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STRENGTHENING OF THE PESTICIDE DEVELOPMENT CENTRE GURGAON, INDIA

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INDIA

Technical report: Recommendations on up-grading laboratory facilities*

Prepared for the Government of India by the
United Nations Industrial Development Organization acting as
executing agency for the United Nations Development Programme

Based on the work of
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* This document has not been edited.

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PREFACE

Background

In the early eighty's the production of pesticides in India was largely in the hands of the private sector. It was built around 32 large industrial units engaged in the manufacture of about 50 technical grade pesticides and over 400 small-scale formulators. The estimated total annual formulation capacity was of the order of 1.6 million tonnes of formulated products. The small-scale sector accounted for 85 to 90 per cent of the total formulation capacity.

The major producer of pesticides in the public sector at that time was Hindustan Insecticides Limited under the administration of the Ministry of Chemicals and Fertilizers with manufacturing units in Delhi, Cochin and Rasayani.

Whilst most major producers of pesticides had fairly adequate quality control facilities, small-scale formulators lacked of specialized equipment and experience or needed modernizing and improvement.

History of the programme

As a response to the problems and needs of the pesticide industry in India at that time, the "Pesticides Development Programme in India" (PDPI) was started. PDPI was a multi-pronged activity geared towards the strengthening and improvement of the pesticide formulation industry in the country. Established with UNDP/UNIDO assistance, this project began in July 1981, implemented in its first phase by the Hindustan Insecticides Ltd. (HIL) on behalf of the Government of India. Its centre at Udyog Vihar, Gurgaon, in the state of Haryana, some 25 km from Delhi, was equipped with research and technology development facilities in the many aspects of pesticide formulation.

With approval of its second phase in 1988, the project was renamed as Pesticide Development Centre (PDC), and then in May 1991 transformed to the IPFT, the Institute of Pesticide Formulation Technology, established as a Government of India Society registered under the Societies Act under the Department of Chemicals and Petrochemicals, Ministry of Chemicals and Fertilizers of the Government of India. The IPFT is an institution building project of UNDP/UNIDO and the Government of India to cater the needs of not only the Indian pesticide industry but also of the Asia and Pacific Region. It is a non-profit making research institute with a governing body comprising of academics, eminent scientists, administrators, financial experts, professionals as well as experts from the pesticide industry.

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LIST OF ABBREVIATIONS & ACRONYMS

CIPAC	Collaborative International Pesticides Analytical Council Limited
DIN	German Industrial Norm
EN	European Norm
GAP	Good Agricultural Practice
GIFAP	International Group of National Associations of Manufacturers of Agrochemical Products
GLP	Good Laboratory Practice
GOI	Government of India
HIL	Hindustan Insecticides Ltd.
IPFT	Institute of Pesticide Formulation Technology
IEC	
ISO	International Standards Organization
MOA	Ministry of Agriculture
MRL	Maximum Residue Limit
PDPI	Pesticides Development Programme in India
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Programme
WHO	World Health Organization

MEASURES:

KV	kilo volts
KVA	kilo volts ampere
psi	pounds per square inch
sqm	square meters
cbm	cubic meters

CURRENCY:

Rs = Rupees (March 1996: 1 USD app. 33.80 Rs)

USD = U.S. Dollar

EXECUTIVE SUMMARY

Objectives of the Mission

The mission's primary objective was to advise the counterparts on necessary modifications of the quality control and formulation laboratories in order to upgrade them and put them more in line with modern laboratories of that kind. In addition to that the counterparts were to be advised on quality assurance and ISO 9000 procedures as they are thinking of attaining an international accreditation for their facilities.

APPROACH AND PROGRAMME OF THE MISSION

After looking into the mandate and organizational structure of the Institute of Pesticide Formulation Technology, discussions were held with all sections in order to obtain an overview of their activities and establish activity related space requirements. Also relationships within the sections and with other sections were clarified.

With handicaps such as to stick to the existing building, concessions to optimal design had to be made and priorities had to be set.

Options and requirements for interior design had been discussed and examples for specific safety devices such as fume cupboards, waste collection systems, emergency showers, eye washing stations, fire fighting facilities etc. were given. Likewise different surface materials for tables and floor finishing were explained and discussed. Samples, brochures, catalogues and other visualization material from big laboratory suppliers in Europe were used to illustrate possible improvements.

In addition to that, a new pharmaceutical establishment located nearby, and having a fairly large R&D and analytical section, was visited. To a large extend, these laboratories were established using local material, and apart from the fume cupboards and exhaust system, could serve to a large extent as a good example or model installation.

As the process of planning, building, or renovation is highly technical, and often fraught with problems, it was important to cooperate and discuss also with local architects and engineers to establish a common language and understanding. As a basis for future work, actual site and floor plans were established and made available as computer drawings in order to have easy access to draft drawings for planning purpose.

The importance of appropriate landscaping was discussed and will be followed up by the institute and the related architects.

During discussions with Government officials in the Department of Chemicals & Petrochemicals at the end of the mission, the question of the financial feasibility of a renovation versus a new complex was raised since major renovations often involve costs similar to construction of new facilities.

Findings of the Mission

The Institute of Pesticide Formulation Technology (IPFT) at Gurgaon is devoted to research and training in various aspects of pesticide formulation technology. Furthermore the institute is playing a central role in maintaining contacts and cooperation with many other national and international R&D institutions and also in coordinating national activities of RENPAP.

The institute has great variety of sophisticated process machinery and analytical equipment, but lacks adequate building facilities, basic services and implementation of GLP (Good Laboratory Practice). The laboratory building constructed in the early eighties and the general working conditions do not correspond to international standards. The present situation is not acceptable and far away from any possibility of obtaining an accreditation according to international standards.

Regardless whether accreditation is aimed for or not, the role of IPFT as national and regional institution for South East Asia demands for a representative establishment. To achieve this, two major improvements are necessary:

a) improvement of facilities
b) improvement of operational procedures

To improve existing facilities, major renovation and up-grading work is necessary as the result of this mission and the report show. The architecture of the building is not ideal for modern laboratories. Limitation in space and in grouping the various work units will always lead to some compromise. Additional space will be required outside the present laboratory building.

Therefore, the options for improvement of facilities should, apart from renovation of present building and up-grading of facilities, also consider shifting of sections and construction of new facilities. Costs for major renovation can be as high as those for new construction and, by experience, the hassle of discovering hidden pipes or undocumented structures during the renovation process had

already caused many disputes in the past. On the other hand the construction of new buildings usually involves long lasting preparations and procedures to obtain all necessary permits such as utility permits, site permits, building permits and others. In any case a proper financial analysis should be done first.

In case a new building would be constructed, the safety & packaging, the formulation laboratory and the chemical stores should be relocated and accommodated on ground level near to the pilot plant.

Additionally a first aid room should be provided to serve the whole complex.

The major recommendations for renovation aim at improving the layout and the occupational health & safety situation of the existing facilities as well as fulfilling some general requirements for laboratories of that kind. The improvement of operational procedures are necessary to work more in line with, or fully implement GLP procedures. The establishment of an adequate quality assurance system should be achieved.

Apart from all technical recommendations it should be mentioned that also proper housekeeping is important in providing a continuously good environment. A properly maintained building has a potentially longer and less expensive service life than a poorly maintained one. Also employee morale and productivity, for instance, are enhanced by clean, attractive, and orderly working environment. Last but not least it contributes to the reputation of any institution.

As the institution is aiming at self-finance generating activities and thus depends on clients, it is quite important to

- render a good service
- have a representable institution
- ensure the protection of clients' confidential information and proprietary rights

Substantial consideration should be given to the latter point as the industrial client would certainly not be interested in using the institute's services for research & development if he knows that others, especially competitors, could easily gain access to ongoing research or results. Therefore, access to certain areas should be controlled and limited, reception areas and meeting rooms for visitors should be available and information should always be kept in secure places and archives.

At the same time status and ownership questions should be clarified with a policy towards a clearer separation between IPFT and HIL. This is of special relevance in view of possible future accreditation as, according to ISO guide 25,

staff and organization shall be fully independent and maintain its integrity at all times.

Specific technical recommendations are summarized in chapter 3 and not repeated here.

The recommendations given should be used to update or create a proper facility master plan which includes also the financial analysis of the different options and show short and long term perspectives. The master plan should identify the chosen options and define construction budget and schedule. The total costs for the construction or renovation works have to be estimated locally by the consulting architect. Cost estimates for safety equipment can be obtained directly from the suppliers. It is strongly recommended to purchase safety equipment such as fume cupboards from well known quality suppliers; they normally would also offer to take over total airflow management.

Finally and whatever way will be chosen, construction or modifications should be reviewed during renovation works to make sure that requirements are being met. Before any ready made furniture or other items are ordered, all relevant dimensions, electrical specifications, water and drainage and other requirements should be verified again. A close cooperation between the architects, engineers and specialists is absolutely necessary.

INTRODUCTION

BACKGROUND

The premises of the Institute of Pesticide Formulation Technology (IPFT) in Gurgaon were established within an institution building project of UNIDO and the Government of India in the early 80´s to assist the pesticide industry in India by developing and promoting safer, new generation pesticide formulations and utilizing indigenously developed technology for production of formulations and improving the formulation capabilities of the country.

OBJECTIVES OF THE MISSION

The mission's primary objective was to advise on the redesigning of the quality control and formulation laboratories in order to upgrade them and put them more in line with modern laboratories of that kind. The mission was also intended to advise the counterparts on quality assurance and ISO 9000 procedures as they are thinking of attaining an accreditation for their facilities.

The respective job description is given in Annex [1].

APPROACH AND PROGRAMME OF THE MISSION

To review and understand the existing situation in the Institute of Pesticide Formulation Technology the consultant looked first into the mandate, organizational structure and activities of the institute. Discussions were held with all sections in order to obtain an overview of their activities and establish activity related space requirements. Also relationships within the sections and with other sections were clarified.

As it was one of the handicaps to stick to the existing building, concessions to optimal design had to be made and priorities had to be set.

Options and requirements for interior design had been discussed and examples for specific safety devices such as fume cupboards, waste collection systems, emergency showers, eye washing stations, fire fighting facilities etc. were given. Likewise different surface materials for tables and floor finishing were discussed. Samples, brochures, catalogues and other visualization material from big

laboratory suppliers in Europe were used to illustrate possible improvements.

In addition to that, a new pharmaceutical establishment located nearby with a fairly large R&D and analytical section was visited. Their laboratories were prepared mostly using local material and, apart from the fume cupboards and exhaust system, could serve to a large extent as a model installation.

As the process of planning, building, or renovation is highly technical, and often fraught with problems, it was important to cooperate and discuss also with local architects and engineers to establish a common language and understanding. As a basis for future work, actual site and floor plans were established and made available on computer drawings in order to have easy access draft drawings for planning purposes and to facilitate the establishment of working drawings.

The importance of appropriate landscaping was discussed and will be followed up by the institute and the related architects.

During discussions with Government officials in the Department of Chemicals & Petrochemicals, the question of the financial feasibility of a renovation versus a new complex was raised since major renovations often involve costs similar to construction of new facilities.

ANALYSIS OF PRESENT SITUATION

1. Location of the IPFT

The Institute of Pesticide Formulation Technology (IPFT) is located at Udyog Vihar, Gurgaon in the state of Haryana, approximately 25 Km from New Delhi, within the compound of the Research Station of the Hindustan Insecticides Limited (HIL).

Whilst the IPFT has a separate building, it is sharing some premises and services with Hindustan Insecticides Ltd. which has a total area of about ..... sqm.

The site plan (see Annex [2]) shows the location of IPFT within the complex of the HIL research station at Gurgaon, along with the following buildings:

HIL Research & Development Unit
HIL Pilot Plant & IPFT Pilot Plant
IPFT main building
service units

Adjacent to the old buildings is a new IPFT complex intended to house offices for the administration, training facilities and accommodation for trainees.

2. Building of the Institute of Pesticide Formulation Technology

The present building of the IPFT has been planned and constructed in the early 80´s, originally not clearly as a laboratory dealing with toxic chemicals.

It is a two storey concrete building with a self supporting concrete structure of columns and beams (frame system) built on a basic area of 460 sqm which includes an inner court of app. 38 sqm. Available floor space in dedicated rooms is only around 250 sqms per floor.

At a later stage some wooden division walls were added to create separate laboratory and office space.

Key planners and architects were Mess. KUKREJA ASSOCIATES LTD. who were also contacted during this mission.

3. General Layout

The main building of the IPFT presently houses the following three sections:

Pesticide Formulation Technology
Analytical Services
Bio Sciences

Bio Sciences and the Analytical Laboratories are located in the ground floor and Pesticide Formulation Technology occupies two third of the first floor.

Access to all sections is via the main entrance which has a porch in front of it. Opposite the main entrance and inner court is a staircase leading to the first floor. The inner court is open to the sky and hosts one tree.

Also within the building are some rooms for administration and a conference hall in the first floor. Comfort rooms for gents and a lady's toilette are also provided as well as a small kitchenette in the first floor.

Another section belonging the Institute is the Pilot Plant which is located in another building next door, separated from the HIL Pilot Plant by a dividing wall. In the same building some office and laboratory space is available and intended to be prepared as packaging and safety laboratory in the future.

The present layout of the various sections in the main building can be seen from the floor plans (ground floor in annex [3] and first floor in annex [4]).

The details and deficiencies of the layout will be discussed in the chapters of the respective sections.

4. Basic Utilities & Services

4.1 Electricity supplies

IPFT and HIL have a common main electricity supply with a substation which was originally designed to feed also some production facilities. An 11 KV 3 phase underground cable feeds a 500 KVA 3 phase transformer, separated by an appropriate air pressure switch. The secondary side of the transformer leads to the power distribution station feeding the various buildings within the compound.

The nominal voltage for the station has been reported as 230 V single phase or 410 V three phases at 50 Hz.

The area is experiencing frequent power cuts and supply problems. Therefore the station had been equipped with two power generators of 63 KVA each. Both generators are identical and driven by diesel engines. The engines are started with the help of batteries and switching to generator supply is done manually. The procedure normally takes 5 to 10 minutes after decision is made to use generators.

