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ASSISTANCE TO PESTICIDE FORMULATION TECHNOLOGY DEVELOPMENT

DG/CPR/91/121

PEOPLE'S REPUBLIC OF CHINA

Technical report: Findings and recommendations*

Prepared for the Government of the People's Republic of China
by the United Nations Industrial Development Organization

Based on the work of D. A. Knowles
Chief Technical Adviser

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United Nations Industrial Development Organization
Vienna

* This document has not been edited.

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SUMMARY

This is the report of the 4th visit of the Chief Technical Adviser (CTA) to China (15 Oct - 10 Nov 1994).

The purpose of the visit was to review progress against the Work Plan for 1994 since the last visit in Apr/May 1994 and prepare the PPER document for the TPR meeting at Nantong. Also to install and commission new equipment in the new Pesticide Development Centre and to assess the requirements for further items of equipment for the laboratory and Pilot Plant. To prepare a Work Plan for 1995 and make arrangements for the WG sub-contract work.

Discussions on the Project Programme and Budget took place at UNDP and CICETE in Beijing, and the technical progress work was carried out at NSCC, Nantong, in the new Pesticide Development Centre. Visits were made to the Chemical Development Zone in Nantong, which is the site for the Pilot Plant, and to an incinerator plant at Nantong No. 1 Pesticide Factory. The Pollution Control Expert, Mr.K.S.Johnson, was also present during these visits.

The CTA and the Pollution Control Expert attended the Project TPR meeting and RENPAP's FMC meeting which were both held at the new Pesticide Development Centre in Nantong. Dr.S.P.Dhua and Dr.B.Sugavanam also attended the meetings.

The new Pesticide Development Centre is now completed and the new laboratory and office equipment has been installed and nearly all the equipment is fully operational.

The project is continuing to progress more or less according to plan and the first phase of development of new liquid formulations is well under way. For the second phase of development, it was agreed at the TPR meeting to go ahead with the proposal for WG sub-contract work at a UK company. A Work Plan for 1995, covering recruitment of consultants, training and study tours, and purchase of equipment was also agreed at the TPR meeting.

Design and erection of the new Pilot Plant is scheduled for the first half of 1995.

RECOMMENDATIONS AND ACTIONS

1. The Work Plan for 1995 should be followed as closely as possible to maintain the project on schedule.

ACTION: CICETE/UNIDO/NPD/CTA

2. The WG Sub-contract should be agreed as soon as possible and development work should start by end of 1994/ early 1995.

ACTION: UNIDO/NPD/CTA

3. Study Tour for WG Sub-contract work should take place in March 1995, followed by Fellowship Training for 2 chemists from China in May/June 1995.

ACTION: UNIDO/NPD/CTA

4. Design and erection of new Pilot Plant building should start as soon as possible to enable installation of liquids formulation and filling equipment to take place from mid-1995.

ACTION: NPD/NSCC

5. A second visit of the Pollution Control Expert should be made in Spring 1996.

ACTION: UNIDO/NPD

6. Details of further items of laboratory and Pilot Plant equipment should be sent to NSCC.

ACTION: CTA

7. A suitable expert on laboratory and process safety is required to visit the project site.

ACTION: UNIDO

1. NEW PESTICIDE DEVELOPMENT CENTRE, NANTONG.

The new Pesticide Development Centre is now complete and all the office and laboratory equipment were transferred during September 1994. The building has been finished internally and externally to a very high standard. The main building comprises meeting rooms, administration offices and laboratories on 3 floors, and an inter-connecting circular building which has an information centre, library and international conference room fitted with the latest sound and visual aids equipment from Sony, Japan.

There are 10 laboratories on the top floor of the main building, 5 fitted with fume cupboards. At present, the fan extractors are too noisy and require adjustment, followed by air flow tests which should give a minimum air flow rate of 0.5 m/s at an opening height of 250mm. The laboratories for formulation development are well laid out, and there are separate laboratories for chemical analysis, physical testing equipment and electronic balances. There are 2 clean writing-up offices and a room for changing into laboratory coats. The floor also has a service lift for materials only.

