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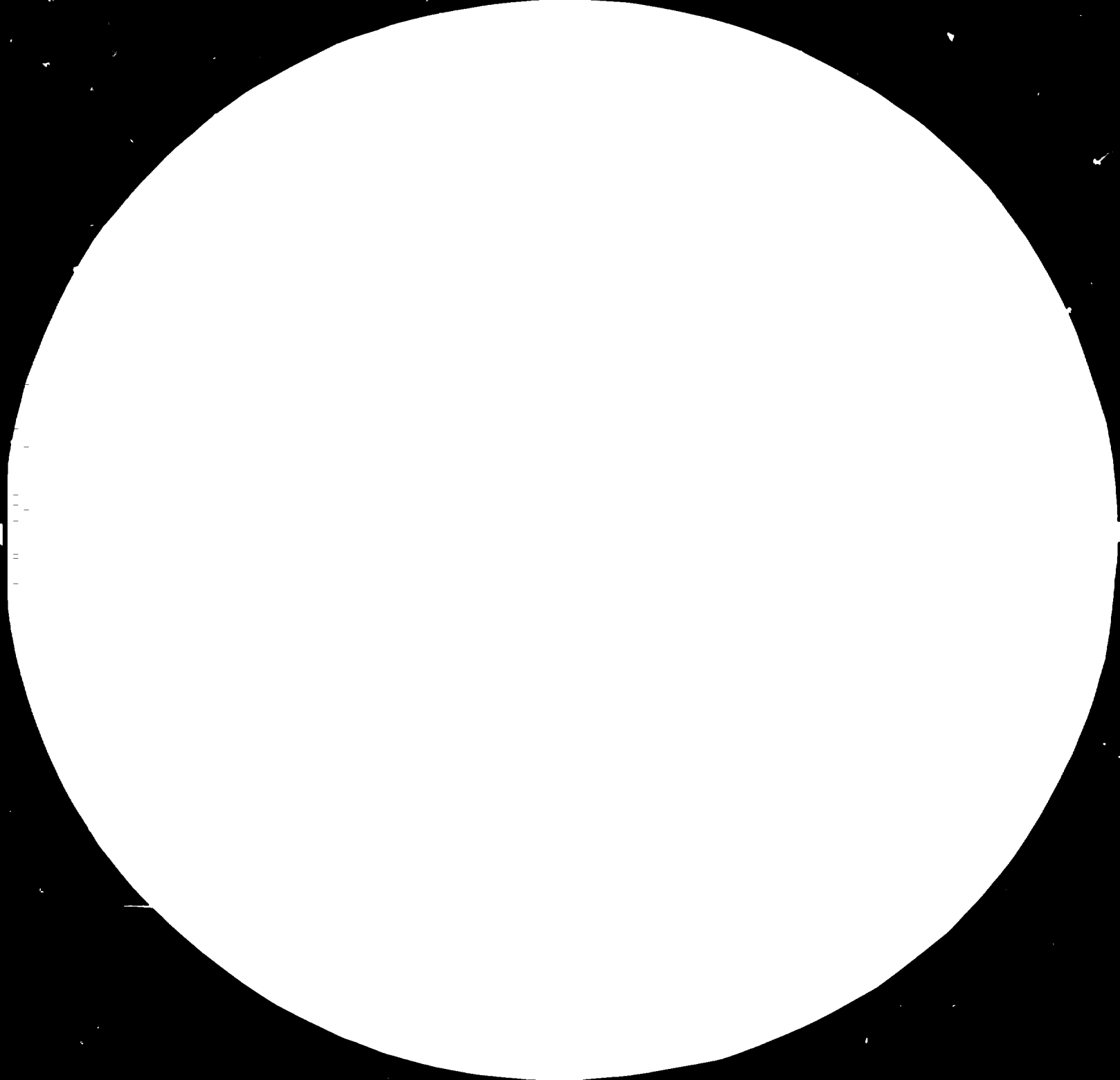