In order to monitor the stability of the electricity and to identify spikes and surges a special monitoring device was connected over several days of laboratory operation. The graphs (see annex [5]) obtained from monitoring under both, outside and generator electricity supply, were evaluated and show, that the voltage fluctuated between 185 V and 245 V.

Tests were also carried out with different equipment running within the IPFT building and the pilot plant. During these tests spikes and surges were recorded, and in one test the switching on of an airconditionner initiated a voltage drop of 11 Volts, indicating problems with the electrical installation (see annex[6]). The extend of interference is beyond the acceptable limit and requires redesigning of some electrical circuits. It also has to be pointed out, that for the whole complex the three phases should be well balanced.

In the past some of the equipment was used in connection with different types of power stabilizers, some of which seem to be dangerous and may even damage equipment, as they do not provide any protection from over voltage.

For the future some UPS (Uninterruptable Power Supply) will be required to guarantee proper operation of essentially computer driven equipment such as the gas chromatographs, the GC-MS or some other computerized equipment. The capacity of the UPS has to be dimensioned as to guarantee operation of all computerized equipment for app. one hour and some vital equipment over a period of 12 hours. The power consumption of the analytical equipment as well as equipment of the formulation laboratory is given in the tables of annex [7] and annex [8].

Furthermore the main supply shall have some monitoring equipment which will cut off in case the supply voltage gets out of specified range.

4.2 Earthing facilities

Details on earthing installations were not known. According to the architect earthing is normally done at the substation by ordinary grounding rods. This, however, is not considered sufficient for laboratory purposes.

According to the head of the analytical section, a separate earthing was provided at a later stage when the GC/MS was installed.

With the renovation works and redesigning of the electrical supply the earthing should be checked again and/or redone for the whole building.

4.3 Water supplies

Water is supplied to the complex from an own deep well located within the compound and pumped electrically to overhead tanks on the pilot plant. From there static distribution takes place to the various buildings of the compound. There is no automation nor monitoring equipment to warn from low water levels.

Water pressure at user outlets was very low with varying temperatures depending on outside temperature and sun radiation. Presently the laboratory does not have a warm water supply but provision of warm water would be useful for future washing rooms.

Due to the given elevation of the main tank, the water pressure can reach a maximum of 0.7 at PSI in the goundfloor and 0.4 at in the first floor which is considered to be very low.

In order to operate condensers, temperature baths and specific equipment requiring cooling, some laboratory chillers with a recirculating system are used.

4.4 Water drainage and sewage system

In the main building of the IPFT rain water from the roof as well as drainage water from several places is collected in a channel surrounding the building. Some drainage pipes are temporarily connected to an adjacent water treatment plant to decontaminate from pesticide residues.

It is recommended to clearly separate rain and ordinary water discharge from the toxic waste discharge and not to overload or use the water treatment plant unnecessarily. All drainage connections should be permanent and properly fixed.

All chemical laboratories should be fitted with a floor drain, the micro-biology laboratory, however, must not be fitted with a floor drain.

Some examples to integrated laboratory waste collection systems (Koettermann, Waldner) were given.

4.5 Gas supplies

The analytical laboratory has been equipped with gas generators for hydrogen, nitrogen and compressed air. In addition to that some gas tanks are used to supply the GC/MS instrument. These gas tanks are located outside laboratory; positioning and installation has to be improved and secured as well as to be protected from direct sunshine. Gas purification equipment should be serviced regularly.

4.6 Air-conditioning

Over the course of the year Gurgaon has varying climate with temperatures increasing up to 45 degrees and extreme high humidity during the raining periods. Originally no central air-conditioning has been foreseen for the building. Some rooms, however, had been fitted with window type ACU's. Furthermore the open design and the type of doors and windows allow dust to penetrate into the laboratories, especially at times of dust storms.

Complete air-conditioning provides an environment of correct temperature, humidity, air movement, air cleanliness, ventilation, and acoustical level.

The future design shall provide a closed roof for the inner court. Windows have to be exchanged by air and dust tight frames fitted with iso glass (double thermo glazing). Furthermore the roof should be overhauled and provided with a thermal insulation (e.g. polyurethane containing layers). Some areas may need additional insulation or wall shading.

The laboratories shall be fitted with air-conditioning. Split type unit are preferable to window types as they result in smoother operation and better air circulation.

As the air conditioning system will be mainly a closed system, special consideration will have to be given to proper fume cupboards and exhaust systems.

4.7 Communication

The institute has a telephone and telefax line but no facility for local interchange and intercom is available. A telephone interchange for at least 3 outside and 12 internal lines is recommended.

Future renovation works should provide universal communication channels to all rooms; these channels should also be suitable to accommodate computer data lines.

4.8 Staff, data collection and filing

The staff of the institute was reported to be around 45, some permanently in IPFT, some with HIL. A number of 30 staff members physically allocated to the various sections of IPFT are listed in annex [9]. Sufficient working area has to be provided to all staff to document data collected from laboratory experimentation. Best solution would be to integrate the different utilities like benches, underbench units, wall cupboards and shelving into the rest of the laboratory furniture.

An additional long term file storage (archive) must be provided at a secure place accessible only to authorized persons. GLP rules have to be followed. It is of great importance that all relevant data are held secure and in confidence to the client.

At the time when training courses are being held there may be an additional 10 to 15 persons to be accommodated, requiring wide passages especially in the formulation section.

4.9 Sample and chemical storage

Presently samples are stored at various places mostly within the laboratory. There is no specific sample storage room available. Samples stored in the formulation section cause tremendous smell and contaminate the working environment. Sufficient chemical storage space both within the laboratories and outside must be provided with the new design.

4.10 Hygiene and safety installations

The institute avails of 2 comfort rooms for gents and 1 lady's toilette along with 2 other private toilettes.

Emergency showers are not available and have to be provided near the laboratory exits. Generally such emergency showers should give a minimum of 30 liters/min of water to guarantee that the body is sufficiently wetted.

Fire fighting equipment should include a number of portable fire extinguishers, fire blankets, sand and other material suitable to cover areas under fire. Local regulations should be observed.

First Aid kids, eye wash stations as well as laboratory coats and eye safety glasses should be available with all sections. For the upper floor an additional emergency exit may be thought of near or above the porch.

B. Analytical Laboratories

The laboratory is presently using the following functional rooms:

1 GC/MS room (semi separation from HPLC room)
1 HPLC room (semi separation from GC/MS room)
1 wet chemical lab
1 large instrument room

The laboratory was reported to analyze app. 800 to 1000 samples per year with the present setup.

There is no specific sample storage room available. Analytical standards are kept in a refrigerator within the section head's small office. There is no specific weighing room and no washing room. No proper fume cupboard is available and the installed exhaust fans do not provide adequate room ventilation.

The layout of the rooms is not practical, as the instrument room could only be reached by passing outside along the bio laboratories.

As a consequence the new layout should provide for the following additional space requirements:

1 sample storage room
1 weighing room or area
1 room for physico-chemical testing
1 washing room or ventilated washing area

Rooms should be arranged in such a way that access is provided in a logical sequence according to the flow of analysis. All laboratories will need air conditioning. Fume cupboards are required for areas where sample preparation and analysis results in fume and odor formation. A weighing room or area should be arranged fitted with a weighing table or a special laminar flow weighing cabinet with exhaust.

A bulk chemical store should be provided to serve all sections. Preferably it's location would be outside the building with direct access for trucks for loading and unloading.

An example of possible layout for the analytical section is given in annex [10]. Important is the use of proper and efficient fume cupboards to reduce the contamination of the working environment to a minimum.

C. Formulation Technology

The section is presently using the following functional rooms:

1 clay laboratory
1 sample process lab
1 liquid mixing lab
1 formulated sample storage

There is no specific weighing and sample preparation area and no washing room. No proper fume cupboard is available and existing exhaust fans do not provide adequate room ventilation. Pesticide smell is strongly noticeable and could endanger the health of the people around. The climatic chamber used for accelerated storage tests (CIPAC, 54 °C) contaminates the working environment when in use and being opened. The operation of the Dyno mill has, in the past, led several times to problems such as bursting hoses.

The clay laboratory is at the opposite side of the building. The room adjacent to it is used to store some old equipment and other material.

The new layout should provide for the following additional space requirements:

1 weighing and sample preparation room or dedicated area
1 dedicated area for climatic chamber (shelf life tests)
1 washing room or ventilated area

Sample preparation and other work involving hazardous chemicals and producing smell should be done in special fume cupboards or other ventilated and protected areas. Some of the equipment need water connection and drainage which should be provided with the respective laboratory furniture. Local scavenger device may be thought of for some of the equipment in the processing lab.

The storage of formulated test samples creates major problems as their smell also contaminates the working area around. The use of proper storage containers in combination with special ventilated safety cabinets for vapour removal would improve the situation. In order to maintain easy visual contact to the stored samples, a special permanently ventilated area with sufficient shelves could be designed using aluminum frames with sliding doors or windows.

Rooms should be arranged in such a way that access is provided in a logical sequence according to the flow of work.

An example of possible layout for the analytical section is given in annex [11]

D. Pilot Plant

The pilot plant which is located in the adjacent building intends to establish a Safety & Packaging Laboratory.

Equipment to be placed in the packaging laboratory includes impact testing, drop test, shear test and tests for moisture absorbance. Relevant recommendations were made in 1992 by a UNIDO consultant (see drawing in annex [12]).

It is recommended to provide also a fume hood as well as a local extraction hoods in cases where barrels or other large packages have to be opened and samples taken.

In anticipation of increased dust formation or hazards of spills the room may be fitted with floor drains to facilitate regular cleaning.

As a general remark the consultant feels that the location of the packaging laboratory in the rooms available in the first floor of the pilot plant is not necessarily practical. In case that future plans include expansion of the facilities or relocation into other buildings, a new location adjacent to the pilot plant and on ground level, with direct access to a store and truck delivery ramp would be preferable.

The present setup poses problems with the contamination of the working environment. The ventilation system is not conducive and the air around sometimes carries strong pesticide smell, which affects also the adjacent office and laboratory space. Furthermore the air is affected by work done in the HIL pilot plant since there is no hermetic separation.

The safety laboratory will work on basic occupational health & safety issues, such as personal protection equipment, measuring of dusts and fumes in working areas, protection from static electricity hazards, fire fighting equipment and others. The layout of the safety laboratory will be prepared by Eng. Dutta in cooperation with the suppliers of the specific equipment.

E. Bio Sciences

The section is presently using the following functional rooms:

1 botanical laboratory
1 bio assay laboratory
1 insectary
1 application laboratory
1 sample processing & treatment lab

The layout of this section should be slightly changed. Dedicated areas for the processing and storage of plant material in the botanical laboratory are required. Work benches need a smooth surface (e.g. TLC area) and provisions for extractions using organic solvents (fume cupboard or suction hood) should be made.

The present way of rearing various species of insects within one single room should be changed and possibly relocated, e.g. by swapping with the sample processing & treatment lab as shown in the annex. Four small insectaries, with special area for feed preparation and separated by aluminum-glass divisions, could be accommodated in one of the rooms. The four insectaries should be individually climatized according to the requirements for the reared species.

Existing concrete slabs, partly with cupboards underneath, would have to be removed or renewed, replacing present tiles by a more suitable, smooth and easily cleanable surface. All washing basins and related plumbing installations need to be renewed as well.

Application of or treatment with pesticides should be done only in special chambers or ventilated areas to avoid contamination of the working environment.

An example of modified layout for the bio-sciences section is given in annex [13]

The section is also planning to have an equipment testing lab that would include the following equipment:

EQUIPMENT	SIZE in MM
1. Spray Pattern Test Rig	2530 x 2550 x 1200
2. Cut-Off Valve Test Rig	920 x 970 x 272
3. Impact Test Rig	1930 x 915 x 915
4. Nozzle Abrasion Test Rig	1250 x 1180 x 640
5. Knapsack Sprayer Test Rig	2000 x 1330 x 820
6. Fatigue Strength Test Rig	1930 x 1480 x 405

For the equipment testing laboratory a separate hall may be used outside the building, complemented by a small workshop.

F. Micro Biology Lab

This will be a new laboratory section within the IPFT aiming at enabling the centre to become involved in the formulation and development of biological control agents and to assist in the formulation of medium and long term research programmes in this area.

Detailed microbiology laboratory designs were made by UNIDO consultant K.A. Cook during his assignment in 1990 along with a list of concerns and problems in converting existing space of the present building into a microbiology laboratory. Some of the points raised were doors to the open air, high ceilings and ceiling fans, adjacent toilets, open drainages and other factors.

As a major concern is obviously with the potential hazard of contamination by microorganisms pathogenic to humans, special care must be taken in preparing and operating the laboratory. For further details reference is made to the report of K.A. Cook.

In general, the laboratory was designed with a space requirement of app. 90 sqm with 2 separate rooms and an specially ventilated foyer to avoid contamination from and to the outside.

The arrangement which was designed within a rectangle of appr. 8.4 m by 10.5 m could be accommodated within the front or rear part of the left wing of the IPFT building. Electrical and other requirements will have to be planned according to the basic needs and the specified equipment of the laboratory.

The possibility of repositioning of the windows towards the outside in order to gain some more space should be discussed with the local architect.

The original drawings of Mr. Cook are given in annex [14].

2. REQUIREMENTS for certification or accreditation

Laboratory accreditation, by way of introduction, can be described as a mechanism to assess the technical competence and quality systems of laboratories thereby giving a high degree of assurance as to the validity of test results produced by those accredited laboratories.

Closely connected with accreditation are national and international norms or recommendations such as

ISO 9000 series (quality systems)
EN 45000 (laboratory accreditation)
OECD Code of Good Laboratory Practice

as well as national and/or international organizations that regulate or deal with accreditations or certifications in one way or another.

Accreditation is carried out by independent accreditation bodies. In Europe they operate according to uniform rules and standards (EN 45000 series).

These accreditation bodies check whether essential requirements are fulfilled, such as:

* an adequate organizational structure
* impartiality, independence and integrity
* technical competence of personnel
* a quality management system
* technically required equipment and technical competence
* traceability and reproducibility of results

The accreditation procedure can be divided into four steps:

* application
* assessment
* accreditation
* surveillance

The accreditation of laboratories is a process requiring high competence. It also has its price.