On the middle floor, there is a room for computers and printers, and on the bottom floor there is a room for photocopiers and duplicators.

14 air conditioner units have been purchased but not yet installed. When this is completed the new Pesticide Development Centre will be well up to International Standards with the most recent office and laboratory equipment.

The new Pesticide Development Centre was opened officially on 27 October 1994 by the Minister of Chemical Industry, Beijing and other dignitaries from China, UNDP and UNIDO. The CTA assisted with laboratory tours and demonstrations of equipment.

2. TPR MEETING CPR/91/120

The TPR pre-meeting and the formal TPR meeting were held in the new Pesticide Development Centre, Nantong, on 26 October 1994. Representatives of CICETE and UNDP were present along with Dr Dhua, Dr Sugavanam and the NPD's and CTA's of the 3 projects.

The notes of the TPR meeting will be available in due course, and the main points on the CPR/91/121 project are as follows:-

(i) The recruitment of International Consultants has gone according to plan, except that 2.5 m/m have been deferred to 1995. On Training about US\$ 100,000 has been spent according to the 1994 Work Plan. Most of the laboratory equipment and some of the Pilot Plant equipment has been received by NSCC, total cost about US \$300,000 in 1994. The laboratory equipment is now installed in the new Pesticide Development Centre.

(ii) A change of site for the Pilot Plant has been made, and it will be necessary to start building work as soon as possible to have the Pilot Plant available by mid-1995 for installation of equipment. The flow sheet for liquid formulations has been agreed.

(iii) The Outputs for the first phase of water-based liquid formulations are going well. A suspoemulsion (SE) formulation is now undergoing field trials. A suspension concentrate (SC) formulation is being developed and an emulsion (EW) formulation is under research.

(iv) For the second phase of the project it was agreed to follow up the WG sub-contract with an organisation in UK. The sub-contract should start at end 1994/early 1995 so that suitable WG pilot plant equipment can be specified by mid-1995.

(v) The third phase of the project to develop slow release formulations will require further inputs to define a satisfactory research programme with suitable active ingredients.

(vi) An International Expert on Pollution Control is now visiting the project site at Nantong to discuss effluent treatment and waste management and make recommendations.

(vii) A Work Plan for 1995 has been prepared and includes a programme to invite 8 International Experts, undertake 4 Fellowships and 1 Study Tour, and to purchase granulation equipment and filling/packing equipment for the Pilot Plant.

(viii) The budget needs to be revised to reflect actual expenditure and to extend the budget by one more year.

It was agreed that the next TPR meeting should be held in Tianjin in early October 1995 (site of the fertilizer catalyst project CPR/91/122).

3. UNDP INPUTS

3.1 International Experts

The following consultants have visited NSCC during 1994:-

BL11-01	D A Knowles	CTA	Apr/May & Oct/Nov
BL11-02	M Gimeno	Formulation Research	May
BL11-06	K S Johnson	Pollution Control	Oct/Nov
BL11-07	J Hartmann	Packaging	April
BL11-09	C R Edwards	IPM	August

Mr K S Johnson, Pollution Control Expert, also visited Tianjin, CPR/91/122 project, for 3 days. The proposed visits of Mr Zsifkovits, BL11-03 and Dr Maramba, BL11-08, were deferred until 1995.

CV's were received from Analytical Consultants and the preferred candidate is Mr J Edmonds, who will be invited in April 1995 (see Annex II).

A suitable candidate for laboratory and process safety aspects (BL11-05) is still being sought.

It is proposed to have 8 visits of International Experts to Nantong in 1995, including 2 visits by the CTA (see Annex II).

3.2 Training and Study Tours

This went according to the Work Plan for 1994, except that the proposed training at IPFT, India, and the proposed Study Tour on the WG sub-contract were deferred to 1995.

