each assuming standard
economy class ticket.

Paper, Xeroxing, Books :
assume $6,000 (because Jung assumed $2,500 for
6 weeks)

Chemicals :
assume replacement chemicals and glassware will
cost $500 per student x 24 students = $12,000

Housing :
one month at ASEAN guest house @ 1,200 baht/month
two months at unexpensive hotel @ 10,000 baht/month
= 21,200 baht = $810 for three months per trainee,
24 students x $810 = $19,440

Subsistence :
subsistence at $10/day x 90 days = $900 for 3 months
(Note $300 per month is about the wage paid to experienced
Thai government chemists)
24 students x $900 = $21,600

UN Per Diem :
if regular UN Bangkok DSA $77 per day applied, then DSA alone
would cost $77/day x 90 days x 24 trainees = $ 166,320

IV.3 Round-trip Airfares to and from RENPAF Countries [1]

	Cheap		Regular	
	Asian Fares		Economy Class	
	baht	US dollars [2]	baht	US dollars [2]
Korea	14,800	(563)	25,720	(978)
Afganistan	17,450	(663)	24,100	(916)
Pakistan	11,950	(454)	20,130	(765)
India	9,650	(367)	16,250	(618)
Indonesia	9,850	(374)	17,150	(652)
Philippines	7,650	(291)	15,400	(586)
Sri Lanka	9,650	(367)	16,250	(618)
Bangladesh		(500)		(800)
Bottomline	$3,550 x 3 = $ 11,000		$5,924 x 3 = $18,000	

Cheap fares will cost about $11,000

Economy class will cost about $18,000

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1 As students would probably purchase tickets in home country, it is assumed that cheap tickets at approximately this price could be purchased in the various RENPAF countries.

2 Exchange rate 26.3 baht per US dollar. June 1986.

V. SUGGESTED SCHEDULE FOR TRAINING

None of the three main laboratories in Bangkok had any time preference for the training. Mr G. Willis from GIFAP said the training program could reasonally expect industry-sponsored short-term technical assistance from chemists in private industry in Europe or the US if the training was held from mid-January until July. According to Mr. Willis, during the peak residue analysis season from August through to mid-January, most everyone is swamped with work.

The weather in Bangkok is another factor that should be considered. The hot season begins in March and lasts until June. If the training is done in the hot season, then the students should reasonably expect an air conditioned room. All the instrument labs in Bangkok have A/C.

Chinese New year is THE big celebration time in Bangkok and the city closes down for several days. In 1987, this holiday season is in January.

Therefore, with all the above things considered, the consultant suggests that in 1987, the course begins on February 2nd and ends on April 24, with the course starting and ending on approximately those same dates in 1988.

SCHEDULE

Week 1	DOA formal lecture/lab
Week 2	DOA formal lecture/lab
Week 3	DOA formal lecture/lab
Week 4	Rotation 1*
Week 5	
Week 6	Rotation 2*
Week 7	
Week 8	Rotation 3*
Week 9	
Week 10	Rotation 4*
Week 11	
Week 12	Review/Evaluation

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* Rotation between DOA, NEB and DMS labs and M/R course at DOA. M/R course means maintenance/repair/troubleshooting/sampling/data analysis course (see Section III 3.)

VI. POTENTIAL TRAINERS IN RENPAF COUNTRIES

Several names were given to the consultant as very good potential classroom lecturers/trainers who are located in the RENPAF area. These are:

India — Dr S.K. Mukerjee
Division of Agricultural Chemicals
Indian Agricultural Research Institute
New Deli 110012

Philippines — Mrs Thelma Antazo

Afganistan — Mr Arpad Ambrus

Thailand [1] — Dr. Sakpryoon Deema
Inspector-General
Ministry of Agriculture and Cooperative
Bangkok 10900

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1 The trainers that were identified in Sections I and II of this report are very competent, but do not enjoy classroom speaking in English. They feel very comfortable training in English with fewer students in a laboratory setting, however.

VII. RECOMMENDATIONS

Most of the recommendations in this section have already been discussed before in this report. However, in order to have all the recommendations in one place, they will be summarized again here.

1. The UNIDO/World Bank pesticide residue training should be conducted at the Department of Agriculture (DOA) laboratory at Bangkhen.

2. There should be two courses over a two year period, each with twelve students.

3. Trainees should be bench chemists working with pesticide residues.

4. The trainees should be carefully selected by a designated person or committee to ensure that they will indeed use this training when they return to their home countries.