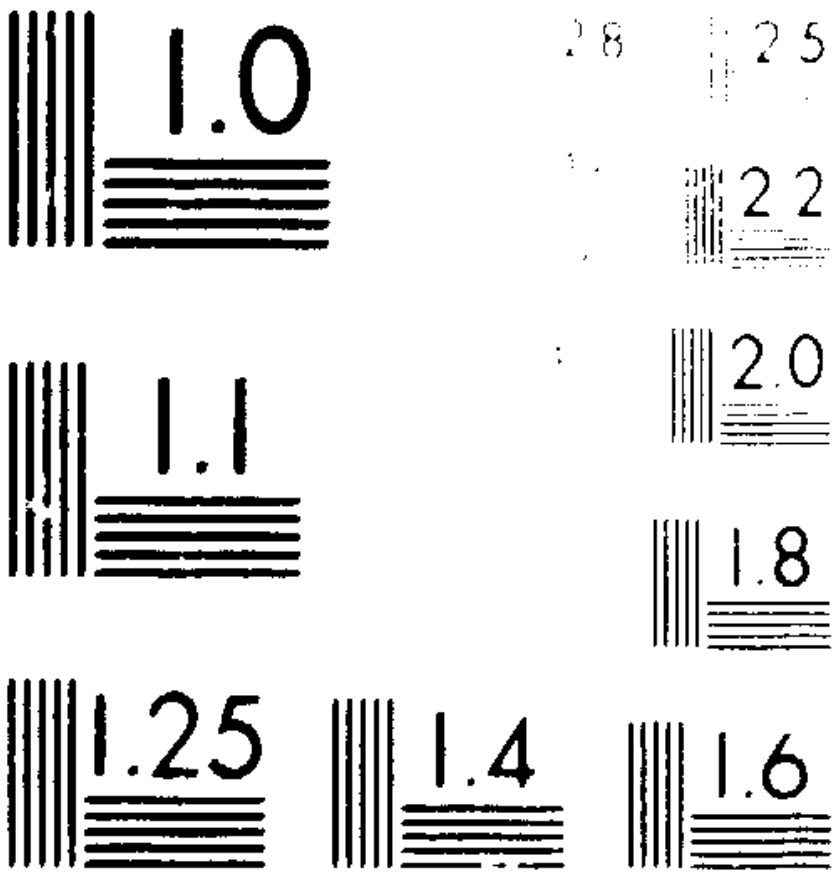
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LIMITED

UNIDO/IO.382
25 September 1980

UNITED NATIONS INDUSTRIAL
DEVELOPMENT ORGANIZATION

ENGLISH

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# PROPOSED ESTABLISHMENT OF MODERN PESTICIDE RESEARCH AND DEVELOPMENT FACILITIES IN SHENYANG, LIAONING PROVINCE

UF/CPR/79/228

Technical report of a UNIDO mission to China *

from 25 June - 10 July 1980

Prepared for the Government of People's Republic of China

by a joint UNIDO/UNITED KINGDOM Mission

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Abstract

This Technical Report comprises the findings of a four-man UNIDO mission sent to the Peoples Republic of China in June-July 1980 to assess aid required by the Chinese Ministry of Chemical Industry in setting up new pesticide R&D facilities in Shenyang, Liaoning Province.

Background information was obtained on present and proposed future pesticide production and usage. Two potential projects (one funded directly by UNDP and one by UK ODA through UNIDO) were defined to provide aid in purchasing specialised laboratory and toxicological equipment unavailable within China and to provide for Study Tours and Fellowships to Europe and Japan.

CONTENTS

SUMMARY

A four-man mission to China was arranged by UNIDO comprising Dr K Szabo (Leader) of UNIDO, Dr A B Hadaway ex-COPR London, Dr G B Pickering of T.P.I. London and Dr A J Davidson representing ICI International Crop Protection Consultants. The mission was hosted by the Chinese Ministry of Chemical Industry (M.C.I.) and the immediate objective was to define ways in which UNIDO can help MCI set up a new national pesticide R & D Centre in Shenyang in N.E. China. The Chinese Project Director is Mr Wang Da-Hsiang, presently Deputy Director of the Shenyang Research Institute for Chemical Industry and Chairman of the Chinese Pesticide Society.

Background information on present day pesticide production and usage in China was obtained through discussions with MCI and the Ministry of Agriculture. Production and usage is dominated by BHC which at 220,000 te/yr technical represents over 40% of total domestic pesticide production. Other major products are trichlorfon and malathion at ca 50,000 te/yr each and methyl and ethyl-parathions at ca 25,000 te/yr. Herbicides are produced at a much lower level and fungicide volumes are trivial. Imports of foreign pesticides are also relatively small, the biggest being MIPC from Japan at 3,000 te/yr.

In the future the Chinese Authorities wish to reduce their dependence on BHC and to become self-sufficient in low cost, highly efficient, non-polluting pesticides. The existing very limited pesticide R & D facilities at Shenyang will be transferred to a new modernised site which should be fully operational in new pesticide synthesis, bioassay, formulation and toxicity testing by 1985. Most urgently, MCI wish to establish the toxicology facilities by Autumn 1982 to allow for studies in compliance with the new Pesticide Registration Law expected in 1981. Capacity should be available using on-site SPF animals for about 100 acute toxicity studies, six 90-day studies and one/two 2-year studies per year. A Government grant has been agreed for ¥2.86m to cover capital and operating expenses through 1983 but MCI request UNIDO assistance in purchasing specialised equipment which is not available in China and in arranging Study Tours and Fellowships to Europe and Japan.