Three training programmes in USA, Germany and UK, have been proposed in 1995 for 6 members. It is also intended to send 2 members to IPFT, India, one funded by the i21 project and one funded by the 061 Regional project.

3 members will make a Study tour of UK to discuss the WG sub-contract, and this may be linked with related visits to Germany and Vienna (see Annex II).

3.3 Equipment

Most of the laboratory equipment, office and transportation equipment and some of the Pilot Plant equipment has been delivered to NSCC, Nantong (see Section 4 and Annex III). This brings the total amount spent up to November 1994 to about US\$ 477,000 (Total Budget BL42 is US\$ 872,800).

During 1995, a further US\$ 147,000 will be spent on Pilot Plant equipment (see Annex II).

So far Government Cost Sharing purchases include:-

- Air conditioning units
- Dodge Maxiwagon
- Copying machine
- Sony Conference Facilities

Further Government Cost Sharing purchases will include the following items for the Pilot Plant:-

- Paste Kneader
- Fluid Bed Dryer
- Jet Mill

3.4 WG Sub-Contract

Of the proposals received for WG Sub-contract work, the preferred candidate is Collag Corporation, UK because they have extensive experience of WG formulation developments and also a comprehensive range of suitable WG technology equipment. It is proposed that a contract should be negotiated with Collag Corporation to include training in WG technology for 2 chemists from China.

Once the contract has been agreed, the CTA will liaise between Collag Corporation, UNIDO and NSCC to provide information and supplies of materials for the initial development work. This will be followed by a Study Tour to UK of 3 members from China, accompanied by the CTA, probably in March 1995. The Study Tour will also include visits to Formulation and Seed Treatment facilities, and to the UK company supplying filling equipment to NSCC.

It is proposed that training in WG technology at Collag Corporation for 2 members from China should take place in May/June 1995.

4. EQUIPMENT

4.1 Laboratory Equipment

All the items of laboratory equipment, except the Haake Rotovisko RV20, have been installed in the new Pesticide Development Centre, Nantong. The CTA assisted with the commissioning of some of the items. Details of a refrigerator circulation unit for the Dyno KDL bead mill will be sent to NSCC by the CTA.

The Sartorius research analytical balance was faulty and service or replacement is now being discussed with the suppliers in Beijing.

The Fritsch high speed motor mill was supplied without the accessories for continuous powder grinding operation. These items are now being ordered from the supplier in Hong Kong (cost about US\$ 2,200).

All the other items of equipment are functioning well and when the Haake Rotovisko RV20 has been received (late November 1994), the new laboratory will be fully equipped with the latest technology for pesticide formulation and analysis.

All the items are listed in Annex III with a note of supplying country and approximate cost.

4.2 Pilot Plant Equipment

The Dyno KD 25 Bead Mill, Silverson Mixers, High Pressure Homogeniser and Electronic Balances have been received and are in storage at NSCC awaiting installation in the new Pilot Plant.

Equipment for liquids filling and capping is now under negotiation with a supplier in UK (US\$ 105,000). A proposal to purchase a Basket Extrusion Granulator BR-200 from Fuji-Paudal will be delayed until the results of the WG Sub-contract work are known (US\$ 42,000).

Equipment for the 1st phase of liquids formulation and filling is now well in hand. For the 2nd phase of WG granule development, filling/packing equipping for granules will be required.

A quotation for a Guseo Micronette M500 Jet Mill (US\$ 37,000) is being compared with locally available Jet Mills.

4.3 Office Equipment and Transportation

The IBM computer, Hewlett-Packard Laser Printer and Canon Fax Machine are now in regular use in the new Pesticide Development Centre. A voltage transformer is still required for the Ricoh Photocopier.

2 other copier and duplicating machines have been purchased. Also 14 air conditioner units. The Dodge Maxiwagon which was damaged in transit from USA, has now been repaired and is in regular use.

A Sony Conference Facility with microphones and visual aid equipment has been set up in the new International Conference Room in the Pesticide Development Centre. However, it requires tuning to optimise sound and visual reproduction.