ISO/IEC Guide 25 sets out the general requirements in accordance with which a laboratory has to demonstrate that it operates, if it is to be recognized as competent to carry out specific calibrations or tests. The OECD Code of Good Laboratory Practice emphasizes on the specific requirements for chemical laboratories which would apply also to IPFT.

In brief, the major requirements of the guide relate to the following areas and demands:

1. Organization and management

* managerial staff with all authorities

* personnel free from commercial, financial and other pressures which might adversely affect the quality of their work

* organized in such a way that confidence in its independence of judgment and integrity is maintained

* specification and documentation of responsibilities and authorities

* supervision by qualified staff

* need for a technical manager

* need for a quality manager

* nomination of deputies

* documented policy and procedures to ensure the protection of client's confidential information and proprietary rights

* participation in inter laboratory comparisons and proficiency testing programmes

2. Quality system, audit and review

The laboratory shall

* establish and maintain an appropriate quality system, documents its elements and make them transparent

* define policies and objectives and its commitment to GLP

* prepare a quality manual

The quality manual shall state the laboratory's policies and operational procedures and shall contain

* table of contents

* declarations (quality policy statements, objectives, commitments)

* organization and management structure of laboratory

* basis of quality assurance system

* procedures for control and maintenance of documentation

* job descriptions of staff

* the laboratory's procedures for achieving traceability of measurements

* the laboratory's scope of calibrations or tests

* monitoring and evaluation of testing facilities and procedures

* reference to calibration, verification and test procedures

* reference to all major equipment

* reference to reference standards

* reference to procedures for calibration, verification and maintenance of equipment

* reference to verification practices including inter laboratory comparisons, proficiency testing programmes, use of reference materials and internal quality control schemes

* procedures for feedback and corrective actions

* arrangements for permitting departures from documented policies in exceptional cases

* procedures for dealing with complaints

* procedures for protecting confidentiality and proprietary rights

* procedures for audit and review

The laboratory shall arrange for audits of its activities at appropriate intervals to verify compliance to its quality system. The quality system itself has to be reviewed on a yearly basis and results must be documented. In addition to periodic audits the laboratory should implement checks such as internal Q.C. checks, proficiency testing and participation in ring analysis.

3. Personnel

The laboratory shall have sufficient personnel with the necessary education, training, technical knowledge and experience; it shall update the training and keep relevant records.

4. Accommodation and environment

The laboratory shall be in a suitable and proper environment (building, layout, energy sources, lighting, heating, cooling, ventilation) not affecting results in any way. Adequate measures shall be taken to ensure good housekeeping in the laboratory.

5. Equipment and reference materials

The laboratory shall be furnished with all items of equipment (including reference materials) required for the correct performance of calibrations and test. All equipment shall be properly maintained and relevant records be kept. Each item of equipment incl. reference material shall, when appropriate, be labeled, marked or otherwise identified to indicate its calibration status. Records shall be maintained of each item of equipment and all reference materials significant to the calibrations or test performed.

6. Measurement traceability and calibration

The laboratory shall have an established programme for the calibration and verification of its measuring and test equipment. Reference materials shall, where possible, be traceable to national or international standards of measurement, or to national or international standard reference materials.

7. Calibration and test methods

The laboratory shall have documented instructions on the use and operation of all relevant equipment, on the handling and preparation of items and for calibration and testing. All instructions, standards, manuals and reference data relevant to the work of the laboratory shall be maintained up-to-date and be readily available to the staff. Calculations and data transfers shall be subject to appropriate checks and as far as computers are used, procedures have to be established and implemented for protecting the integrity of data.

8. Handling of calibration and test items

The laboratory shall have a documented labeling system to ensure that there can be no confusion regarding the identity of such items at any time; condition of test items upon receipt shall be recorded. The laboratory shall have documented procedures and appropriate facilities to avoid deterioration or damage to the calibration or test item, during storage, handling, preparation, and calibration or test. Where items have to be stored or conditioned under specific environmental conditions, these conditions shall be maintained, monitored and recorded where necessary. Furthermore the laboratory shall have documented procedures

for the receipt, retention or safe disposal of calibration or test items, including all provisions necessary to protect the integrity of the laboratory.

9. Records

The laboratory shall maintain a suitable recording system retaining all original observations, calculations and derived data, calibration records and a copy of the calibration certificate, test certificate or test report for an appropriate period of time. All records, certificates and reports shall be stored, held secure and in confidence to the client.

10. Certificates and reports

The results of each calibration, test, or series of calibrations or tests carried out by the laboratory shall be reported accurately, clearly, unambiguously and objectively, in accordance with any instructions in the calibration or test methods. The results should normally be reported in a calibration certificate, test report or test certificate and should include all the information necessary for the interpretation of the calibration or test results and all information required by the method used. A minimum of information is listed in the guide.

11. Sub-contracting of calibration or testing

Where a laboratory sub-contracts any part of the calibration or testing, this work shall be placed with a laboratory complying with these requirements. The laboratory shall ensure and be able to demonstrate that its sub-contractor is competent to perform the activities in question and complies with the same criteria of competence as the laboratory in respect of the work being sub-contracted. The laboratory shall advise the client in writing of its intention to sub-contract any portion of the testing to another party.

12. Outside support services and supplies

The laboratory shall use only those outside support services that are of adequate quality to sustain confidence in the laboratory's calibrations or test.

13. Complaints

The laboratory shall have documented policy and procedures for the resolution of complaints received from clients or other parties about the laboratory's activities. A record shall be maintained of all complaints and the actions taken by the laboratory.

3. SUMMARY OF RECOMMENDATIONS for upgrading laboratory facilities

The present situation and condition of the laboratories requires an urgent up-grading to improve working conditions and to put the laboratory more in line with international standards.

In particular the following modifications or improvements are suggested:

GENERAL

1. All laboratories need a clean working environment, free of dust and with moderate climate. In order to achieve this the following measures are recommended:

   a) all windows to be changed to dust and air tight frames (e.g. aluminum frames with double thermo glazing)

   b) the building's inner court to be closed from the roof, providing however a mechanism for ventilation and air exchange

   c) the roof to be provided with thermal insulation (e.g. polyurethane containing layers)

2. The layout of the laboratories has to be improved as to provide separate areas for specific functions to be performed, such as sample storage, sample preparation, weighing, physico-chemical testing and other wet chemical procedures; an instrument room, a separate room for GC/MS, a washing room, an archive, a meeting room and a bulk chemical store. Such areas and rooms shall be arranged in a logical sequence and have direct access.

3. Old laboratory furniture has to be removed and should be replaced by more flexible modular units. Surface materials should be chosen according to the specific requirements and environment of the particular rooms. A good and functional design of all laboratory furniture is important and should provide also for integrated work space for analysts and laboratory technicians. Work tables with a height of 750 mm may be combined easily with 900 mm work benches. The special architecture of the old building suggests to make use of the niches for wall cabinets, integrated working desks or washing basins.

4. The electrical wiring for the laboratories needs to be checked and partly modified. High and low voltage protection as well as a phase failure protector should be provided for the whole laboratory.

5. Computerized equipment as well as some other vital equipment (permanently ventilated safety cabinets, storage for reference standards etc.) shall be serviced through an UPS (Uninterruptable Power Supply) through separate circuits.

6. Grounding facilities have to be checked and improved if found unsatisfactory. Please refer also to local regulations.

7. Water pressure in the building should be improved either by increasing height of water tanks or by installing a water pressure pump.

8. Warm water supply is recommended for the washing rooms or areas in the building.

9. As water supply in the complex depends on reservoirs to be filled periodically, an alarm system indicating low and no water situations should be installed. Automatic filling of reservoir would be useful.

10. The drainage system for rain and ordinary waste water should be separated from drainage of contaminated waste water which would be treated in the adjacent water treatment plant.

11. Additional waste collection points shall be incorporated into the laboratory furniture or layout.

12. All chemical laboratories may be fitted with floor drains except for the micro biology lab where no floor drain is permitted.

13. Gas supply lines should be kept at minimum length; small numbers of gas cylinders may be kept in the laboratory in special safety cabinets. Alternatively installation may be done outside the building in a secured and shaded place. Gas purity shall be 99.9995 % or better for nitrogen and hydrogen.

14. Air-conditioning is required for the laboratories during the hot season of the year. Considering local conditions and problems, split type units are preferable to window type or central air-conditioning.

15. Communication channels shall be provided throughout the building enabling the connection of telephones and computers.

16. Emergency showers have to be provided near the exits of all laboratories with min. of 30 liters/min of water flow. Likewise the pilot plant should have an emergency shower. Along with the emergency showers proper eye washing stations will have to be installed.

17. Fire fighting equipment has to be provided in sufficient quantities and along with local regulations. Additionally a sprinkler system may be useful.

18. Provision for fire hydrants should be made according to local standards and regulations. A master plan for fire fighting and other emergency procedures should be prepared together with HIL.

19. For the upper floor an emergency exit / escape route should be provided and marked.

20. A general alarm system should be installed for the building and the pilot plant.

21. A bulk chemical store may be provided outside the IPFT building and shared with the pilot plant. Easy access by car and truck should be guaranteed along with facilities to unload bulky materials such as palettes or drums. The store shall also make provision to repack or refill material for transport to and use in the laboratories.

22. Floor finishes shall be uniformly smooth and washable. Floor drains (except for microbiology labs) will facilitate general cleaning.

ANALYTICAL LABS

23. The following rooms or functional areas have to be added:

    1 sample storage room
    1 weighing room or area
    1 room for physico-chemical testing
    1 washing room or ventilated area

24. Analytical reference standards have to be kept in dedicated areas and stored under prescribed and defined conditions (size of equipment to be considered).

25. Weighing of standards and samples has to be performed in safe areas. The use of special weighing tables, such as laminar flow weighing cabinet, is recommended.

26. Proper fume cupboards have to be installed in the sample preparation area and used for all work producing odours of pesticides or other toxic or hazardous material.

27. Waste collection systems should be provided either as an integral part of the laboratory furniture or as separate utilities placed in safe areas.

28. The layout of the analytical laboratory has to be replanned so that the rooms are in a logical sequence according to the work flow.

FORMULATION TECHNOLOGY

29. The new layout has to provide for the following additional rooms or dedicated areas:

    1 weighing room or dedicated area
    1 room or dedicated area for climatic chamber
    1 washing room or dedicated ventilated area

30. Weighing and preparation of samples has to be performed in safe and well ventilated areas. Proper fume cupboards have to be installed in the sample preparation area and used for all work producing odours of pesticides or other toxic or hazardous material.

31. In addition to fume cupboards local scavenging devices are recommended to control small areas where fumes or odours could develop (e.g. at the malvern sampling devices).

32. Waste collection systems should be provided either as an integral part of the laboratory furniture or as separate utilities placed in safe areas.

33. The climatic chamber used for the accelerated storage tests should be relocated to a dedicated area or room and fitted with a special exhaust system to be activated before the chamber is opened.

34. The new layout of the analytical laboratory should bring the rooms closer together and arrange them in a sequence according to the work flow.

PILOT PLANT

35. For the establishment of the Safety & Packaging Laboratory the recommendations made by previous UNIDO consultant in 1992 shall be followed.

36. The installation of proper fume cupboards is required for both laboratories. In addition to these it is recommended to provide some local scavenging devices for areas where barrels or large packages containing pesticides or other hazardous material are opened.

37. The laboratory floor should be fitted with a floor drain; it should be smooth and washable and slightly sloped towards the drain.

38. Ideally, however, this laboratories should be relocated outside the pilot plant and on ground level.

BIO SCIENCES

39. Four separate insectaries should be arranged with individual temperature and humidity control. Their ventilation system should not be interconnected with the rest of the laboratory.

40. Dedicated areas for the processing and storage of plant material has to be provided for the botanical laboratory.

41. Existing concrete slabs (partly with cupboards) will need a new and smooth working surface as far as they are not removed completely. Also all sinks have to be renewed.

42. Pesticide application must be done in special chambers or ventilated areas to avoid contamination of the working environment.

43. The future equipment testing laboratory will require an additional room or separate hall. The laboratory may be located outside the present building and complemented by a workshop.

MICROBIOLOGY

44. This new laboratory should be located in an area well separated from the other laboratories with a special ventilated entrance foyer.

45. The laboratory must be air conditioned and is not allowed to have a floor drain.

46. Specific recommendations made in the report of K.A. Cook shall be followed.

4. CONCLUSIONS

The Institute of Pesticide Formulation Technology (IPFT) at Gurgaon is devoted to research and training in various aspects of pesticide formulation technology. Furthermore the institute is playing a central role in maintaining contacts and cooperation with many other national and international R&D institutions and also in coordinating national activities of RENPAP.

The institute has great variety of sophisticated process machinery and analytical equipment, but lacks adequate building facilities, basic services and implementation of GLP (Good Laboratory Practice). The laboratory building constructed in the early eighties and the general working conditions do not correspond to international standards. The present situation is not acceptable and far away from any possibility of obtaining an accreditation according to international standards.

Regardless whether accreditation is aimed for or not, the role of IPFT as national and regional institution for South East Asia demands for a representative establishment. To achieve this, two major improvements are necessary:

a) improvement of facilities
b) improvement of operational procedures

To improve existing facilities, major renovation and up-grading work is necessary as the result of this mission and the report show. The architecture of the building is not ideal for modern laboratories. Limitation in space and in grouping the various work units will always lead to some compromise. Additional space will be required outside the present laboratory building.

Therefore, the options for improvement of facilities should, apart from renovation of present building and up-grading of facilities, also consider shifting of sections and construction of new facilities. Costs for major renovation can be as high as those for new construction and, by experience, the hassle of discovering hidden pipes or undocumented structures during the renovation process had already caused many disputes in the past. On the other hand the construction of new buildings usually involves long lasting preparations and procedures to obtain all necessary permits such as utility permits, site permits, building permits and others. In any case a proper financial analysis should be done first.

