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ESTABLISHMENT OF A PILOT PLANT FOR PESTICIDE FORMULATION

DP/MYA/80/011

UNION OF MYANMAR

Terminal report 1*

Prepared for the Government of the Union of Myanmar
by the United Nations Industrial Development Organization,
acting as Executing Agency for the United Nations Development Programme

Based on the work of I. Bendefy, consultant in
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I. DEVELOPMENT PROBLEM AND IMMEDIATE PROBLEMS ATTACKED

The project is expected to switch over importation of liquid Pesticide Formulations into local formulation thereof using imported technical active substances and local solvent, moreover to develop new formulae for pesticides intended to be introduced into the country. It is integral part of the Government's Integrated Pest Control Management Programme aiming at keeping the country at the prevailing relatively pest free conditions while increasing and intensifying commodity crops cultivation and substantially increase the yield per acre of cotton to meet the needs of the existing cotton textile mills.

The history of the project is traced back to 1974 and from that time through various versions and by the aid of more expert studies, described more in detail in Report 2., came to implementation. SICPLANT (Italy), selected as sub-contractor, took control of installation works in February 1990. Performance tests concluded in a three day Performance Test Run on 12, 14 and 15 June 1990, which demonstrated that the equipment is suitable to provide the planned & expected capacity by producing good quality product.

By this time, due to proper organization of UNIDO the Laboratory had already been provided with equipment sufficient to cope with immediate needs and the senior staff of the Plant underwent serious training abroad. These circumstances together with the in-service training provided by the subcontractor made it possible to follow on after the test runs with regular operation and commercial output controlled strictly by the Laboratory.

The immediate objectives of the project include three functions:

- 1) A Pesticide Formulation Laboratory capacity to provide direct support to the Plant Protection Division of the Ministry of Agriculture by developing receipts for liquid pesticides appropriate and applicable to the target crops and to their ever changing pest complex.
- 2) An enlarged laboratory scale capacity to supply pesticides in minimal but sufficient quantity to carry out semi-commercial size field testing of new pesticide formulae and/or on new pest strains.
- 3) A Pilot Formulation capacity to supply MAS with sufficient quantity of various pesticides according to his actual needs of which the main objective can be characterized by:

- about 400 000 litres of pesticides for paddy crop,
(Fenitrothion 50 EC, Phenthoate 50 EC, Diazinon 40 EC)
 - about 300 000 litres of pesticides for cotton crop,
(Cypermethryn 10 EC, Endosulfan 35 EC)
- and any other crops & products to be involved in the future.

II. OUTPUTS PRODUCED AND PROBLEMS ENCOUNTERED

The project was aimed at the establishment of a Pilot Plant for Liquid Pesticides Formulation sized as a minimum economic capacity worthwhile for maintaining continuous activity and make commercial use of its produced goods.

The Project was to be established under Ministry of Industry No.1. as a new branch of Myanma Pharmaceutical Industries. This organization provided the senior staff, assisted the implementation and held the responsibilities undertaken by the Government until October 31, 1992. With an effective date of November 1st, 1992 a Government decree ordered the project to be shifted under Ministry of Agriculture, MAS. Details of the decision have not been disclosed to UNDP at the time of drafting the present report.

Three major outputs were targeted within the Project:

- 1) Pesticide Formulation Laboratory,
- 2) Production Quality Control Laboratory,
- 3) Pilot Formulation Plant.

It should be mentioned that in the Summary of Tripartite Review Report (Report 10.) further three Outputs were required (defined in Project Revision I. only) to be achieved before next TPR Meeting, under section (h). These Outputs are not dealt with separately as

- the objectives thereof are almost identical to those of Output 1),
- their significance has been substantially changed by the takeover of the Project by MAS, as mentioned above.

It must be noted as well that Outputs No.1. and 2. are physically not separated, there exist no separate Formulation and Q.C. Laboratory facilities, they are different only in their targets, activities and responsibilities. The main equipment and most facilities are used in common.

A. Laboratory; Physical facilities

Accommodation

The Laboratory is housed in a purpose built two level building, the layout is shown in Annex III. The rooms - where necessary - are well equipped with benches, however not chemically resistant, with fume cupboards, air conditioning and de-humidification. The balance room is equipped with appropriate stable benches. Separate rooms are available for storage of glassware and chemicals, well furnished with shelves. For high value instrumentation specific rooms were selected. There is a room for Library, another spacy one for conferences. Office room is adequate.

Equipment

Instrumentation in general has been well set up and can adequately cope with all present demands, assuming there is no major equipment malfunction. HPLC instrument recently acquired still awaits installation. A list of major equipment is presented in Annex IV. From all the equipment recommended additionally by consultants only one over-sink wall mounted water heater is outstanding. It is needed as according to Report 5. many residues in volumetric flasks, beakers etc. can be removed only by thorough washing, preferably in hot water. The water heater would provide instantaneous hot water.

Moreover the two recently acquired refrigerators arrived without voltage stabilizer. It is very important to provide it for both to prevent them from damage.

Having a look on the delivery dates of the individual instruments it is very likely that GC apparatus and some of the minor instruments needs to be replaced and Nitrox instrument needs serious reparation within or by the end of the next five years.

The respective cost involved might also be included into the follow-up project.

The formulation laboratory has an enlarged laboratory scale mixer in the Liquid Formulation Plant which enables it to produce experimental batches of 100 to 200 lit. By error the scale provided to serve this mixer is graduated in lb-s instead of kg-s, it should be replaced.