All the items of equipment with status and costs are listed in Annex III.

5. PILOT PLANT BUILDING

It has been decided to change the site of the new pilot plant from the existing building at Nantong No.3 Pesticide Factory because of a lack of suitable effluent treatment facilities. It is now proposed to build a pilot plant facility at a new Chemical Development Zone nearby which has a biological treatment plant (activated sludge process) and a proposal to build an incinerator to handle waste materials.

The pilot plant will cover 2000 square meters on 2 floors and will have its own effluent treatment unit for pre-treatment of chemical effluents to remove toxic organic materials before release to the sewage treatment plant. The Chemical Development Zone and sewage treatment plant were visited by the CTA and the Pollution Control expert, Mr.K.S.Johnson. It is recommended that a 1 cubic meter Allman "Sentinel" effluent treatment unit would be ideal for the pre-treatment of toxic chemical effluent in the pilot plant (cost US\$ 22,000 approx). For more details of effluent treatment and waste disposal see Mr.K.S.Johnson's visit report.

It is essential that design and building work for the pilot plant should begin as soon as possible so that the equipment can be installed from mid-1995. The proposed timetable is :-

Design agreed and approved by Spring 1995.

Building erection completed by Summer 1995.

Installation of equipment completed by end 1995.

Trials and operations by Spring 1996.

The date of Spring 1996 is important in order to meet the needs of the Outputs for liquid and WG formulations, and also to coincide with the proposed International Symposium to be held at Nantong during April/May 1996. This would also be a suitable time to invite the Pollution Control expert to make a follow-up visit to carry out a waste management audit on the pilot plant and to take part in the International Symposium.

NSCC have allocated US\$ 1 million for the pilot plant, effluent treatment system and locally made equipment, such as a Jet Mill for powders, and a Kneader and Fluid Bed Drier for WG formulations. It will also be necessary to provide a refrigerant cooling circulation system for the Dyno KD25 bead mill.

A quotation has been agreed for liquids filling and capping equipment for the pilot plant from GEI Filling Capping & Labelling Ltd., UK following recommendations from Mr.J.Hartmann, Packaging Adviser. The filling machine will be a 2-head volumetric filling machine VP-2-D BHM machine for automatic filling of 100ml, 250ml and 500ml polythene bottles. The cost is US\$ 48,000 approx.

The capping machine will be a Zalkin TM 125 semi-automatic screw capping machine suitable for 3 sizes of Roll-on Pilfer Proof caps. There will also be a 4 meter length slat conveyor with variable speed drive for conveying the bottles. The cost is US\$ 54,000 approx, making a total cost for filling and capping US\$ 102,000 approx.

Labelling of capped bottles will be done by hand.

6. FORMULATION DEVELOPMENTS/OUTPUTS

6.1 Suspension Concentrates (SC)

A useful paper has been written on the use of the Malvern Laser Particle Size Analyser to compare the particle size of suspension concentrates with other formulation types and technical materials. This paper should be translated into English and could be published and/or presented at the International Symposium at Nantong.

The Dyno KDL bead mill has been commissioned by making a 40% carbendazim SC formulation. Satisfactory particle size was obtained after a single pass through the mill at a flow rate of 5 litres/hour (residence time < 5 minutes). The laboratory Silverson high shear mixer L4R has been set up, so now all the equipment is in place for making SC formulations to international standards. When the Haake Rotovisko viscometer has been delivered, it will be possible to carry out all the essential tests for SC development.

A mixed SC formulation of 20% carbendazim and 20% iprodione has good storage stability after 3 years at room temperature. Field trials on tobacco in Yunnan Province were abandoned due to an earthquake earlier in the year.

A 30% SC formulation of clofentazine has good storage stability after 2 years at room temperature. This is a possible alternative to the suspoemulsion formulation for field trials next year.

Comparisons will be made between NSCC and ICI Surfactants dispersing agents.