In case a new building would be constructed, the safety & packaging, the formulation laboratory and the chemical stores should be accommodated on ground level near to the pilot plant.

Additionally a first aid room should be provided to serve the whole complex.

The major recommendations for renovation aim at improving the layout and the occupational health & safety situation as well as fulfilling general requirements for laboratories of that kind. The improvement of operational procedures are necessary to work more in line with, or fully implement GLP procedures. The establishment of an adequate quality assurance system should be achieved.

Apart from all technical recommendations it should be mentioned that also proper housekeeping is important in providing a continuously good environment. A properly maintained building has a potentially longer and less expensive service life than a poorly maintained one. Also employee morale and productivity, for instance, are enhanced by clean, attractive, and orderly working environment. Last but not least it contributes to the reputation of an institution.

As the institution is aiming at self-finance generating activities and thus depends on clients, it is quite important to

- render a good service
- have a representable institution
- ensure the protection of clients' confidential information and proprietary rights

Substantial consideration should be given to the latter point as the industrial client would certainly not be interested in using the institute's services for research & development if he knows that others, especially competitors, could gain access to ongoing research or results. Therefore, access to certain areas should be controlled and limited, reception areas and meeting rooms for visitors should be available and information should always be kept in secure places and archives.

The various suggestions for laboratory furniture layout given in the annexes should be considered as still flexible and can of course be modified. The brochures of several laboratory furniture suppliers attached to this report are <u>not</u> meant to propagate these products - but rather to visualize and illustrate present technology. Whilst many items could probably be manufactured locally, it is strongly recommended to obtain safety technology from well known suppliers accredited or certified for quality production. A list of some European suppliers, some of them with projects in India, is given in annex [15]. Often these companies do also perform detailed planning and installation of their equipment.

Special consideration must be given to total airflow management, especially since air conditioning systems are mainly closed systems. Proper fume cupboards and exhaust systems are vital for any pesticide or other laboratory where toxic or hazardous material are handled.

If time and resources permit, above recommendations should be used to update or create a proper facility master plan which includes also the financial analysis of the different options and shows short and long term perspectives. The master plan should identify the chosen option and define construction or renovation budget and schedule.

At the same time ownership questions should be clarified with a policy towards a clearer separation between IPFT and HIL. This is of special relevance in view of possible future accreditation as, according to ISO guide 25, staff and organization shall be fully independent and maintain its integrity at all times.

Finally and whatever way has been chosen, construction should be reviewed during renovation works to make sure that requirements are being met. Before any ready made furniture or other items are ordered, all relevant dimensions, electrical specifications, water and drainage and other requirements should be verified. A close cooperation between the architects, engineers and specialists is absolutely necessary.

B. Sugavanam/tg
12 February 1996

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

JOB DESCRIPTION

DP/IND/89/128/11-78

Post Title: Quality Control/Quality Assurance Specialist (Pesticides)

Date required: ASAP

Duration: 2 weeks

Duty station: New Delhi (travel to Gurgaon)

Purpose of the project: An institution building UNIDO/GOI project, to assist the pesticide industry in India by developing and promoting safer, new generation pesticide formulations and utilizing indigenously developed technology for production of formulations and improving the formulation capabilities of the country.

Duties: The specialist in consultation with the counterparts is expected to advise on the redesigning of the quality control and formulation laboratory, upgrade the facilities including provision of fume cupboards, utility lines, extraction devices and storage areas for chemicals and cylinders. The renovation is needed for the building to make it more in line with modern laboratories. He is expected to advise on quality assurance protocols and ISO 9000 so that the institute could apply for these once the laboratories are upgraded.

He is expected to submit a report on his findings and recommendations.

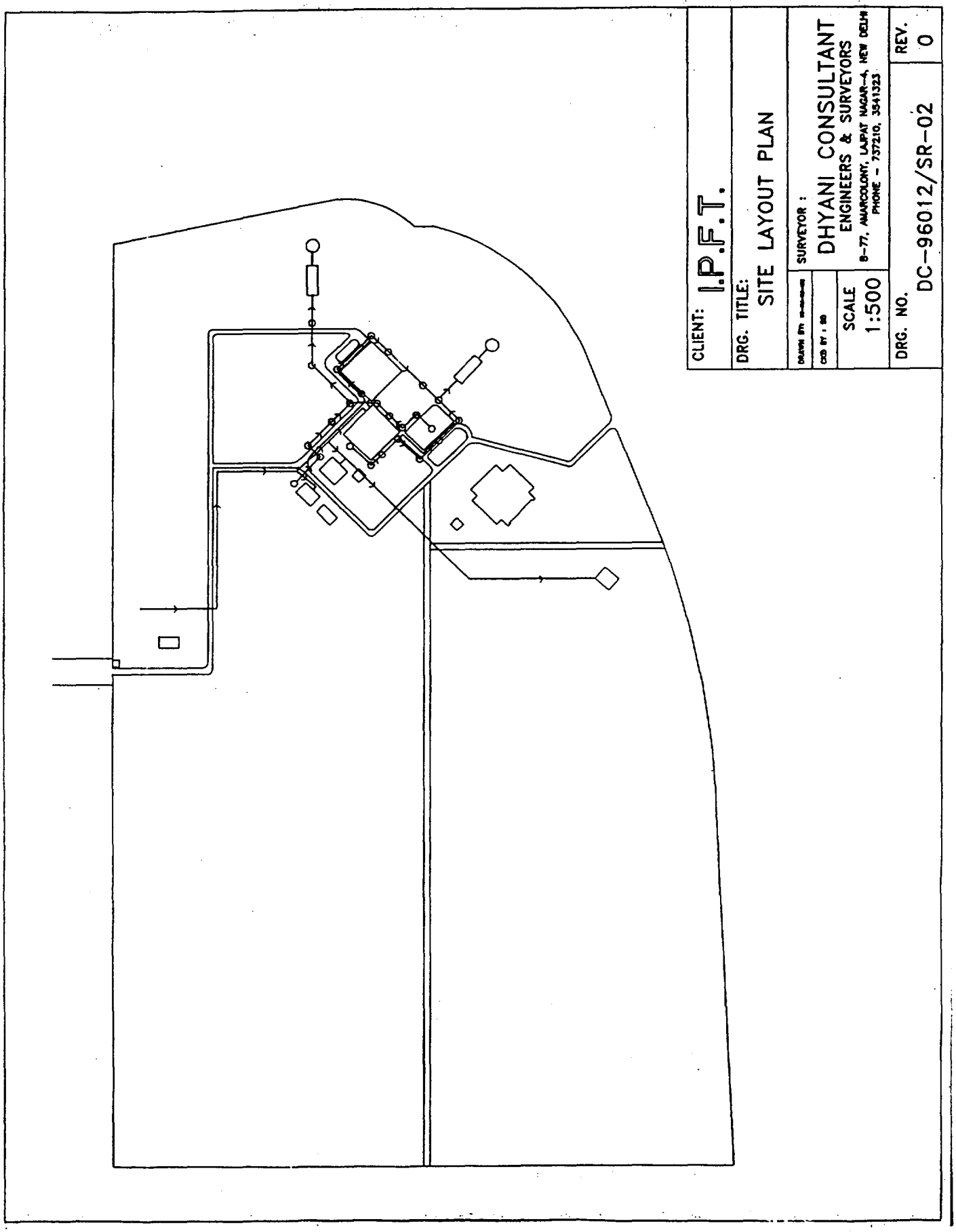
Qualifications: An analytical Chemist with long standing experience in a setting up of analytical laboratories especially those using toxic chemicals. He/she should be familiar with international standards, FAO specification, MRL, QA and ISO 9000.

Language: English

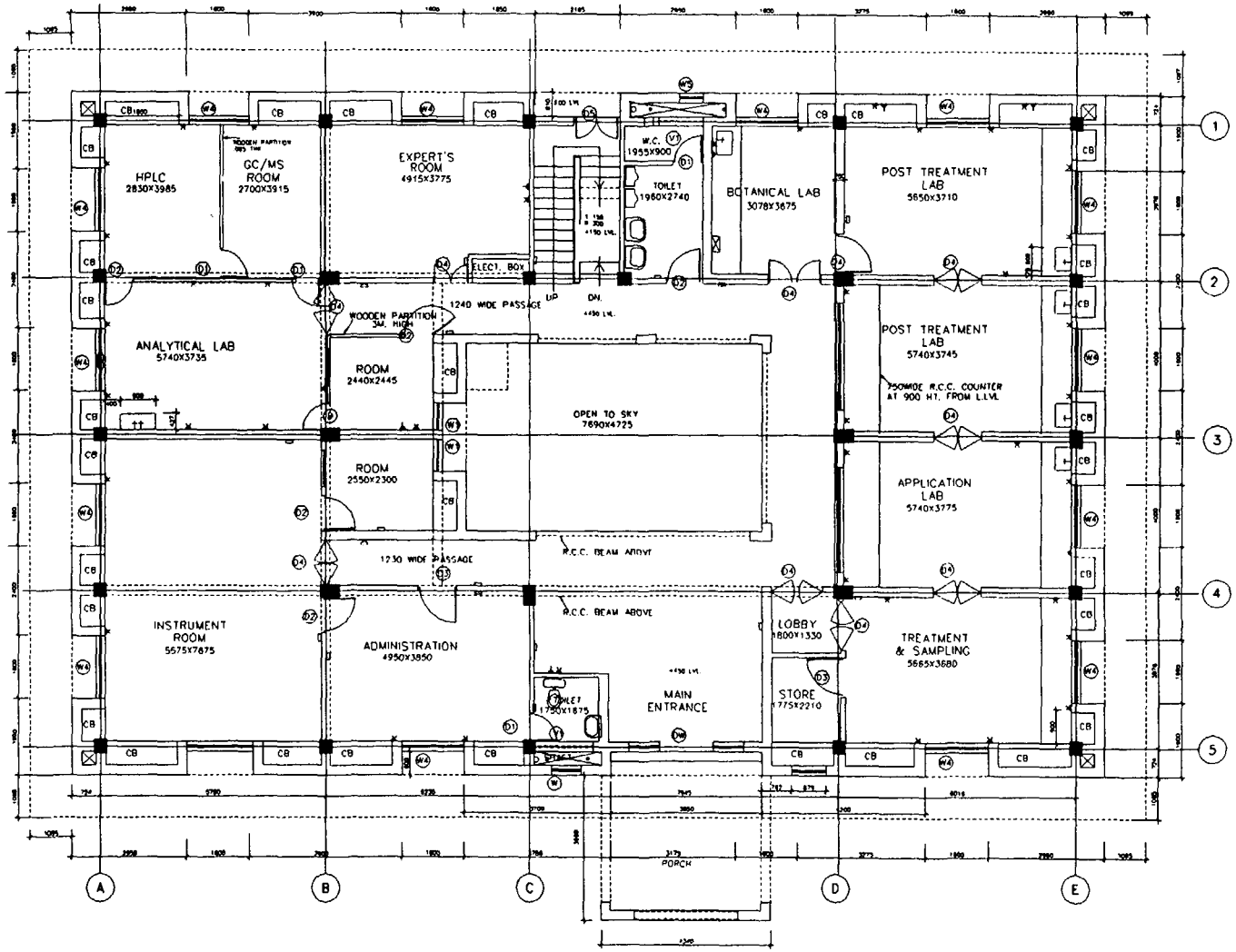
Background Information:

The Institute of Pesticide Formulation Technology (IPFT) located in Gurgaon on outskirts of New Delhi is a National Institute, set up by the Government of India with assistance from UNIDO. The Institute is devoted to research and training in various aspects of pesticide formulation technology, it safe use and is planning a central role in maintaining contacts and cooperation with other national and international R&D institutions and also in coordinating national activities of RENPAP.

Site plan of IPFT



Plan of ground floor



NOTES:-

1. ROOM HEIGHT FLOORLVL. TO ROOF BOTTOM 3540
2. ALL DIMENSIONS ARE IN MM.
3. DON'T SCALE THE DRAWING, ONLY WRITTEN DIMENSIONS TO BE FOLLOWED.
4. HEIGHT OF SHUTTER OF DOORS FROM FLOOR LEVEL IS 2000

SCHEDULE OF DOORS & WINDOWS

S. NO.	DESCRIPTION	SIZE	CILL	LINTEL
1	D	750x2000	-	2515
2	D1	750x2515	-	2515
3	D2	900x2515	-	2515
4	D3	1000x2515	-	2515
5	D4	1200x2100	-	2515
6	DW	3000x2515	-	2515
7	W1	850x1700	840	2515
8	W2	2900x1700	840	2515
9	W3	750x1700	840	2515
10	W4	1600x1700	840	2515
11	V1	1200x900	1450	2350

LEGEND

SYMBOL	NAME	HEIGHT
	METER BOX	1200
	SWITCH BOARD	1200
	POWER POINTS (5 AMP)	1200
	POWER POINTS(15 AMP)	1200
	BUZZER	2400
	RAIN WATER PIPE 100ø	
	VENT PIPE 75ø	

CLIENT:

DRG. TITLE:
EXISTING GROUND FLOOR PLAN

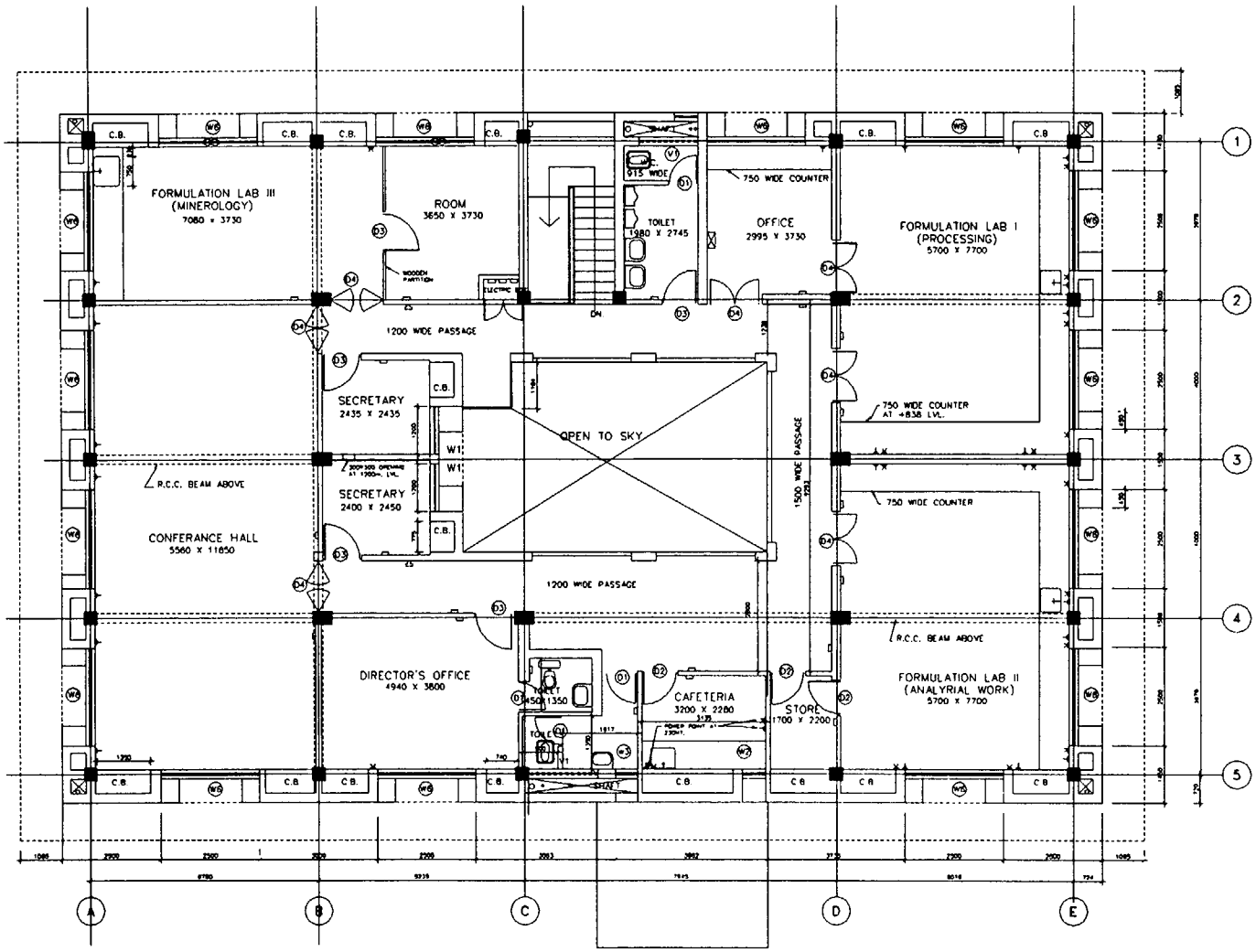
SURVEYOR :
DHYANI CONSULTANT
ENGINEERS & SURVEYORS
B-77, AMARCOLONY, LAJPAT NAGAR-4, NEW DELHI
PHONE - 737210, 3541323

SCALE
1:50

DRG. NO.
DC-96012/SR-01

REV.
0

Plan of first floor



NOTES:-

1. ROOM HEIGHT FLOORLVL. TO ROOF BOTTOM 3540
2. ALL DIMENSIONS ARE IN MM.
3. DON'T SCALE THE DRAWING, ONLY WRITTEN DIMENSIONS TO BE FOLLOWED.
4. HEIGHT OF SHUTTER OF DOORS FROM FLOOR LEVEL IS 2100.

SCHEDULE OF DOORS & WINDOWS

S. NO.	DESCRIPTION	SIZE	CILL	LINTEL
1	D	750x2000	-	2515
2	D1	750x2515	-	2515
3	D2	900x2515	-	2515
4	D3	1000x2515	-	2515
5	D4	1200x2100	-	2515
6	DW	3000x2515	-	2515
7	W1	850x1700	840	2515
8	W2	2900x1700	840	2515
9	W3	750x1700	840	2515
10	W4	1800x1700	840	2515
11	V1	1200x900	1450	2350

LEGEND

SYMBOL	NAME	HEIGHT
	METER BOX	1200
	SWITCH BOARD	1200
	POWER POINT(6 AMP)	1200
	POWER POINT(15 AMP)	1200
	BELL/FAN	2600
	RAIN WATER PIPE 100Ø	
	VENT PIPE 75Ø	

CLIENT:

DRG. TITLE:
EXISTING FIRST FLOOR PLAN

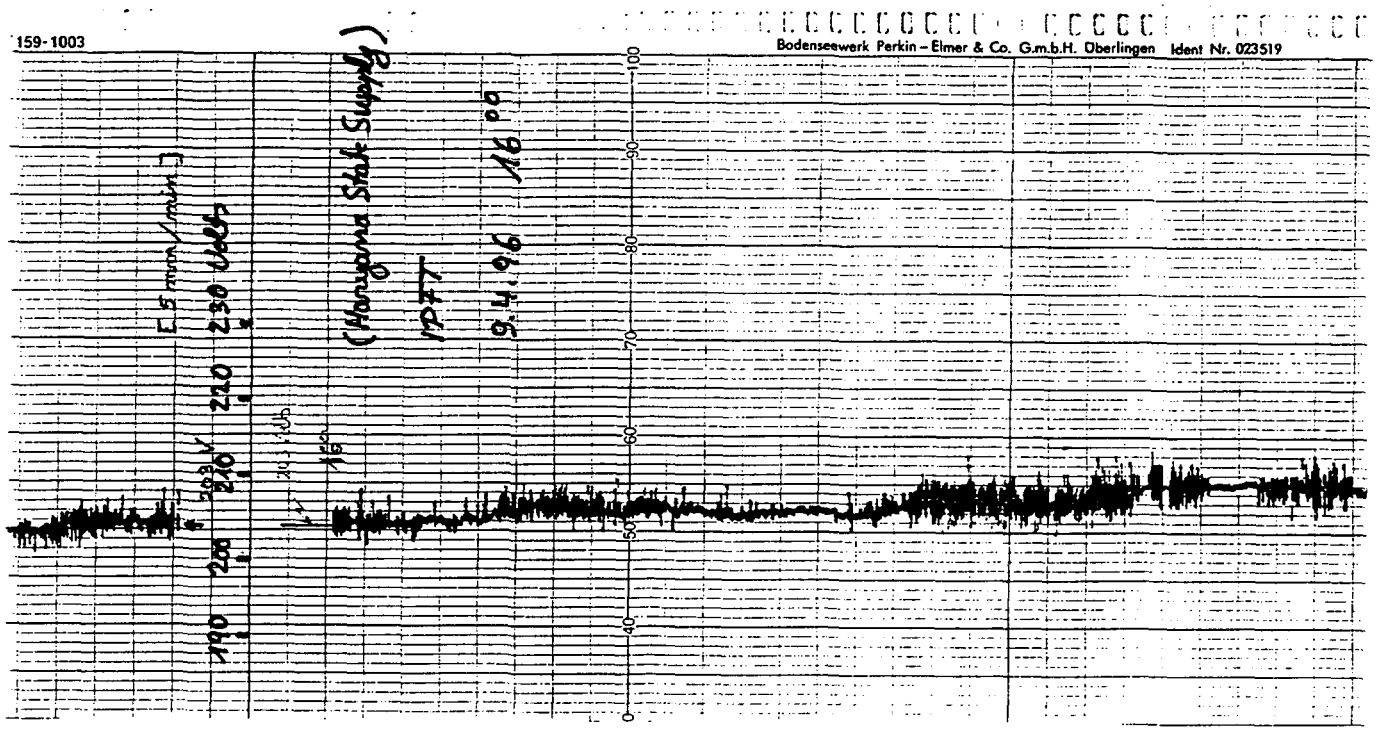
SCALE
1:50

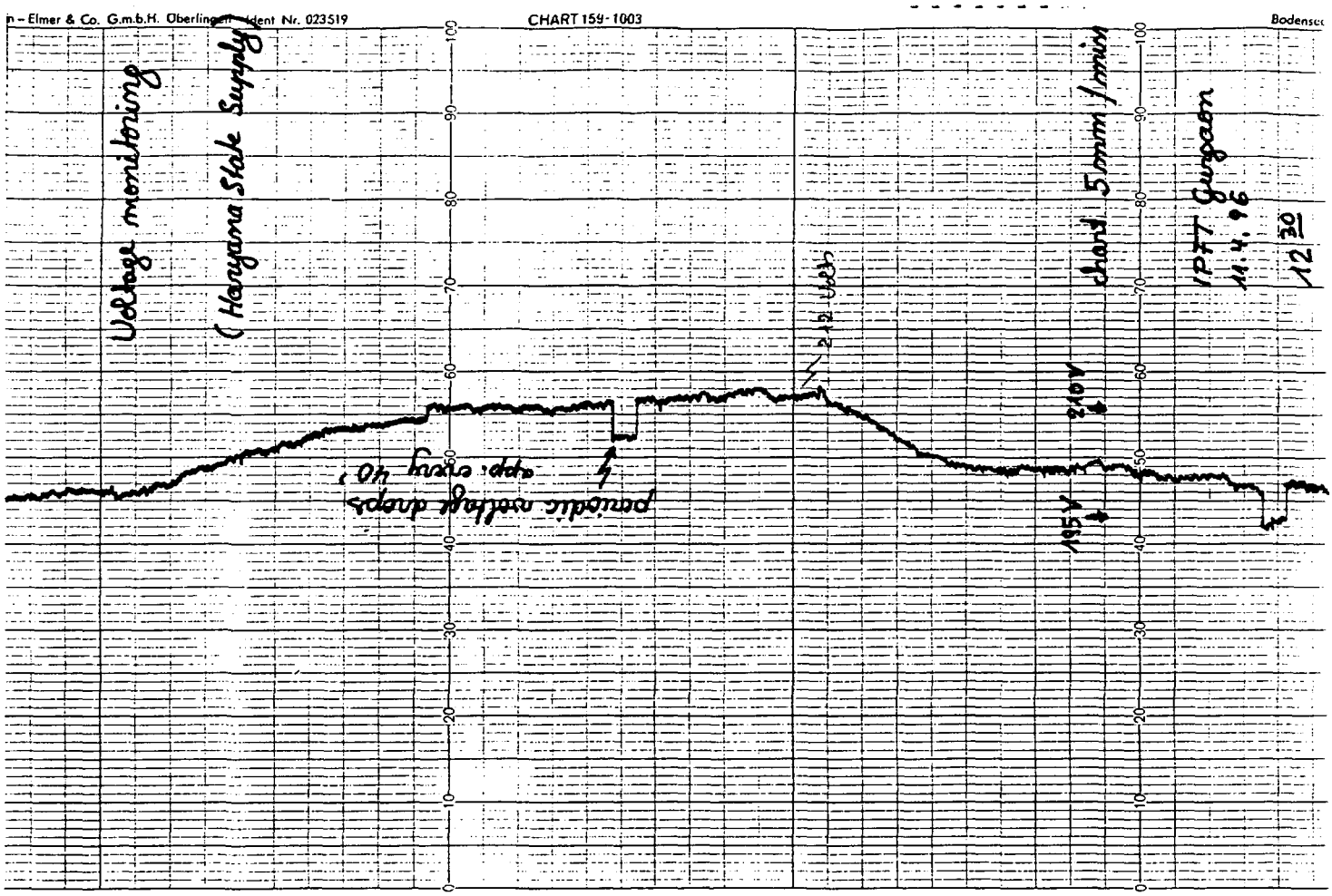
SURVEYOR :
DHYANI CONSULTANT
ENGINEERS & SURVEYORS
B-77, AMARCOLONY, LAJPAT NAGAR-4, NEW DELHI
PHONE - 737210, 3541323