5. Trainee should attend an intensive course for the first three weeks and this training should be modeled on the 1985 RENPAP course.

6. Trainee would then rotate between the laboratories at DOA, DMS, NEB and the GLC maintenance and repair course located at DOA. Each rotation would last two weeks.

7. The training program should be flexible enough to accommodate the specialized training needs of the individual trainees.

8. The training program for pesticide residues should be twelve weeks long, not thirteen weeks.

9. Hotel costs at designated places would be paid directly by UNIDO or the project representative.

10. A daily amount of $10 be given to each student to cover food, transportation, etc. Paying the DSA of $77 per day in Bangkok would make the training course prohibitively expensive (over $166,000 for these two courses alone).

11. Airfare costs should be reduced by using less expensive Asian fares, not economy fare tickets.

12. Bring P. Greve and E. Bolygo back to run the three week intensive session at the beginning of each course. Based on various comments, they must be very talented teachers.

13. Better coordination with FAO is needed. FAO is technically the lead UN agency in the area of pesticide residues. Dovetailing this project with FAO efforts would make good sense, and would avoid duplication.

14. An on-site coordinator is needed to handle the multitude of details that will certainly come up. Although someone from the DOA could certainly do this. It will be close to a full time job for about six months a year. For two courses, that

would be a commitment of a full year. The less hassle the training program is to DOA and the other rotational labs, the better. The expense of an on-site coordinator could be justified if that person could also function as an occasional trainer.

15. Formulation training could also be done in Thailand. DOA would have the equipment and space for this training. Technical assistance, though, would be needed to put on the course. Logistically, it would be easier to coordinate if both residues and formulation were taught at separate courses, but in the same country.

16. Request GIFAP members to help with technical assistance and perhaps equipment, old or new. Another GLC and HPLC at DOA would be most useful.

UNITED NATIONS

Annex 1

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNIDO
DP/RAS/85/023/11-51

JOB DESCRIPTION

Post title Consultant on Pesticide Analysis
(Quality Control and Residue Analysis)

Duration 1 month

Date required June - July 1986

Duty station Thailand with internal travel

Purpose of project To provide technical assistance to the Regional Network in a Pesticide Evaluation Safety Testing Training Programme dealing with quality control and residue analysis of pesticides.

Duties The consultant, with the help of the National Co-ordinator of the Project, will:

- evaluate the adequacies and needs of candidate laboratory facilities in the country to conduct the training programme,
- identify equipment needs and technical staff for the programme,
- assess the availability of physical facilities to accommodate trainees,
- evaluate local personnel capable of assisting the training programme,
- estimate the cost of conducting such a programme once or twice during the two year duration of the project,
- submit a report giving his findings and recommendations.

Applications and communications regarding this Job Description should be sent to:

Project Personnel Recruitment Section, Industrial Operations Division
UNIDO, VIENNA INTERNATIONAL CENTRE, P.O. Box 300, Vienna, Austria

Qualifications	Chemist, Bio-chemist or Environmentalist with extensive experience in the quality control, residue monitoring and environmental safety of pesticides. He should be familiar with the international norms for good laboratory practice (glp), registration and MRL and ADI for pesticides.
Language	English
Background information	The Regional Network was established in 1982 through a project executed by UNIDO (DP/RAS/82/G06). The initial phase of the project which is the first of its kind implemented in the region, attempts to develop a lasting co-operative system in Asia involving Government institutions and bodies dealing with pesticides at all levels of the national economy. On behalf of member Governments the project is managed by the Regional Project Co-ordinator who has been assigned by the Government of the Philippines at the Fertilizer and Pesticide Authority in Manila. Members of the Network are Afghanistan, Bangladesh, India, Indonesia, the Republic of Korea, Pakistan, Sri Lanka, the Philippines and Thailand. The activities of the project comprise expert consultations, workshops, study tours, fellowships, and technical advisory services rendered by experts from within and outside the region. A supplementary function of the Network is the creation of active sub-networks covering specific subjects of common interest to member countries, such as data collection and exchange of information. In particular, the exchange of expertise is being promoted through the implementation of various project activities relating to registration requirements, quality control, pesticide residues, toxicology, pesticide trade and tariff regulations etc. Due to the benefits accrued by the member countries, the project has been extended under DP/RAS/85/G23 for another two years. One of the activities of the project is to conduct Pesticide Evaluation and Safety Testing training programme in India and Thailand in a laboratory where facilities in terms of staff and equipment exist to conduct such a program

ANNEX 2

GOVERNMENT, INDUSTRY AND UNIVERSITY REPRESENTATIVES CONTACTED

ESCAP Agricultural Requisites Scheme for Asia and the Pacific (ARSAP), ESCAP Agricultural Division, United Nations Building, 9th floor, Rajadamnern Nok Avenue, Bangkok 10200, telephone 282-9161.