Two separate projects were defined, one to be funded directly by the UN Development Programme to a value of $150,000 and one possibly to be funded through UNIDO by UK Overseas Development Administration probably to a value of £300,000.

RECOMMENDATIONS

It is the recommendation of the mission that both projects, as defined in Section 5 of this report, be progressed.

## 1 INTRODUCTION

The visit was made under the terms of the Assistance Agreement between the United Nations Industrial Development Organisation (UNIDO) and the Government of the Peoples Republic of China, in order to provide China with "technical assistance in planning the research and development of pesticides and constructing various facilities for pesticide production". A four man mission was organised by UNIDO comprising the following:

| | |
|---|---|
| Dr Karoly Szabo (Leader) | UNIDO, Vienna<br>(In China June 25 - July 6) |
| Dr Alan J Davidson | ICI International Crop Protection Consultants Ltd, Fernhurst, England<br>(In China June 27 - July 10) |
| Dr Alan B Hadaway | Ex-Centre for Overseas Pest Control, Porton Down, England<br>(In China July 2 - July 10) |
| Dr Geoffrey B Pickering | Tropical Products Institute, London, England<br>(In China June 30 - July 10) |

Drs Davidson and Hadaway were contracted under the terms of UNIDO Special Service Agreements while Dr Pickering was funded directly by UK Overseas Development Administration (ODA).

The immediate objective of the mission was to define details of two separately proposed aid projects, one to be provided by the United Nations Development Programme (UNDP), to a value of $150,000 the other possibly to be provided through UNIDO by ODA to a value of ca £300,000. The host ministry in China was the Ministry of Chemical Industry (MCI) and visits were arranged both in Beijing (MCI, Ministry of Agriculture) and also in Shenyang in Liaoning Province, N.E. China (Shenyang Research Institute of Chemical Industry; Shenyang Chemical Factory) as well as to the UNDP and the British and USA Embassies in Beijing. A list of officials contacted is provided in Appendix 2.

## 2 THE PESTICIDE INDUSTRY IN CHINA

The following background information was obtained by discussion primarily with Messrs Wang and Hong of the MCI and separately with Professor Chang of CAAS. Individual product volumes for domestic production and import are indicative only.

### 2.1 Pesticide Manufacture in China in 1979

| | Te of Technical Product |
|---|---|
| Total Volume of Technical Product (published statistics) | 537,000 |
| **Insecticides** | |
| BHC (containing 14% gamma-isomer) | 200,000 |
| Gamma-BHC (separated from approx. 20,000 te BHC) | 2,000 |
| DDT | 10-20,000 |
| Toxaphene | small |
| OP's | 100-150,000 |
| Trichlorfon | 50,000 |
| Malathion | 50,000 |
| Methyl/Ethyl parathion | 25,000 |
| Dimethoate/DDVP, etc. | small |
| Carbaryl | small (100) |
| **Herbicides** | |
| Pentachlorophenol (produced from $\gamma$ - $\beta$ BHC residues) | 10,000 |
| Nitrofen | 5,000 |
| Propanil | 500 |
| 2, 4-D esters and salts | 1,000 |
| **Fungicides** | |
| Zineb | 1,000 |
| Carbendazim | 500 |
| 'Kitazin' | small |
| Wettable sulphur | 200 |
| Bordeaux | 2,000 |

Plant Growth Regulators

| | Te of Technical Product |
|---|---|
| B - 9 | 100 |
| Ethephon | small |

2.2 Pesticides Imported into China (indicative per annum tonnage as technical product)

| | |
|---|---|
| MIPC | 3,000 |
| 'Furadan' | 500 |
| 'Sumithion' | very small |
| 'Treflan' | 1,000 |
| 'Saturn' | 100 |
| 'Topsin' | 1,000 |
| 'Captan' | 500 |

2.3 BHC

As can be seen from the figures, pesticide manufacture and usage in China is dominated by BHC. The Shenyang Chemical Factory visited by the mission was apparently typical of many similar units throughout China with nominal capacity at ca 15,000 te/yr. The BHC unit is integrated with a large chloralkali facility (ca 250 diaphragm cells) producing chlorine and 85,000 te/yr NaOH. Benzene feedstock is provided approximately equally from coal-tar distillation and the petrochemical industry. Reaction is by light-initiation in a series of reactors at about 60° /atmospheric pressure and the reaction solution is batch distilled in about 10 units to give a product containing 14% $\gamma$- isomer.

The major part of BHC production is formulated as a dust containing 3% $\gamma$-isomer (i.e. approximately 21% BHC) mixed with 1.5% methyl/ethyl parathion. A lesser part is formulated as an 80% WP. Official statistics quote 1979 formulation production in China at 1 million te of dusts and 300,000 te of others mainly EC's and WP's. BHC in its mixture with parathions, together with DDT can obviously account for all of the dust volume.