6.2 Suspoemulsions (SE)

A mixed suspoemulsion formulation of 10% clofentazine and 10% fenpropathrin has good storage stability after 1.5 years at room temperature. However, field trial results have shown some problems of poor activity compared with tank mixed formulations of the two active ingredients. Particle size analysis showed some increase in the amount of oversize particles which could be an indication of heteroflocculation. Spraying conditions will also be checked. Further field trials will be carried out in 1995, and this formulation or the SC formulation mentioned above could be the first new formulation type to be available.

6.3 Oil/water Emulsions (EW)

Development work on EW formulations of organophosphorus active ingredients has been abandoned because of poor chemical and physical stability.

Work will now concentrate on pyrethroid EW formulations. Permethrin 10% EW, cypermethrin 10-20% EW and fenvalerate 20% EW formulations have been made and have good chemical stability. Higher concentrations will be tested to improve physical stability, along with the use of the laboratory high pressure homogeniser, which can reduce droplet size to < 0.5 micron. PVA (Goshenol GL-05) will be tested as an emulsifier and stabiliser.

Some collaborative work with Hoechst and Akzo Nobel (formerly Berol) is taking place with emulsifier surfactants for EW's.

6.4 Water Dispersible Granules (WG)

Water dispersible granule formulations are seen as the second phase of new safer formulation developments following the development of water based liquid formulations.

The Fuji-Paudal laboratory kneader and extrusion granulator have been set up and tested by making kaolin and talc granules.

A 40% glyphosate WG formulation was made but it was possible to incorporate only 3% of wetter (Surfactant No.2) in this formulation. Ideas were discussed for further experimental work using different fillers and wetters. Further input to the development of optimised WG formulations, especially for glyphosate, will be gained from the WG sub-contract work and training in the UK to take place in early 1995 using starting materials supplied by NSCC, China.

7. MISCELLANEOUS ITEMS

The CTA and Pollution Control expert attended the RENPAP PMC meeting which was held at the new Pesticide Development Centre, Nantong.

Various reports and papers on trends in formulations and the use of surfactants were discussed by the CTA with the formulation groups. It is recommended that NSCC should purchase the new 10th edition of The Pesticide Manual from BCPC, UK (cost US\$ 190).

The level of spoken English continues to improve noticeably at NSCC. Three younger members of staff have now completed their English training course successfully at Nanjing. They are:-

Mr.Zhang Qiming, Mr.Zhong Sulin and Mr.Han Yinbao.

Two other younger members are now undergoing training:-

Mr.Song Jianrong and Mr.Qian Wei.

The planned visit of Mr.L.Rogiers of ICI Surfactants to Nantong to give a one day seminar on "Surfactants for Agrochemical Formulations" was postponed until the next visit of the CTA in April/May 1995.

8. ACKNOWLEDGEMENTS

The CTA would like to thank once again Mr.Hong Chuanyi (NPD) for his help with the project, especially with negotiating equipment purchases, and also for his excellent arrangements and hospitality during the visit to China. Also the staff at NSCC for their continuing enthusiasm and commitment to the project.

The CTA would also like to congratulate Mr.Leng Yang, and all those involved, on completing the new Pesticide Development Centre at Nantong on time and to a very high standard.

ANNEX I



UNITED NATIONS DEVELOPMENT PROGRAMME

PROJECT PERFORMANCE EVALUATION REPORT SUMMARY SHEET

Project Number and Title DG/CPR/91/121 Assistance to Pesticide Formulation Technology Development	Executing Agency	Date last report Oct. 1993	Date this report Aug. 1994	Planned date Tripartite Review 26 Oct. 1994
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	Original Budget (US\$)	Latest Signed Revision (US\$)
Total Budget (budget line 99)	2,074,800	
Government cost sharing (line 101)	300,000	
Other contributions (lines 103-8)		
UNDP contribution (line 999)	1,774,800	as original
Govt. cash contribution (from prodoc cover page)		
Govt. contribution in kind (in local currency)	RMB Y 19,900,000	