Mr Luc M. Maene, FADINAP/ARSAP Team Leader

FAO, Food and Agriculture Organization, Via delle Terme di Caracalla, 00100 Rome, Italy, telephone 57973623.

Dr F. W. Kopisch-Obuch, Pesticide Residue Specialist

GIFAP, Avenue Hamoir 12, 1180 Bruxelles, Belgium, telephone (02) 374-59-82.

Mr G.A. Willis, Chairman, GIFAP Residue Committee

ICI Asiatic (Agriculture) Co.,Ltd., 53-55 Oriental Avenue, G.P.O. Box 1510, Bangkok 10500, telephone 236-0220.

Dr Apichai Daorai, Manager for Product Safety and Registration

International Health Development Foundation, P.O. Box 271, 7400 AG Deventer, The Netherlands, telephone (Amsterdam) 0205753025.

Dr B. H. Uythof, Executive Secretary

Kasetsart University, Bangkhen, Bangkok 10900, telephone 579-0588.

Dr Prasan Yingchol, Dean of Faculty of Agriculture
Dr Neungpanich Sinchaisri, Insect Toxicologist
Dr Vichai Korpraditskul, Head of Central Laboratory, Kamphaengsaen Campus
Mrs Patana Anurakpongsatorn, Residue Chemist
Dr Banpot Napompeth, Director, National Biological Control Research Center

Ministry of Agriculture and Cooperatives (MOAC), Department of Agriculture (DOA), Agricultural Toxic Substances Division, Bangkhen, Bangkok 10900, telephone 579-3577.

Mr Riksh Syamananda, Deputy Director General, DOA, telephone 579-0151-8

Mr Adul Worawisitthumron, Division Chief
Mrs Yubon Yingchol, Chief, Pesticide Residue Laboratory
Mrs Nuansri Tayaputch, Chemist
Mrs Supranee Impithuksa, Chemist
Mrs Chiraporn Sriplachit, Chief, Pesticide Formulation Laboratory

Ministry of Agriculture and Cooperatives (MOAC), International Security Operation Command (ISOC), 68 Paholyothin 45, Bangkok 10900, telephone 281-0857.

Dr Sakprayoon Deema, Inspector-General

Ministry of Agriculture and Cooperatives (MOAC), Department of Agricultural Extension (DOAE), Plant Protection Service Division, Bangkhen, Bangkok 10900, telephone 579-3008.

Miss Orapin Thirawat

Ministry of Public Health, Technical Division of the Food and Drug Administration, Bangkok 10200, telephone 282-4180-5, ext 24 or 37, 282-2569.

Mrs Yupa Leelaprute, Chief of Toxic Substances Section

Ministry of Public Health, Department of Medical Sciences, Division of food analysis, Yod-se, Bumrungmueng Road, Bangkok 10100, telephone 233-1444, ext. 265, 233-9873.

Mrs Chaweewon Halilamian, Division Chief
Miss Amara Vongbuddhapitak, Chief, Pesticide Residue Analysis Laboratory

National Environment Board, Environmental Quality Standards Division, Soi Pracha-Sampan 4, Rama 6 Road, Bangkok 10400, telephone 279-7180.

Dr Jarupong Boon-Long, Chief, Toxic and Hazardous Substances Section
Mr Sirithan Pairoj-Boriboon, Division Director
Mrs Monthip Tabucanon, Chief, Laboratory and Research Section

Oregon State University, Department of Agricultural Chemistry, Corvallis, Oregon 97331, U.S.A., telephone (503)754-3791.

Dr Virgil H. Freed, Professor of Agricultural Chemistry-Emeritus

RENPAP Regional Network for the Production, Marketing and Control of Pesticides in Asia and the Far East, c/o Fertilizer and Pesticide Authority, 7th floor, Benavides Street, Legaspi Vill., Metro Manila, Philippines, telephone Manila 818-5115.