DRG. NO.
DC-96012/SR-02

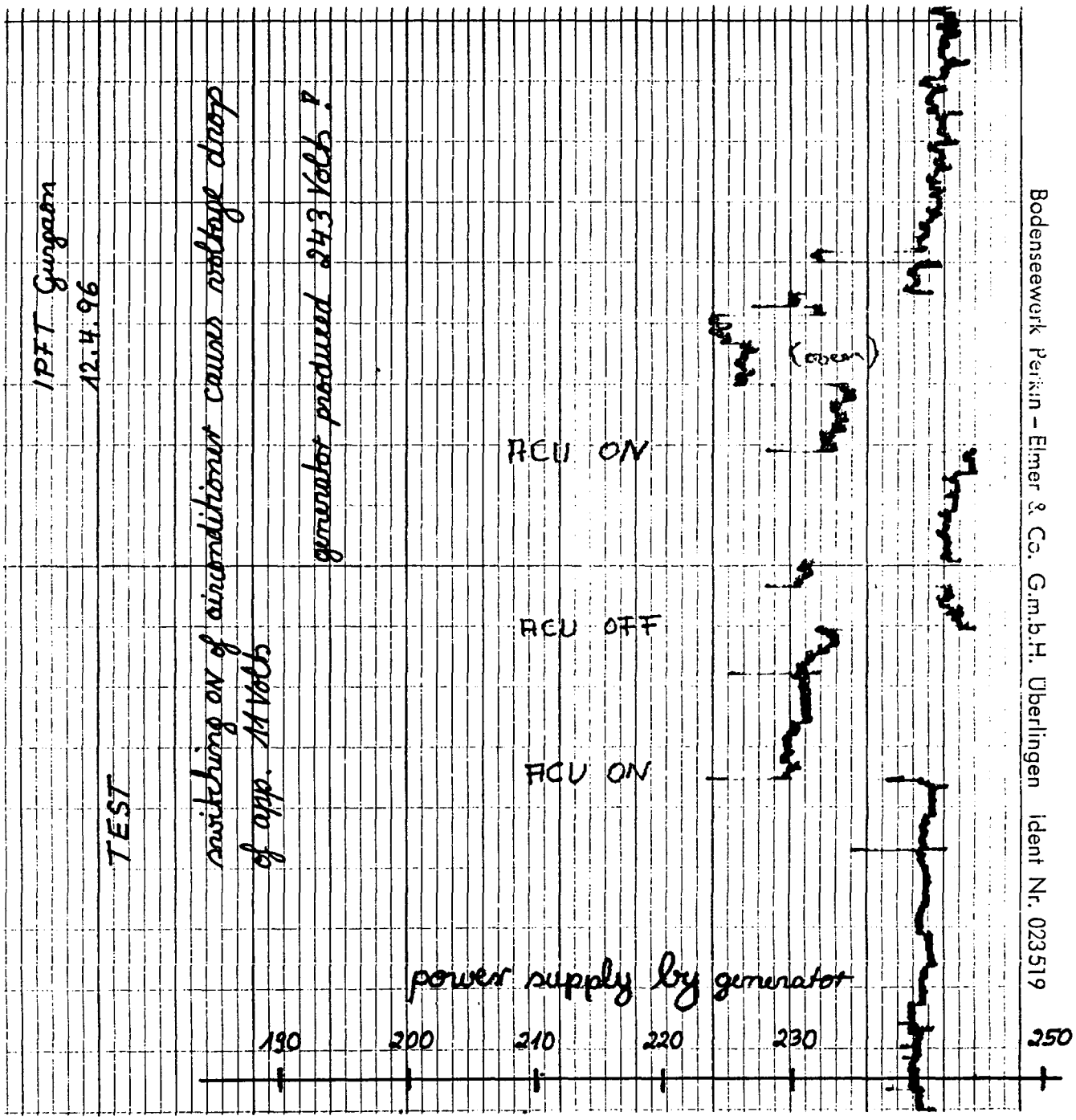
REV.
0

Electricity monitoring





Electricity monitoring with equipment load



Equipment of analytical section and their power consumption

	IPFT - Institute for Pesticide Formulation Technology										
DEP	SN	EQUIPMENT	FUNCTION	Volts	Cycles	Amps	Watts	Ph	Plug	special requirements	Use
AN-1	1	Büchi 681 & 683	MPLC	220	50		100	1	LS		y
	2	Perkin Elmer 559	UV-VIS	220	50				LS		y
	3	Büchi Rotavapor	Vacuum Evaporation	220	50	5,5	1210	1	LS		y
	4	Scientific	Heating mantle	220	50		500	1			y
	5	Scientific	heating mantle	220	50		500	1			y
	6	Pye Unicam	vacuum pump	230	50	1,3	299	1			y
	7	local	vacuum pump	220	50	7	1540	1			y
	8	Haake K	circulating cooler	220	50		515	1			y
	9	Haake F3	heater	220	50		1100	1			y
	10	York Scientific	drying cabinet	220	50						y
	11	Bausch & Lomb	spectrophotometer				0	1			y
AN-2	12	Mettler PM 2000	laboratory balance	200/240	50		10	1	LL		y
	13	Mettler AE 240	analytical balance	200/240	50		10	1	none		y
	14	Orion AF 8	Karl Fischer titrator	240	50		200	1	LS		y
	15	HP 1050	HPLC pumps	200/240	50		300	1			y
	16	HP 1040	HPLC detector	200/240	50		200	1			y
	17	HP 9153 C	HPLC computer system	200/240	50		220	1			y
	18	HP 300 (9000)	HP data station	200/240	50		250	1			y
	19	HP screen	HP screen	230	50		45	1			y
AN-3	20	HP 5890	gas-chromatograph	240	50		2200	1			y
	21	HP 5970	MSD	240	50		930	1			y
	22	HP 9133	GC/MS computer	230	50	0,75	172,5	1			y
	23	HP 300	data station	240	50		250	1			y
	24	HP screen	screen	230	50		45	1			y
	25	HP 7475A	plotter	220	50		35	1			y
	26	GastroNorm'90	freezer				0				y
	27	Kelvinator	freezer	220			0	1			y

	IPFT - Institute for Pesticide Formulation Technology										
DEP	SN	EQUIPMENT	FUNCTION	Volts	Cycles	Amps	Watts	Ph	Plug	special requirements	Use
AN-4	28	Perkin-Elmer 1600	FTIR				0	1			y
	29	HP ColorPro	plotter				0	1			y
	30	HP 3392A	integrator	190/233	48/66		45	1			y
	31	Pye Unicam	PALL, HEAT-LES*Dryer	240	50	1	240	1			n
	32	Perkin Elmer 197	IR-spectrophotometer	230		0,4	92	1			y
	33	Suprex SFC/200A	Supercritical Fluid Chrom.	120			0	1			y
	34	PE- ISS 200	HPLC sampler	230	50		230	1			y
	35	PE-200	HPLC pump	230/240	50/60		70	1			y
	36	PE-235 C	HPLC diode array detector	220/230	50/60		105	1			y
	37	PE-600	HPLC link	220/240	50/60		45	1			y
	38	DEC PC 433dx	computer	220/240	50/60		300	1			y
	39	DIGITAL	screen	100/240	50/60		150	1			y
	40	OKIDATA 320	printer (9 pin dotmatrix)	220	50/60	0,45	99	1			y
	41	Perkin Elmer	LC pump 250	220/240	50/60		300	1			y
	42	PE-LC ovem 101	column oven	220/240	50/60		0	1			y
	43	PE LC 290	UV-VIS detector	220/240	50/60		200	1			y
	44	CAMAG II	TLC scanner	220			0	1			y
	45	HP 3396 A	integrator	230	50/60	0,3	69	1			y
	46	Epson LX-800	printer	220	50/60	0,4	88	1			y
	47	Perkin-Elmer 551	UV-VIS spectrophotometer	220	50		140	1			y
	48	Perkin-Elmer 8700	gas-chromatograph	240	50	8	1920	1			y
	49	Epson FX-850	printer	240	50/60	0,8	192	1			y
	50	P.-E. AutoSystem	gas-chromatograph	230	50/60	8	1840	1			y
	51	PE NELSON 1022	computer	110/220	50/60		0	1			y
	52	OKIDATA 320	printer (9 pin matrix)	220	50/60	0,45	99	1			y
	53	Chrompack 7525	hydrogen generator	230	50	1,2	276	1			y *
	54	Chrompack AG-110	air generator	220	50		140	1			y
	55	Chrompack 300-1	nitrogen generator	220	50		90	1			y
	56	Du Pont 8800	HPLC gradient controller				0	1			y

	IPFT - Institute for Pesticide Formulation Technology										
DEP	SN	EQUIPMENT	FUNCTION	Volts	Cycles	Amps	Watts	Ph	Plug	special requirements	Use
	57	Du Pont	HPLC column oven				0	1			y
	58	Du Pont	HPLC pump				0	1			y
	59	Du Pont	refractive index detector				0	1			y*
	60	Du Pont 860	absorbance detector				0	1			y
	61		integrator				0	1			y
	62	Sartorius 2405	analytical balance								y
	63	Mettler AE 240	analytical balance				0	1			y
	64	Bandelin RK102P	unltrasonic cleaner	220	50	0,6	132	1			y
	65										
	66	PYE UNICAM	IR				0	1			n*
	67	Perkin Elmer	GLC Sigma 2B				0	1			y*
	68										
	69										
	70		**TOTAL:**				**17493,5**				
	71										
	72		(Analytical Section)								
	73										
	74						Notes:		y	still used	
	75								n	no longer used	
	76								*	out of order	
	77										
	78		Note: ceiling lights, fans, air conditioners are not listed								
	79										
	80										
	81										
	82										
	83										
	84										
	85										

INSTRUMS.XLS

	IPFT - Institute for Pesticide Formulation Technology										
DEP	SN	EQUIPMENT	FUNCTION	Volts	Cycles	Amps	Watts	Ph	Plug	special requirements	Use
FO-1	86		corrossion tester	200	50/60		700	1			n
	87		peristaltic pump		50/60		180	3			y
	88	Dynomill	mill	380	50/60		0	3			y
	89	Turbula	mixer	380	50/60		180	3			y
	90	Eiger Mill (UK)	mill		50/60		750			110 V DC 750 W	y
	91	Eiger Mill	control unit	220	50/60		0	1			y
	92	Netsch	blender	110/220	50/60		80	1			y
	93	Aeromatic AG	fluid bed granulator	220	50/60		1500	1			y
	94	Watson-Marlow	pump for fluid bed granulator	220	50/60		150	1			y
	95	Büchi 190	spray dryer	220	50/60		2600	1			y
	96	Silverson	mixer	220/240	50/60		?	1		estimated 150 W	y
	97	Retsch	sample divider	220	50/60		12	1			y
	98	Erweka	sample processor (gran.)	220	50/60		?			estimated 750 W	y
	99	Seishin	recorder of photosizer	?				1			n
	100	Seishin	photosizer measuring unit	?				1			n
	101	Voetsch	climatic chamber	230	50	14,5	3100	1			y
	102	Bobe AEG	micropulverizer	220/380	50		750	1			y
	103	Haake K	cryostat for Dynamill	220	50/60		680	1			y
	104	Haake F3	cryostat portable	220	50/60		1100	1			y
	105	Haug	compr. for fl. bed gran.+spr.dr.	220	50		550	1			y
	106	Seishin	centrifuge for photosizer					1			n
	107	IKA	kneader	220/380	50		1100	3			n
	108		hotplate	240				1			
	109										
	110										

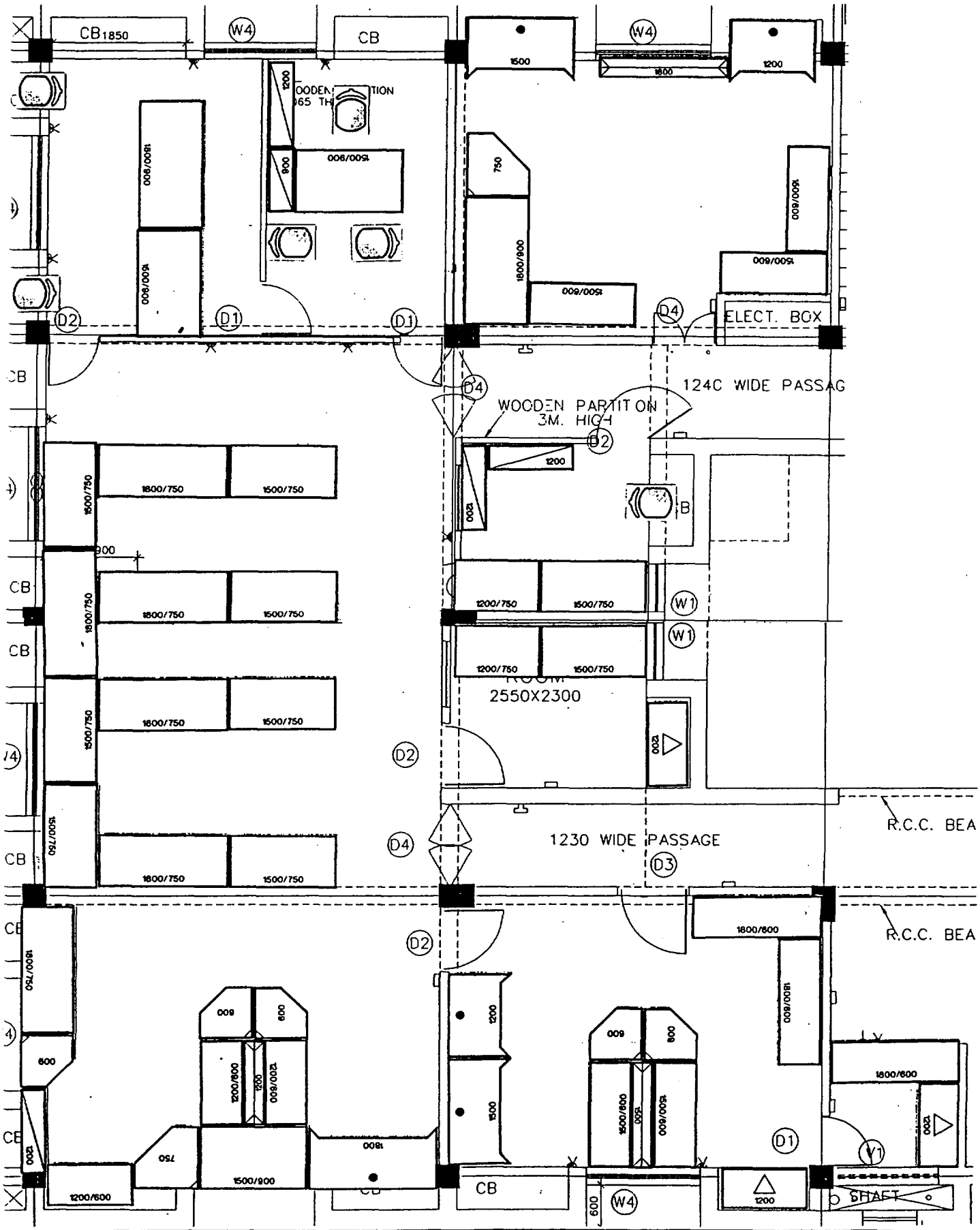
	IPFT - Institute for Pesticide Formulation Technology										
DEP	SN	EQUIPMENT	FUNCTION	Volts	Cycles	Amps	Watts	Ph	Plug	special requirements	Use
FO-2	99	Malvern	computer				350	1		estimated	y
	100		printer				45	1		estimated	y
	101	Malvern	particle sizer								y
	102	Malvern	sample unit liquid	220				1			y
	103	Malvern	sample unit powder	220/240			?	1			y
	104	Kruess	measuring unit film bal. meter	220				1			y
	105	Kruess	film balance meter								y
	106	Brookfield	digital viscosimeter	230			0	1			y
	107	Haake	recorder for Rotovosco	220/240			40	1		estimated	y
	108	Haake	measuring unit Rotovisco	100-240	50/60		100	1			y
	109	M5	viscosimeter								y
	110	LAUDA M3	thermostate bath	220/240	50/60		1200	1			y
	111	Mettler DL 40 RC	memotitrator	220/240	50/60		45	1			y
	112	Mettler GA 40	printer	220/240	50/60		25	1		estimated	y
	113	Kruess	tensiometer								y*
	114	Kruess	measuring unit tensiometer								y*
	115	Braun	sample homogeniser								y
	116	Labsonic 2000	control unit of homogeniser	240	50	2,5		1			y
	117	Bausch & Lomb	refractive index meter								y
	118	Cole Parmer 4658	hot plate				750	1		estimated	y
	119	Sartorius balance		220	50/60		30	1		estimated	?
	120		light intensity regulator								y
	121	Olympus	var. int. light for microscope					1			y
	122	Olympus BH-2									y
	123	Olympus S2H									y
	124	YORCO (local)	drying oven incl stabilizer	220/230			750	1		estimated	y
	125	ZENITH (local)	refrigerator	230	50	1,4		1			y
	126	METTLER	pan balance	200/240	50/60	0,045		1			?