Project starting date		Project completion date	
Originally planned	Actual	Originally planned	Current estimate
5/92	2/93	1996	1997

SUMMARY OF CONCLUSIONS:

1. Recruitment of consultants according to plan and budget since 1st PPER.
2. Training and study tours planned according to budget for 1994.
3. Most of the laboratory and pilot plant equipment for liquid formulations already on site at NSCC.
4. Flow sheet for liquids pilot plant at NSCC agreed. Engineering design is undertaking.
5. Sub-contract for WG formulations at quotation stage.
6. Successful development of liquid formulations taking place at NSCC.
7. Slow release formulations under research.
8. Moved to the new research centre in Sept. 1994

SUMMARY OF RECOMMENDATIONS:

(Whenever possible, indicate who should take the action and by when)

1. Work plan and timetable for recruitment of consultants, training and study tours and equipment purchase in 1994 to be executed by UNIDO, CICETE, NPD, & CTA.
2. Sub-contract quotations for WG development and training should be available by winter 1994 for decision by UNIDO, CICETE, NPD & CTA.
3. Pilot plant building to be refurbished by NSCC for operations in 1995.
4. Further research input needed on slow release formulations, UNIDO, NPD & CTA.
5. Liquid filling / packaging equipment is under ordering by NSCC and CICETE.
6. Project budget to be rescheduled to 1993-1997 (5 years) at TPR meeting, Oct. 1994.

Prepared by:	Distributed to:	Date:
Government Project Coordinator Name and signature: <u>Hong Chuangyi</u> NPD Agency Project Coordinator Name and signature: <u>D.A. KNOWLES</u> , CTA Name and signature: <u>D.A. Knowles</u> 17-8-94	_____ _____ _____ _____ _____	_____ _____ _____ _____ _____

ANNEX II

Assistance to Pesticide Formulation Technology Development—CPR/91/121
Work Plan of 1995 (Draft)

1. Recruitment of Consultants.

Title of the Post	Identification of Experts and the Institution	Duration	Desired	Status
BL11-01 Chief Technical adviser	Mr. D.A. Knowles Form-AK, UK.	3 m/m	Apr/May 1995 Oct/Nov 1995	2 m in field +1 m home
BL11-02 Formulation Research	Dr. K.C.Lin Zeneca AG Products Western Research Center USA	0.5m/m	May, 1995	
BL11-03 Formulation Technology	Dr. Damo Hoechst Co. Germany	0.5m/m	Apr. 1995	
BL11-03 Formulation Technology	Mr. Zsifkovits Kwizda, Austria.	0.5m/m	Oct/Nov 1995	
BL11-04 Analysis	Mr. A. Huggett, UK. 2 nd choice Mr. Edmonds, UK. 1 st choice	1m/m	Apr. 1995	
BL11-05 Safety				
BL11-07 Packaging	Mr. J.Hartman, Germany	1m/m	Oct/Nov 1995	
BL11-08 Hygiene	Dr. Maramba Philippines	1m/m	March 1995	
BL17 National Professionals	Mr. Zhang, China Miss Song, China	1m/m		

2. Training and Study tours

Title of Training/Study tour	Identified Institute	Identification of Train	Duration	Desired timing
BL31-00 2 members to training of analysis in USA	State laboratories Maryland, USA	Identified	5 weeks	May/June 1995
BL31-00 2 members to training of EW in Hoechst	Hoechst Co. Germany	Identified	2 weeks	Mar/Apr. 1995
BL31-00 Training for 2 members in WG technology	Collag Corporation. UK.	Identified	3 weeks	May/June Apr/May 1995
BL31-00 1 member to training in formulation technology	IPFT, India	Identified	2 weeks	Feb. 1995
BL32-00 3 members to visit for sub-contract of WG formulation	Collag Corporation and Zeneca, UK, and Bayer Germany	Identified	2 weeks	March 1995

3. Equipment and Instrument Purchasing

Items of Equipment	Total Cost	Remarks
BL-42 1. Packaging System	US\$106,000	details to be decided
2. Basket Granulator Model BR-200	US\$42,000	details to be decided