## 3 PESTICIDE USAGE IN CHINA

The following information was obtained from discussions with Professor Chang.

### 3.1 Insecticides

The BHC/parathion dust is used on paddy rice at a rate equivalent to 0.3 kg/ha of $\gamma$-isomer so that the 1 million te of dust could be theoretically equivalent to ca 100 million application hectares. Given 2-3 applications per season, this must indicate a very high proportion of BHC usage in rice (total area 35m ha) as well as in other crops. Professor Chang estimated that over 50% of rice is so treated.

The BHC 80% WP is largely used as a soil insecticide for soya (total area approximately 10m ha). At a rate equivalent to 1.3 kg/ha of $\gamma$-isomer, however, the proportional usage is probably relatively small.

Rice also accounts for usage of imported MIPC (for virus control in seed-beds) and for most of the imported 'Furadan', together with a substantial proportion of locally manufactured trichlorfon and malathion. Other major crops for insecticide usage are cotton (approximately 4m ha total area; trichlorfon, parathions, DDT) and vegetables (trichlorfon).

### 3.2 Herbicides

Herbicide usage in China is increasing rapidly (up 50% in 1978/79) but land area treated is still very small only amounting to 4 million ha in 1979. Of this, approximately 2.7 million ha was paddy rice, equivalent to 8% of the total rice area. Major products used in rice are nitrofen and PCP, although the latter is also used as a wood preservative and as a molluscicide. Other products with much lower usage are propanil and imported 'Saturn'. Other herbicide-treated crops are winter wheat (700,000 ha; 2,4-D), soya (350,000 ha: 'Treflan') and, with a much lower level of usage, cotton, maize, groundnuts, etc. Weed control will obviously remain for a long time a mechanical operation.

### 3.3 Fungicides/PGR

Fungicide usage in China is at a very low level, the major product being imported 'Topsin' at ca 1,000 te/yr. Very little priority appears to have been given to this market despite obvious potential and uncontrollable problems on potatoes, other vegetables, fruit and rice. Carbendazim is manufactured by a process developed at the Shenyang Research Institute but volumes are trivial, partly because of difficulties with intermediates supplies. Plant growth regulators, although again at trivial volumes, do, as usual, receive considerable attention at the Research Institutes and processes have been developed for Ethephon and B-9.

3.4 Future Trends

The message regarding future trends was the same from all quarters in China. Agricultural production must increase through land reclamation and more efficient farming. Such improvements in efficiency will partly depend on labour saving techniques, including a higher usage of pesticides - in particular in the North where unit areas are large and populations small and in the South where multiple cropping is increasingly practised. At the same time working conditions for the farmer must be improved and the rural population maintained. Environmental pollution must be reduced and the overwhelming dependence on persistent chlorinated hydrocarbon pesticides must be relieved, not least of all because of the inefficient usage of benzene which they represent. Clearly China wishes to be reasonably self-sufficient in modern pesticide production and usage as soon as possible but any major changes in this respect will take several years to effect.

4 SHENYANG RESEARCH INSTITUTE FOR CHEMICAL INDUSTRY

MCI has decided that the Shenyang Institute will become the national centre for pesticide R & D in China.

4.1 Present Organisation

Presently Shenyang comprises two main operating divisions - Pesticides and Dyestuffs with a total staff of ca 1,000 people:

| | Staff Employed (Graduate/ Non-graduate) |
|---|---|
| (i) Pesticides | |
| New Product Synthesis and Process Development | 100 (70/30) |
| Insecticides/Fungicides (70) | |
| Herbicides (30) | |
| Intermediates Process Development | 40 (20/20) |
| Formulation | 40 |
| Biotesting | 40 |
| Toxicology | 40 |
| (ii) Dyestuffs | 250 |

(iii) Staff Functions

| | |
|---|---|
| Chemical Engineering (mainly fluid-bed design for oxidation processes to phthalic anhydride, etc.) | 70 (40/30) |
| Physical Chemistry (MS-GLC; NMR, etc.) | 80 |
| Drawing Office<br>Information Services<br>Utilities, etc. | 340 |

Within the Pesticides Di· .sion facilities are restricted but there is a nucleus of personnel and experience to provide for an integrated modern R & D Centre in the future.

4.1.1 Pesticides New Product Synthesis and Process Development

Work in this group is concentrated on insecticides, both process and product invention, with the latter resuming only within the last few years after being stopped during the Cultural Revolution. OP insecticides are under the charge of Deputy Director Wang's wife who is running a team of 10 people. Compound synthesis has to date built up to a rate of only ca 50 per year.