Mrs Cecilia P Gaston, Regional Coordinator
Mr Riksh Syamananda, MOAC, Thailand, Representative,
telephone 579-0151-8

Shell Chemical Company, Chong Nonsei Installation, Klong Toey, Bangkok 10110, telephone 249-0531.

Mr Suchon Boonchanawiwat, Agrochemicals Development Manager
Mr Chugiad Saneetonikul, Pesticide Formulation Chemist
Miss Patchanee Chittawisuttikul, Pesticide Formulation Chemist

Siriraj Poison Center, Siriraj Hospital, Mahidol University, Bangkok 10700, telephone 411-2003.

Dr Sompool Kritalugsana, M D, Director of Center, President of the Toxicology Society of Thailand

Thailand Pesticides Association, Du Pont (Thailand) Ltd., 9th Floor, Yada Building, 56 Silom Road, Bangkok 10500, G.P.O. Box 2398, telephone 236-8585-93.

Mr Chalat Sripicharn, former president of TPA

UNIDO, United Nations Building, Rajadamnern Avenue, Bangkok 10200, telephone 282-9161 ext 1826

Mr Kei Kimpara, Assistant to Senior Industrial Development Field Adviser

UNDP, United Nations Building, Rajadamnern Avenue, Bangkok 10200, telephone 282-9161.

Mr Y.Y. Kim, Resident Representative

UNDP, 1 UN Plaza, New York, New York 10017,
telephone (212)906-5872.

Mr Egbert A. Semple

World Bank, 1818 "H" Street, NW, Washington, DC 20433, U.S.A., telephone (212)477-5894.

Dr Bernard Baratz
Dr Agie Kiss
Dr Donald King

VIDHAYAKOM CO.,LTD.
158 PHYATHAI ROAD BANGKOK 10400 THAILAND. TEL. 2150600-11
CABLE: "VIDHAYAKOM BANGKOK" TELEX "TH 82357 VIYAKOM"

In response please refer to: Our Ref. No.ME.271/2529 June 26, 1986

AGRICULTURAL TOXIC SUBSTANCES DIVISION
DEPARTMENT OF AGRICULTRUE
BANG KHEN
BANGKOK

Dear Sir,

We are pleased to submit you our quotation as for the following items:-

Item	Q'ty.	Descriptions	Price ฿	C.I.F. Japan (¥) Unit	C.I.F. Japan (¥) Amount
		A. MAIN UNIT			
1.	1 set	221-24179-93 Gas Chromatography Model GC-9APE Complete with (No.221-25055-91) ECD-9A Cell and Temperature Program, 220 V 50 Hz			1,746,000.-
2.	1 set	221-25562-93 Flame Photometric Detector, FPD-9A (does not include filte			910,000.-
3.	1 pc.	221-00892-01 Filter For Sulphur			31,000.-
4.	1 pc.	221-00897-01 Filter For Phosphorus			80,000.-
5.	1 set	080-82550 Recorder Model R-111 Complete with step-Down Transformer			269,000.-
		B. INSTALLATION AND OPERATION			
1.	1 pc.	670-12510-16 Microlitre Syringe, Fixed Needle 10 µl			7,000.-
2.	1 pc.	670-12510-33 Microlitre Syringe, Gas Tight Seal Type, 25 µl			9,000.-
3.	2 pcs.	670-12020-01 Pressure Regulator for N_2 & O_2		20,000	40,000.-
4.	1 pc.	042-41099 Pressure Regulator for H_2			20,000.-
5.	3 pcs.	201-48067 Carrier Gas Supply Pipe, 2.5 m		3,500	10,500.-
6.	1 set	201-36688 Air Filter and Air Supply Pipe			20,600.-
7.	2 pcs.	221-05619-01 Molecular Sieve, Gas Filter		34,500	69,000.-
8.	5 rolls	201-48315 Chart Paper for Recorder R-111		650	3,250.-
9.	1 cylinder	N_2 Gas with Cylinder	฿ 4,200.-		
10.	1 cylinder	O_2 Gas with Cylinder	฿ 4,200.-		
11.	1 cylinder	H_2 Gas with Cylinder	฿ 4,500.-		
		Note: Items 9,10, 11 is supplied in domestic			
		C. PACKING MATERIAL AND COLUMN			
1.	1 pc	Glass Column Silicone DC-200 for General use			70,000.-
2.	1 pc	Glass Column Silicone OV-105 for Presticides			70,000.-
3.	3 pcs.	221-14368-21 Empty Glass Column, 3 mm I.D. x 2.1 m Long		6,050	18,150.-
		Total F.O.B.Japan			¥ 3,373,500.-
		Estimated Airfreight & Insurance			300,000.-
		Total C.I.F.Bangkok			3,673,500.-

At 170 yen/dollar,
3,673,500 ¥ = ฿ 21,609

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We look forward to hearing from you soon and thank you for your kind cooperation.