	IPFT - Institute for Pesticide Formulation Technology										
DEP	SN	EQUIPMENT	FUNCTION	Volts	Cycles	Amps	Watts	Ph	Plug	special requirements	Use
	127										
FO-3	128	Du Pont 1090	thermal analyser								n*
	129	Yorco	glass drying oven								y
	130		water destillation set								y
	131	Fisher	sub sieve analyser								n
	132	Barnstead	organopure								n
	133	Pye Unicam SP9	AAS								n*
	134	Yorco	pH meter								?
	135		conductivity meter								?
	136	Sartorius	analytical balance								?
	137										
	138						Notes:		y	still used	
									n	no longer used	
									*	out of order	
			TOTAL :				**16767**				
			(Formulation Section)								
			Notes: 1) ceiling lights and fans are not included								
			2) some equipment data are still missing								

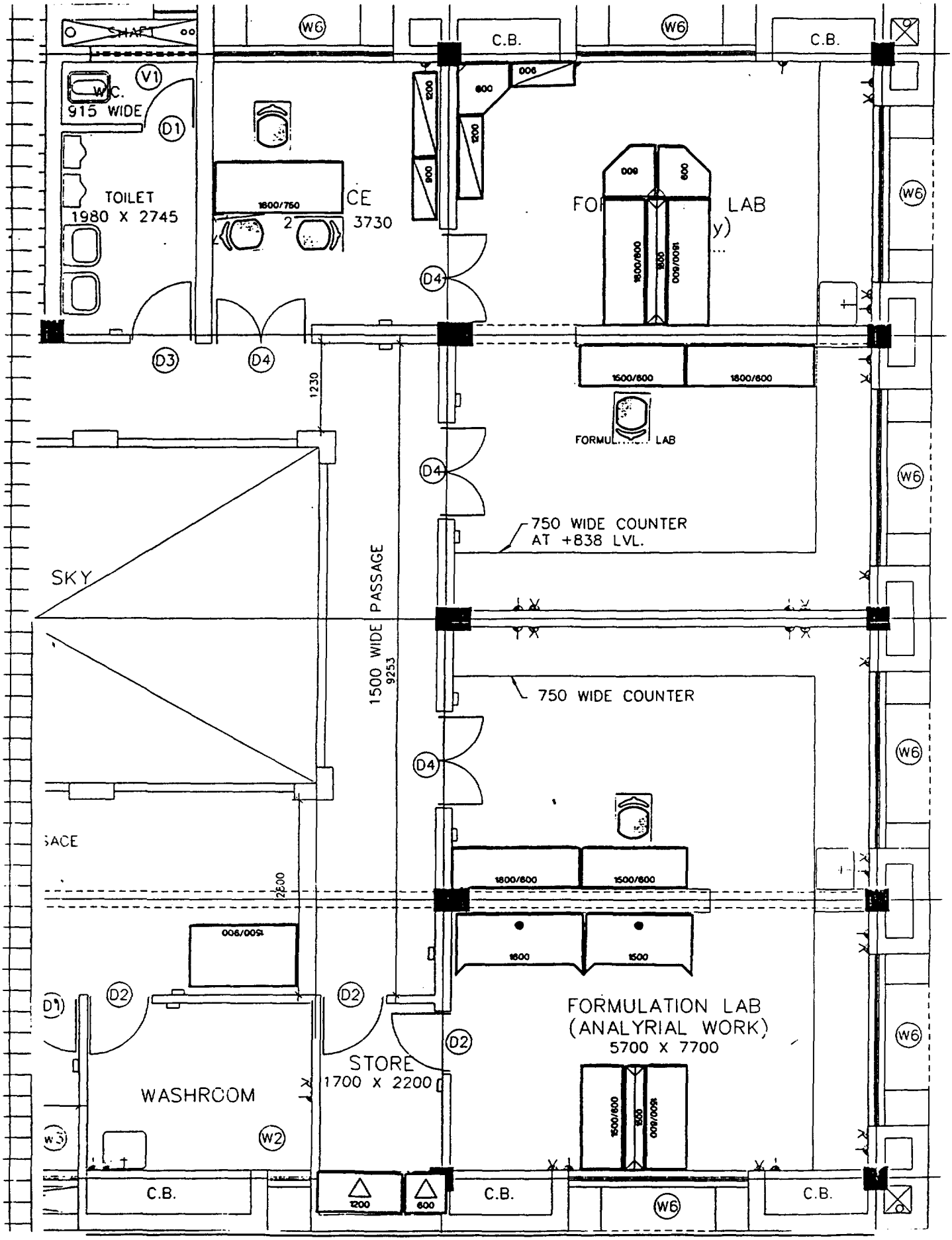
Staff list IPFT building - Institute for Pesticide Formualtion Technology

SECTION	ST	TITLE	NAME	FIRST	QUALIFICATION	DESIGNATION	SINCE	SPECIALIZATION
Analytical	1	DR	PANDEY	S.Y.	MSc. agr.chem.	Head of Section	1987	analytical instrumentation
	2	MR	AGRAWAL	G.D.	MSc. org. chem.	Scientist / supervisor	1985	
	3	DR	TALIWAL	A.K.	MSc. org.chem.	Scientist / supervisor	1987	
	4	MR	GUPTA	M.L.	BSc.	SSA / supervisor	1985	
	5	MR	GOEL	N.C.	MSc. anal.chem.	Analyst	1986	
	6	MR	VERMA	A.K.	MSc. phys.chem.	Analyst	1986	
	7	MR	PANDEY	H.R.	B.A.	Lab attendant		
	8	MR	YADAV	T.R.	H.S.	Lab attendant		
Formulation	1	DR	RAMDAS	P.K.	MSc phys.chem.	R&D man. / Head of S.	1984	pesticide formulation
	2	DR	PATANJALI	P.K.	MSc phys.chem.	Sr. surf.coll.ch./Dy.Head		colloid & surface chem.
	3	MR	SARIN	R.M.	BSc	SSA / supervisor		
	4	DR	KHATTER	S.K.	ind.ass.chemist	scientist / Supervisor		
	5	DR	SINGHAL	G.K.	MSC org.chem	Scientist / Supervisor		
	6	DR	AGRAWAL	A.K.	MSc org.chem.	Analyst		
	7	MR	KUMAR	S.	I.S.C.	Lab attendant		
	8	MR	CHAUHAN	A.S.	I.S.C.	Lab attendant		
Bio Science	1	DR	BHATESHWAR	N.K.	MSc entomology	PDM / Head of Section	1984	bio/botanical pesticides
	2	DR	RAMDEV	Y.P.	MSc entomology	entomologist / Dy Head	1984	application & data man.
	3	MR	DEGRA	J.P.	BSc agriculture	Field supervisor	1987	bio efficacy & field trials
	4	MR	SINGH	Y.	BSc agriculture	JSA	1987	application technology
	5	MR	MANDAL	B.C.	MSc zool./entom.	JSA	1988	screening of bio/bot.pes.
	6	MR	SHARMA	A.K.	H.S.	Lab attendant		
Pilot Plant	1	ENG	LUTHRA	R.P.	Chem. Eng.	Head of Section & IPFT		formulation safety
	2	ENG	DUTTA	V.N.	Chem. Eng.	T.O. / Head Pilot Plant	1994	formulation safety
	3	ENG	SINHA	R.N.	Chem. Eng.	T.M. Pilot Plant		formulation safety
	4	MR	SINGH	S.D.	H.S.	Lab attendant		
Administr.	1	MR	JAIN	N.K.	BCOM	cashier		
	2	MR	GHANDI	S.	BA	stenotypist		
	3	MRS	DAYAVATI		BA	typist		
Cleaning	1	MR	NARAYAN	S.	H.S.	cleaner		

Possible layout for analytical section

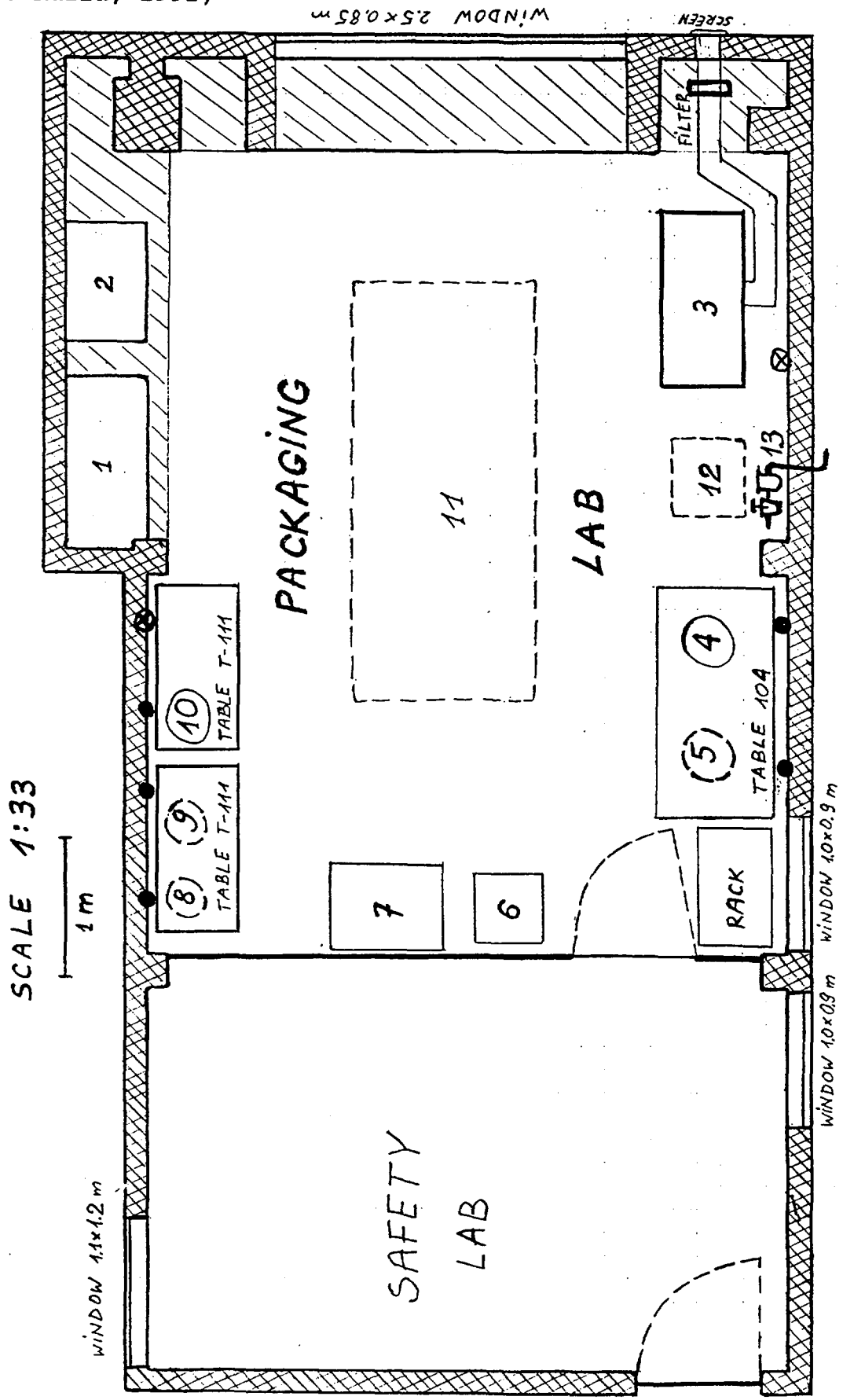


Possible layout of formulation section

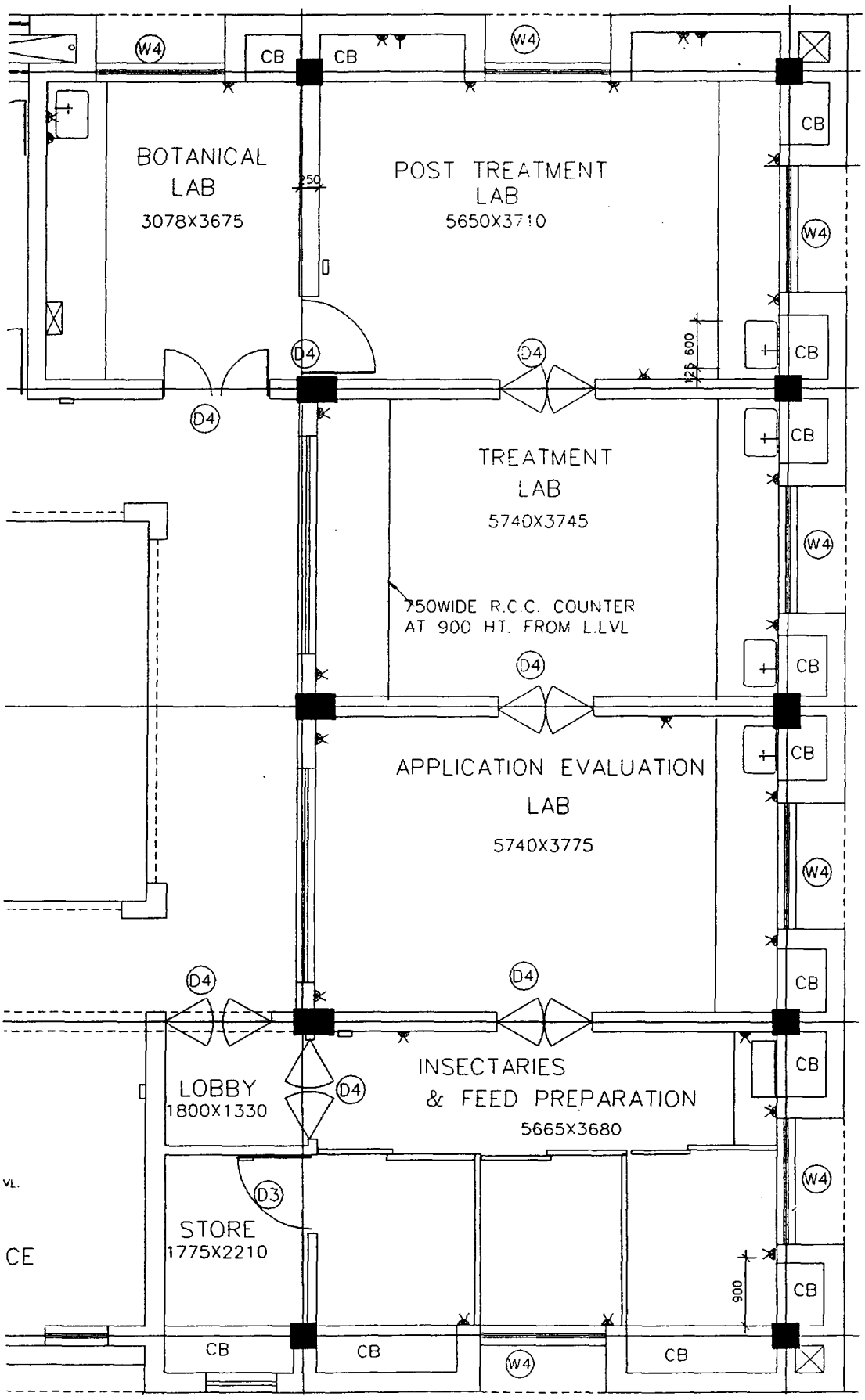


Recommended layout for packaging lab

(by Mr. Kuzia, 1992)