Fungicide and herbicide work is largely limited to process development with established products, either to avoid dependence on foreign technology or to utilise the short supplies of intermediates or raw materials which are available within China.

A fourth group was concerned with processes to surfactants and was using a small autoclave to treat alkylated phenols with ethylene oxide. Each group apparently for historical reasons had its own analytical services, usually including simple GLC's.

4.1.2 Intermediates Process Development

This group plays an important role at Shenyang. They were at the time of visiting working on hot-tube processes for alkylation of phenols but had in the past developed a process to $\beta$-naphthol by hydrogenation of naphthalene to tetralin followed by oxidation and aromatisation.

In general terms, raw materials such as benzene/toluene/xylene/ethylene/ethanol, etc., etc., from coal and oil will become more readily available in the next few years but it will be a long time before a general industrial scale intermediates infrastructure is established.

Manufacture of small scale speciality products, such as pesticides, will likely therefore continue to require expenditure of foreign exchange on intermediates and will therefore only be undertaken where considered absolutely necessary.

4.1.3 Formulation

Within the formulation group work was in progress for micro-encapsulation of malathion/parathion for use in forestry and for slow release granules for rice.

4.1.4 Biotesting

Herbicide testing facilities were very limited with a wheat-seed germination bioassay and a 15' x 20' glasshouse with rice, maize, soya, cotton, cucumber and beans and a few weeds. Insecticide testing seemed more ambitious with the following species:

| | | |
|---|---|---|
| Tetranychus cinnabarinus | - | spider mite |
| Tribolium confusum | - | flour beetle |
| Aphis laburni | - | aphid |
| Chilo suppressalis | - | rice stem borer |
| Pseudaletia separata | - | rice army worm |
| Musca domestica | - | housefly |
| Culex pipiens | - | mosquito |
| Pleonomus canaliculatus | - | wheat wire worm |

Insecticide screening under charge of Mr Rong Chang-Chi who had recently spent 6 months with Ciba-Geigy in Switzerland. A Burkhard micro-applicator was in use for topical treatment of Musca, but there was no air-conditioning for standardisation in any of the insect breeding or test rooms.

Fungicide screening was limited to in vitro tests on cultures of which the three most important were stated to be Gibberella, Verticilium and Rhizoctonia.

Each of the screens apparently checks ca 50 chemicals per year at present.

4.1.5 Toxicology

Toxicology studies are presently done at two sites - the ground floor of the Dyestuffs Applications Building at the main site and on the second floor of the Biotesting Building which is at a separate smaller site. Facilities are available for studying acute oral and dermal toxicity with rats, mice and guinea-pigs; eye irritation with rabbits; inhalation, 90-day and 2 generation reproduction with rats: teratogenesis with mice and the in vitro Ames test. Two pathologists are on the staff and to date 4 chemicals have been put through 90-day studies (typically with 5 animal groups, including a control, each with 10 rats). Animal breeding and maintenance facilities were primitive, the mice being housed in earthenware pots, with no air conditioning. A room is being prepared to start up a fish toxicity unit within the next few months.

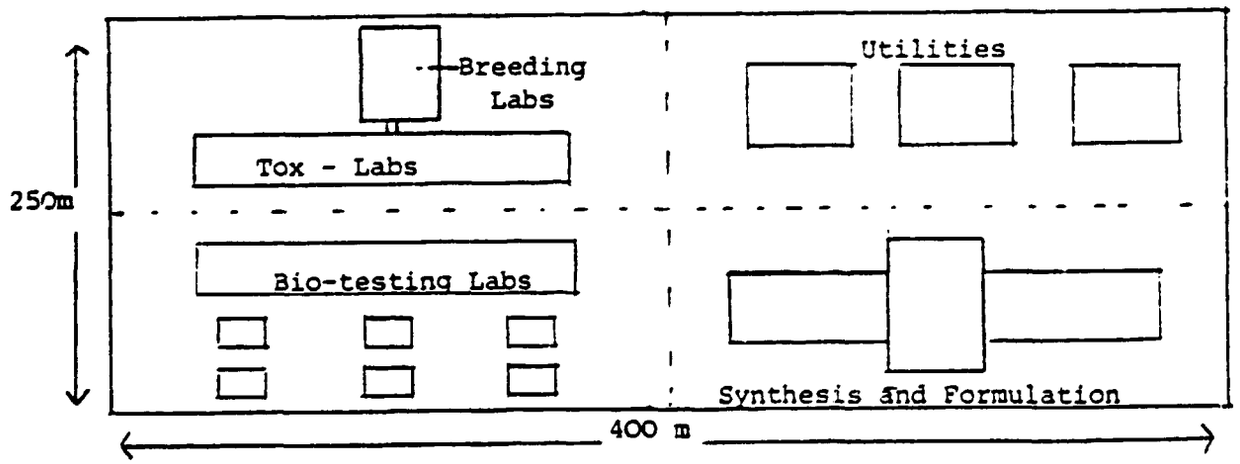
4.1.6 Physical Chemistry

The Physical Chemistry group serving both Pesticides and Dyestuffs contained many sophisticated analytical instruments, including a Bruker WH-90 NMR, a Varian MAT 311A MS-GLC, a Perking-Elmer 580 IR, a Jasco/ China-produced HPLC and various GLC's with electron capture, flame photometric etc detectors.