Yours very truly,

Mr.Chitpan Wongchesada
Manager
Machinery & Electronic Dept.

JW/VP.

Program for the pesticide residue training course, Bandkok 1985

Time	Lectures on general topics			Lectures on special topics	
	Monday 21/1	Tuesday 22/1	Wednesday 23/1	Thursday 24/1	Friday 25/1
9.00-9.40	Wellcome; introduction to the course; practical information (K)	TLC (B)	Concept of MRL; role of JMPR and CCPR (K)	Organochlorine pesticides; interference by PCBs (G)	Fumigants; inorganic bromide (G)
9.40-10.00	interval	discussion	discussion	discussion	discussion
10.00-10.40	Set-up of the laboratory; Good Analytical Practice (G)	GLC (B)	Metabolites relevant to the MRL (B)	Pyrethrins/pyrethroids (B)	Phenyl-/phenoxy acetic acid herbicides (G)
10.40-11.00	discussion	discussion	discussion	discussion	discussion
11.00-11.40	Sampling; preparation of the Analytical Sample (B)	HPLC (B)	Reporting of data; analytical errors; when is an MRL exceeded? (G)	Organophosphorus penticides (B)	Urea herbicides (G)
11.40-12.00	discussion	discussion	discussion	discussion	discussion
12.00-13.00	interval	interval	interval	interval	interval
13.00-13.40	Extraction; purification of solvents (B)	Multiresidue methods; samples of unknown origin (B)	Collaborative tests; international standardisation (B)	Carbamates and dithiocarbamates (G)	Triazine and other herbicides (G)
13.40-14.00	discussion	discussion	discussion	discussion	discussion
14.00-14.40	Clean-up procedures; standardisation of adsorbents (G)	Screening-procedures; "simplified" methods (G)	Automation; data processing (G)	Polar fungicides (G)	Growth regulators (G)
14.40-15.00	discussion	discussion	discussion	discussion	discussion
15.00-15.40	Derivatisation procedures for GLC and HPLC (G)	Confirmatory tests (G)	Future trends (G)	Dinitro compounds (B)	Tin compounds (B)
15.40-16.00	discussion	discussion	discussion	discussion	discussion
16.00-16.30	general discussion	general discussion	general discussion	general discussion	general discussion

Excercise	Equipment	Room	Tutor	Mo 28/1	Tu 29/1	We 30/1	Th 31/1	Fr 1/2	Mo 4/2
I paraquat	ion exchangers; spectrophotometer	? 304	K	a	b	c			
II carbaryl (if time permits, also: carbendazim)	HPLC	203	G		a	b	c		
III diazinon/ malathion/ monocrotophos	GLC/FPD Tracor 560 and 222	305 and 205	B			a	b	c	
IV butachlor	GLC/AFID; Shimadzu 7-AG	304	O	preparatory days			a	b	c
V endosulfan/ vinchlozolin	GLC/ECD; Tracor 222 and 220	205	G	c				a	b
VI mancozeb (CS_2-method)	GLC/ECD; Tracor 220	305	B	b	c				a

a, b and c denote the groups of participants (4-5 persons per group)

FPD/AFID
- Shimadzu 7 AG (room 304): 5% SE-30 (AFID)

- Tracor 560 (room 305): 3% OV-1 (FPD)
- Tracor 222 (room 205): 3% OV-210 (FPD) (1 ft)

ECD
- Tracor 222 (room 205): 1.5% SP-2250 + 1.95% SP-2401
- Tracor 220 (room 205): 1.5% SP-2250 + 1.95% SP-2401
- Tracor 220 (room 305): → Tenax (not present yet)

Each exercise will be introduced to the participants by the tutors (9.00 hrs.) prior to the practical performance.