possible layout for bio-sciences lab

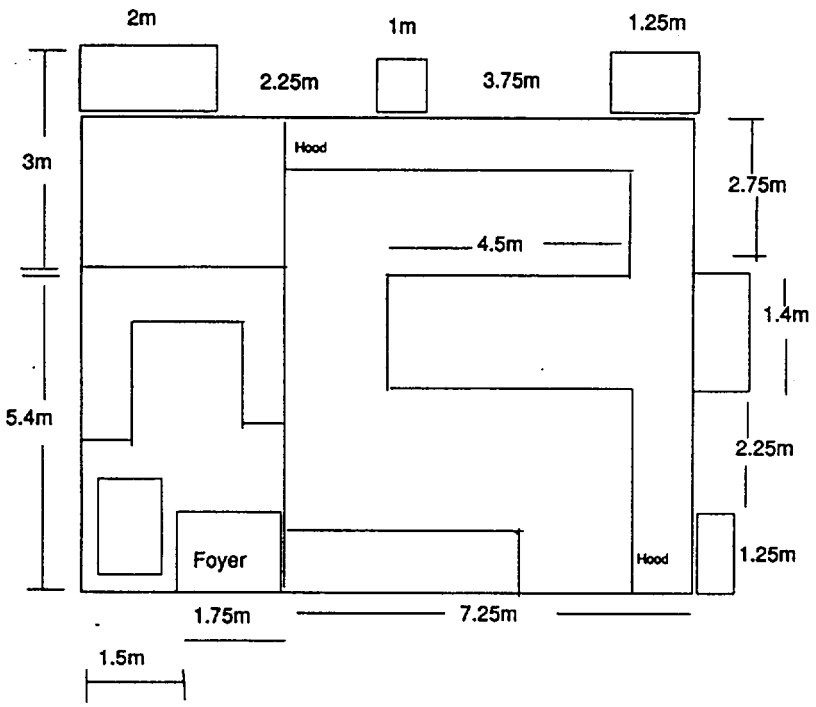


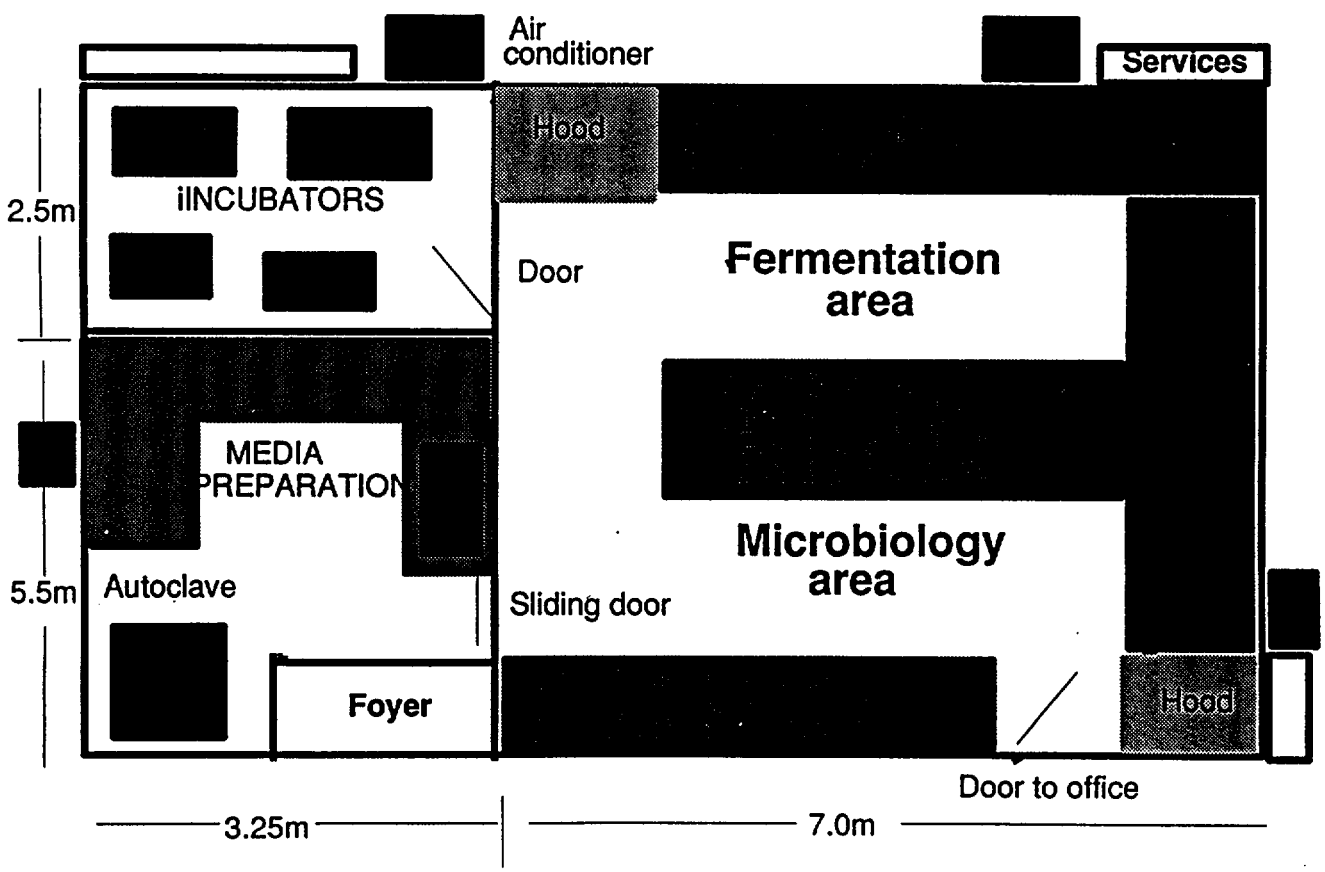
Recommended layout for microbiology lab

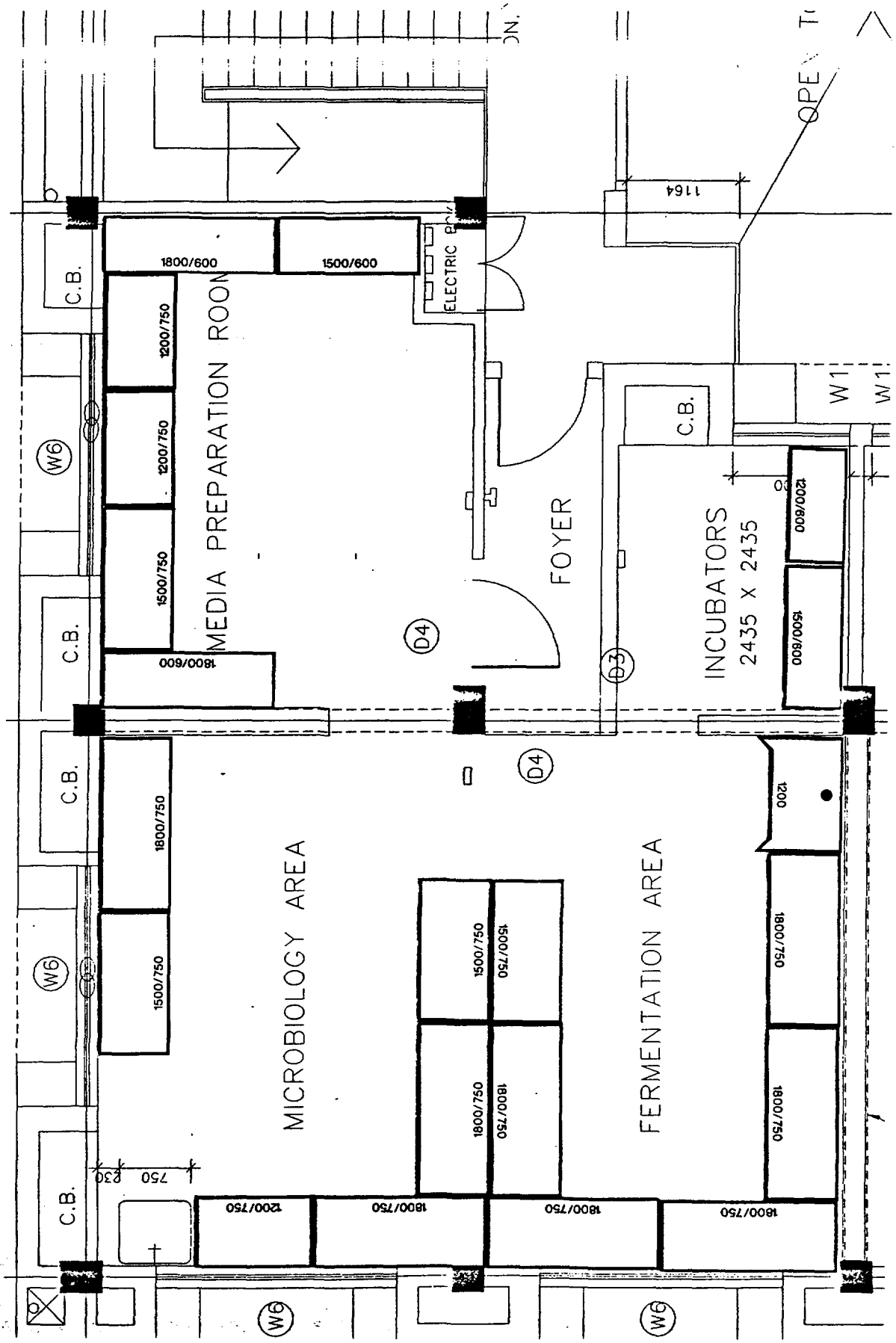
(according to Mr. Cook)

Microbiology laboratory

Scale drawing






MEDIA PREPARATION ROOM
FOYER
INCUBATORS
2435 X 2435
MICROBIOLOGY AREA
FERMENTATION AREA
ELECTRIC
C.B.
D4
D3
W6
1800/600
1500/600
1200/750
1500/750
1800/750
1200/600
1500/600
1200
1164
750

Addresses of some suppliers for laboratory furniture and safety devices

1) Waldner Laboreinrichtungen GmbH & Co
POB 1362
D-88229 Wangen im Allgäu
Germany

Fax: 0049-7522-986 521

2) Köttermann GmbG & Co
Industriestrasse 2-10
D-31311 Uetze
Germany

Fax: 0049-5147-977620

3) Hohenloher Spezialmöbelwerk
Schaffitzel GmbH + Co.
POB 1360
D-74603 Öhringen

Fax: 0049-7941-696 103

4) wrt - Laborbau GmbH & Co KG
Schneider Laborservice
Herderstrasse 26
D-07743 Jena
Germany

Fax/Tel: 0049-3641-820194

Postal address of the consultant:

Klaus Ziller
Am Dietrichsberg 5
D-66333 Völklingen 7

Fed. Rep. of Germany

Phones: 0049-6898-79177
0049-6898-41972

Fax: 0049-6898-43153
0049-6898-79177

UNIDO Comments

Mr. Ziller's report is mainly intended to advise the project authorities to plan their modifications to up-grade the facilities at IPFT. Upgradation of the laboratories is of great importance because the country is going through a liberalized market economy with the chemical industries especially the pesticide industries are having an accelerated growth. Ten years ago no one would have predicted that India would play a significant role in the international market. But today India is in the league of major exporting countries reaching more than $100 million./ annum. This is a great achievement in itself considering the fact that there is a severe competition in the world pesticide market. Despite this performance the Indian pesticide industry needs assistance and advice on advanced analytical methods, high-tech formulations, user and environment friendly products, good packaging. integrated safety(SHE aspects) , waste minimization , sound management of toxic waste and life cycle analysis.

UNDP/UNIDO project started more than 10 years ago and the IPFT has grown from strength to strength and today it is an excellent centre for pesticide development not only for India but also for the region. It has an excellent staff with modern equipment. While the standard improved the quality of physical facilities, utility services and general mauintenace of the laboratories started deteriorating and the building does not reflect national or international standards needed to support the ever vibrant national pesticide industry. In order to make it a model for the country and the region and be recognized by the technical community it is very essential to allocate additional funds to modernize the building and the surroundings and allot recurring budget for maintenace.

The report clearly puts the responsibility on the shoulders of the Government, the industry and the UN Agency to do what all they can to upgrade the laboratories for the benefit of the industry, environment and the public.