The group is responsible for providing technical data to the Ministry of Agriculture for standardising pesticides specifications in China and also for some amount of crop residue analysis, as well as for analytical method design and new product structure determinations.

4.2 Proposed Future Organisation

The MCI in Beijing are committed to improving the pesticide R & D facilities at Shenyang by eventually moving all groups - synthesis and process development, formulation, biotesting and toxicology to a new site, presently green field, about 5 km from the present centre and just beyond the present outskirts of the town. The new site will eventually be to the following plan, comprising a total floor area of ca 15-20,000 $m^2$ on a site area of 110,000 $m^2$ with a staff of ca 375 (compared with the present staff of ca 260).




4.2.1 Synthesis and Formulation

Total Floor Area : 8000 $m^2$ (on 3 floors)

Total Staff : 175 (synthesis 75, process development 50, formulation 50)

Effort will be placed more or less equally on herbicides, fungicides and insecticides with the intention of eventually providing new chemicals for screening at a rate of ca 1-2,000 per year.

Routine analysis will be done at the new site but the existing (expanded) central analytical facilities in the Physical Chemistry Division will be used for MS-GLC/NMR, etc. Pilot plant facilities will eventually be located in the existing Chemical Engineering Division and will again not therefore be part of the new site. Plans assume multi-purpose batch equipment up to ca 500 l size

4.2.2 Biotesting

Total Laboratory Floor Area : 3000 $m^2$ (on 3 floors) 3 Glasshouses at ca 500$m^2$ each and 2 constant environment rooms. Total Staff : 100.

Screening of 2,000 chemicals per year is expected to select ca 100 compounds suitable for acute toxicology and field testing. Field testing will continue to be done as at present primarily through Ministry of Agriculture Provincial Agricultural Institutes. Exchange screening agreements with foreign companies will be welcomed.

4.2.3 Toxicology

Total Laboratory Floor Area : 4000 $m^2$ (on 2 floors)

Breeding Area : 1000 $m^2$

Total Staff : 100 (66 graduate/34 non-graduate)

Facilities will be available for 22 laboratories/offices with the following capacities, using SPF animals bred on-site.

| | |
|---|---|
| Acute studies | 100 chemicals per year |
| 90-day studies | 6 " " " |
| Fish TLM 96hr | 6 " " " |
| 2 year rat studies ) | |
| Teratogenic studies ) | 1-2 " " " |
| Carcinogenic studies ) | |
| Animal metabolism studies ) | |

In addition to animal metabolism, soil and water degradation studies will be done using radio-labelled chemicals synthesised at other laboratories.

4.3 Priorities for the Future Organisation

During earlier discussions between MCI and UNIDO it was considered that highest priority should be given to the re-establishment of pilot-plant facilities. However, MCI now believe that this should take low priority and that highest priority should be given to establishment of the new Toxicology Division. This is partly because, of all the Divisions, the toxicology is presently least able to operate in a meaningful way because of problems with maintaining standard experimental conditions. It is also partly because a new Pesticide Registration Law is due to be enacted in 1981 and new products or old products with suspicious toxicology may require urgent appraisal. Present toxicological facilities at the Ministry of Health are already overstretched and the Ministries of Health, Agriculture and Chemical Industry have decided that pesticide investigations should be the responsibility of Shenyang. Mr Wang described Shenyang as eventually inventing, evaluating and toxicity testing new pesticides and providing the efficacy and toxicity data to the Ministries of Agriculture and Health respectively for assessment and final registration. Shenyang might similarly act on behalf of foreign companies for products which are thought suitable for local production in China.

Against this priority Shenyang plan to complete the Toxicology Department by Autumn 1982 with design being completed in April 1981. A government grant for ¥2.86 million to cover capital expenses for land, services, utilities, building and equipment and operating expenses through 1983 has already been agreed and 30,000 $m^2$ of land has been purchased (at ca ¥1/$m^2$!). Assuming further money is available as expected, the rest of the new site will be completed by 1985 with priority if necessary firstly to bioassay and then to formulation and synthesis. This timing will fit reasonably with the availability of new graduates from University technical courses which started up again after 1976.