ANNEX III

LIST OF EQUIPMENT ITEMS

<u>EQUIPMENT ITEM</u>	<u>STATUS SUPPLIER</u>	<u>DATE</u>	<u>APPROX COST US\$</u>
<u>LABORATORY EQUIPMENT</u>			
Malvern Mastersizer E	UK	7/93	53,000
Waters Millipore HPLC	USA	7/93	47,660
Lab. Ultra-Turrax IKA	Germany	11/93	4,820
Lab. Powder Grinder IKA	Germany	11/93	2,520
Sartorius Analytical Balance	Germany	4/94	5,600
Sartorius Formulation Balance	Germany	4/94	2,690
Sartorius Moisture Analyser	Germany	4/94	3,820
Sartorius Density Determinator	Germany	4/94	380
Dyno KDL Bead Mill	Switzerland	8/94	20,000
Fritsch Rotor Mill	Germany	8/94	9,000
APV Lab. Homogeniser 8.30H	Denmark	8/94	12,500
Fuji-Paudal Kneader PN-1	Japan	8/94	7,700
Fuji-Paudal Granulator KAR-75	Japan	8/94	6,500
Silverson Mixer L4R	UK	10/94	1,600
Haake Rotovisko RV20	Germany	11/94	40,000
		SUB-TOTAL	217,790
<u>PILOT PLANT EQUIPMENT</u>			
Sartorius Elect. Balances (2)	Germany	4/94	6,460
Dyno KD25 Bead Mill	Switzerland	8/94	86,000
APV Homogeniser 10.50H	Denmark	8/94	25,740
Silverson Mixer AXR	UK	10/94	4,600
Silverson Mixer GX10 (2)	UK	10/94	17,800
		SUB-TOTAL	140,600

<u>EQUIPMENT ITEM</u>	<u>STATUS</u>	<u>APPROX COST</u>	
	<u>SUPPLIER</u>	<u>DATE</u>	<u>US\$</u>
<u>OFFICE AND TRANSPORTATION</u>			
IBM PS/2 486 Computer	USA	9/93	4,050
HP Laser Jet Printer	USA	9/93	2,700
Canon Fax Machine	Japan	9/93	2,050
Ricoh Photocopier	Japan	9/93	4,500
Mitsubishi Air Conditioners (14)	Japan	10/93	29,000
Dodge Ram 350 Maxiwagon	USA	11/93	27,000
Gestetner Printer	UK	7/94	3,000
Gestetner Duplicator	UK	7/94	1,500
Super Computer & Printer	Taiwan	7/94	1,350
Technical Documents	Netherlands	9/94	1,000
Sony Conference Facilities	Japan	10/94	42,000
		<u>SUB-TOTAL</u>	<u>118,150</u>

TOTAL FOR ALL ITEMS PURCHASED AT NOVEMBER 1994 US\$ 476,540

FURTHER EQUIPMENT REQUIREMENTS

GEI Liquids Filling and Capping Machines, UK	105,000
Guseo Micronette M500 Jet Mill, Italy	37,000
Allman Sentinel Effluent Treatment Plant, UK	22,000
Fuji-Paudal Basket Granulator BR-200, Japan	42,000
Granules Filling and Packing Machines, ?	(approx) 80,000
	<u>SUB-TOTAL (approx)</u> <u>286,000</u>

CPR/91/121 Equipment Budget BL-42

US\$ 872,800

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UNIDO Comments

The report covers the progress made during the 2nd half of 1994 and the results of the evaluation meeting. The project has already shown a very good performance in establishing building and analytical facilities. The work plan for 1995 will be critical in that many activities will directly contribute to the overall objective of the project. The change of site for the pilot plant in a new chemical development zone would provide a better planning and more space for safe operation and for effluent treatment.

The type of formulations to be developed all fit in with user/environment friendly formulations which would assist China to introduce safer formulations in the market.