5 THE UNIDO PROJECTS

Shenyang require help from abroad in two main areas - in purchase of equipment which is not available in China and which would otherwise require foreign exchange and in the provision of fellowships and study-tours. After considerable discussion the following two projects were agreed for joint recommendations by MCI and the UNIDO mission.

5.1 China/UNDP Project

(for details see Project Document agreed July 7, 1980)

| | $ (of the year) |
|---|---|
| Purchase of Equipment (1980-81)<br>(continuous still; flash evaporator; electro-sphygmometer; electrophoresis densitometer) | 30,000 |
| Study Tour (1980)<br>(6 men for 2 months to study pesticide R&D management, technology and laboratory designs in UK, W Germany, Switzerland and Japan) | 44,000 |
| Fellowships (1981) | 70,400 |
| 2 men for 6 months to study bioassay methods (entomology and plant pathology) | |
| 2 men for 6 months to study analysis methods (ai, formulation and crop residue) | |
| 2 men for 6 months to study formulation (laboratory, pilot plant and full scale) | |
| 2 men for 3 months to study toxicology (pathology and electron microscopy) | |
| Contribution to present UNIDO mission (1980) | 5,600 |
| Total | 150,000 |

Planning for the 6 man - 2 month study tour, which will be led by Mr Wang, will be initiated by Dr Szabo as soon as the China/UNDP Project Document is signed. It is hoped that the Tour can be completed before Christmas 1980 and a provisional list of sites to visit was agreed as follows:

UK

| | | |
|---|---|---|
| (i) | MRC Toxicology Lab<br>Carshalton, Surrey (contact Dr Aldridge) | Toxicology |
| (ii) | Tropical Products Institute<br>London (contact Dr G Pickering) | Analysis |
| (iii) | Centre for Overseas Pest Control<br>London (contact Mr T Jones) | Insecticide Bioassay<br>Formulation |
| (iv) | Weed Research Organisation<br>Oxford (contact Dr J Fryer) | Herbicide Bioassay |

| | | |
|---|---|---|
| (v) | Rothamsted Experimental Station<br>Harpenden (contact Dr Bowden) | Fungicide Bioassay<br>Synthetic Pyrethroids |
| (vi) | Ministry of Agriculture, Plant Pathology Department, Harpenden (contact Mr D Papworth) | Registration |
| (vii) | ICI Plant Protection Division,<br>Jealotts Hill (contact Dr P Doyle) | R & D Management<br>Formulation<br>Soil & water residue degradation |
| | NB Dr Doyle also to consider visit to Central Toxicology Laboratories, Cheshire | (Toxicology) |
| (viii) | Shell Research Centre<br>Sittingbourne (contact Dr D Yeo) | R & D Management |

West Germany

Hoechst & Bayer

Switzerland

Ciba-Geigy

Japan

CLEA Co

Decisions on locating the Fellowships will probably be delayed until after the Study Tour. As an alternative the 12 m/m for toxicology could be combined to provide for a formal one year post-graduate course at say University of Surrey, Guildford or Chelsea Polytechnic.

5.2 ODA/UNIDO Project (For details see Draft Project Document, July 1980)

| | $ (of the year) |
|---|---|
| Purchase of Equipment - See Appendix I<br>(GLC; HPLC; automatic blood and body chemistry analysers; inhalation toxicity system; continuous flow fish toxicity system; electropolygraph, etc., etc.) | 600,000 |
| Study Tour (1981)<br>(2 m/m visit to UK to decide equipment specifications - possible visit to W Europe if equipment not available in UK) | 6,800 |

| | $ (of the year) |
|---|---|
| Fellowships (1981)<br>1 man for 6 months to study toxicology (general techniques) | 20,000 |
| 1 man for 6 months to study metabolism (animal and to a lesser extent plant and soil/water degradation) | |
| Expert and UNIDO Consulting Missions to Shenyang (1981-82)<br>(11.5 m/m; pesticide synthesis and usage; toxicology including metabolism; bio-chemistry; agronomy) | 81,200 |
| Total | 708,000 |

Dr Pickering will make a preliminary assessment of equipment availability in UK prior to the Study Tour. Location of the two fellowships may be delayed until after the 1980 6 man/2 month Study Tour to be organised under the China/UNDP project. Details of the Expert Consultancy Missions will also likely be decided in 1981, but should certainly include general discussions of modern pesticide usage in Western Countries.

5.3 General

The two projects are set up as above to provide a reasonably self-contained programme for the proposed ODA contribution and a technical paper in support of the latter will be written for ODA by Dr Pickering. Dr Szabo will write the final formal UNIDO Project Documents for both projects.

The net result if ODA agree to the Projects is that Shenyang Research Institute will receive expert on-site Western advice in setting up their new pesticide facilities, that ca 10 professional staff from Shenyang will receive Fellowships for technical study in the West (a list of potential candidates has already been drawn up with special reference to fluency in English), that various pieces of specialised equipment mainly in the toxicological field and only available outside China will be purchased for China in the UK (if possible) and that 6 Management Staff from Shenyang will make an introductory study Tour to the West (primarily UK) in 1980.

6 NEW PESTICIDE LAW

Mr Bien of the Ministry of Agriculture Department for Control of Agrochemicals is responsible for setting up standard specifications for both imported and domestic pesticides and for operating various aspects of the new Pesticide Law expected to be enacted in 1981. The Law will likely require data on physical and chemical properties, biological efficacy, toxicology and residues in crop, soil, water and fish.

The Law will apply to all pesticides - new and old - but Mr Bien implied that in respect of established products the Ministry of Health, who will assess toxicology, may waive requirements for chronic data. With regard to residues, tolerances are already set for BHC (e.g. 0.1 ppm in rice grain), DDT, mercury, parathion, etc., and the responsibility for checking actual levels lies with the Provincial Agricultural Institutes.

Dr Pickering will arrange for Mr Bien to be supplied directly with the Joint FAO/WHO Reports of the Codex Committee for Pesticide Residues (CCPR) which will provide data on internationally accepted tolerances as well as references to residue analytical methods. Dr Pickering will also ask UK Ministry of Agriculture Plant Pathology Department at Harpenden to send Mr Wang information on UK pesticide specifications and analytical methods.

APPENDIX I

List of Instruments to be purchased under the UNIDO/ODA project.

| | Name | Estimated cost US $ |
|---|---|---|
| 1. | Gas Chromatograph | 28,000 |
| 2. | Liquid Chromatograph | 45,000 |
| 3. | Rotary evaporator, X 3 | 2,000 |
| 4. | Sequential multiple analyser | 170,000 |
| 5. | Ultra low temperature cabinet | 10,000 |
| 6. | Biological microscope system | 20,000 |
| 7. | Ultra centrifuge | 30,000 |
| 8. | Balance for weighing animal tissues | 10,000 |
| 9. | High speed, refigerated centrifuge | 10,000 |
| 10. | Rapid blood analyser | 30,000 |
| 11. | Connective flow system for fish toxicology study | 10,000 |
| 12. | Inhalation toxicity study system | 10,000 |
| 13. | Microspectrophotometer | 20,000 |
| 14. | Fluorospectrophotometer | 20,000 |
| 15. | Electropolygraph | 30,000 |
| 16. | Cryomicrotome | 15,000 |

APPENDIX II - Officials Contacted

Ministry of Chemical Industry - Beijing

| | |
|---|---|
| Chen Pi-Fu | (Official Host)<br>Deputy Chief, Technical and Scientific Co-operation Division |
| Chao Wen-Bin | (Visit Organiser in Beijing)<br>Engineer, Technical and Scientific Co-operation Division |
| Yang Guang-Qi | Head of Planning Division |

Ministry of Agriculture, Beijing

| | |
|---|---|
| Chang Tse-Pu | Professor, Chinese Academy of Agricultural Sciences (CAAS) |
| Bien Shao-Chung | Vice Director, Department for Control of Agrochemicals |
| Mdm Chang Chun-Juan | |

Commission for Economic Relations with Foreign Countries: 6th Dept

| | |
|---|---|
| Yang Chen-Lun | (Co-ordinator for UNIDO Projects) |

Shenyang Research Institute for Chemical Industry

| | |
|---|---|
| Wang Da-Hsiang | (Pesticide Project Director)<br>Deputy Director of Research Institute |
| Mdm Li Shiang-Shin | Deputy Director of Research Institute |
| Chang Shao-Min | General Engineer of Research Institute |
| Hong Chuan-Yi | (Visit organiser in Shenyeng)<br>Deputy General Engineer of Research Institute |
| Chang Ze-Chung | Chief of Design Department of Research Institute |
| Yin Yong-Guei | Deputy Chief of Toxicology Department of Research Institute |

Liaoning Provincial Officials

| | |
|---|---|
| Chang Hung-Shu | Vice Chief of the Provincial Technology and Science Bureau |

UNDP Field Office, Beijing

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| Alan Doss (Mr Jia) | Deputy Resident Representative |

British Embassy, Beijing

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| Bernard Halliwell | 2nd Secretary |

USA Embassy, Beijing

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| William L Davis | Agricultural Attaché |

Mr Wang as Project Director is clearly a key man in providing for the successful completion of the projects. He graduated as a chemist from Peking University in 1952 and except for a 2 year period during the Cultural Revolution he has worked at Shenyang Research Institute since 1953. He is not only now Deputy Director of the Institute but is also Chairman of the Chinese Pesticide Society, of which Professor Chang of CAAS is a Vice Chairman and of which Mr Hong is General Secretary.