Minor equipment, accessories

At the present the Laboratory is quite satisfactorily equipped with minor standard equipment. Need for replacement of glass-ware broken, accessories and spares for the major equipment is estimated to amount abt. 4000 US\$/year. This amount should be allocated in the framework of the follow-up project.

Purchase of some additional tools was recommended in Report 5., listed in its Annex VII. from local budget. Purchase is still outstanding.

Chemicals

The annual budget needed for the replenishment of essential chemicals is estimated to be abt. 2000 US\$. This amount should be allocated within the follow up project.

Library

The stock of the Library has recently been replenished, however a regular supply of literature on recent advances has vital importance. Therefore the allocation of abt. 1000 US\$/year seems to be necessary within the framework of the follow up project.

Within the Laboratory building one room is separated for Medical Room.

B. Laboratory; Pesticide Formulation

The Laboratory is run at the moment by two qualified chemists and one Laboratory technician. Urgent recruiting is necessary for two more technicians to cope with all responsibilities given. The same staff is to perform both the Quality Control and the Formulation Development activities.

The Formulation Development activities have the following targets:

1. Development of new formulae by inclusion of Superior Kerosene as replacement for imported solvent(s) into the original receipt containing xylene only.
Target: Increase of the local input, savings in FE.
2. Development of new formulae using active substances not yet formulated, originating from standard suppliers thereof.
Target: Extension of the range of products formulated locally, savings in FE.
3. Development of new formulae using active substances originating from alternative sources.
Target: Search for more economic but reliable sources of supply, further savings.
4. Development of new formulae using new types of emulsifiers from various suppliers.
Target: Search for more economic receipts by keeping or even improving the Quality Specifications.

C. Laboratory; Production Quality Control

The staff of the Laboratory has already been mentioned under B. The Laboratory, however with some gaps in equipment and training, was already operational by the time the test runs were performed. This made it possible, that from the very beginning all the produced batches - experimental and full scale ones alike - were tested and the results recorded in Certificates of Analysis. Bottling of the batches took place only after QC approval.

The QC Laboratory will have an important role at the waste management as well. Waste material will partly be decontaminated by incineration, partly by effluent treatment. The Laboratory should be capable to test decontaminated waste material before disposal. The facilities of the Laboratory are considered to be sufficient to do such testing but there is still lack of experience and training in doing it. Therefore it is necessary, that together with the installation of the incinerator & waste-water treatment unit respectively literature, methodology and training be provided to the QC staff.

D. Pilot Formulation Plant

The implementation of the Pilot Formulation Plant as a manufacturing unit has practically been completed by the Performance Tests carried over however many additions, modifications since that contributed and some still await contribution to making the installed facilities more useful, more flexible and mostly more safe. This main Output of the Project is described hereunder in detail.

Construction works

The responsibility for the construction of the buildings and civil engineering works had been undertaken by the Government. According to the Layout Plan in Annex VI. the following construction works had been completed:

- Fence
- Gate house
- Office
- Laboratory (as dealt with under A.)
- Liquid Formulation Plant & Finished Product Store
- Local Solvent Tanks' shelter
- Imported Solvent & Bottles' Store
- Electric Power Sub-Station
- Maintenance Workshop
- Garage
- Effluent water reservoir & foundations of Waste-water Treatment Plant
- Water well & pumphouse with underground reservoir and water-tower
- 30 000 gal capacity fire fighting water reservoir
- Internal concrete roads (ready abt. 55%)
- The construction of an open wall, roof shaded store is going on intended to store solvents in drum.

The construction of some further items partly included in the original plan, partly recommended later by consultants has been delayed, reasons are various.

These are presented below:

- Foundations and shelter for the incinerator
- Fire water dry lagoon
- Shelter for the fire engine
- Shelter for the drum crusher

- Lockers for the workers. It is advisable that the building should be sized in consideration of potential future extensions of the plant activities. The building should comprise room for the storage of clean and contaminated clothing separately as well as laundry. The roof should be raised by one level over the ceiling with no walls around providing an airy space for the drying of the wet clothes. The laundry should be provided with washing machine (industrial size with centrifuge*) as the present practice of washing contaminated clothing by hand must be changed.
- Dining room. It is necessary that a kitchen should also be included into the building with possibility of heating ready food and offering fresh food, hot and cold beverages. A refrigerator is also needed. Proper nourishment of the workers should be considered as a prevention against hazards caused by toxic chemicals.

Services

The plant gets its power supply from the National Network however with often shut-downs and a constant fluctuation of the voltage. The shutdowns can be overcome by the use of the plant's own diesel generator. The generator can usually be started only later than ten minutes after shutdown and this pause may damage the expensive analytical equipment. Therefore the generator should be provided with an automatic start.

The water supply from a tube well is satisfactory however for the long run the establishment of a second tube well is advisable.

The long awaited telephone line is now already built up to the neighbouring Asbestos Factory, just needs to be connected to the plant. There is no apparatus yet in the plant; points to be provided with internal lines: Manager's office, Formulation Workshop, Maintenance Workshop, Laboratory (both levels), Gate house.

Vehicles: the plant has got two trucks (6,5 t each), one light truck (1,5 t), one Jeep and one microbus (8 persons + driver). The Jeep needs to be changed and, in case of boosting the capacity, one additional truck would be needed.

The access road to the plant is in the same bad condition it used to be since the implementation of the project started. Some repairworks are going on at present, but by using the same technology which already proved to be very insufficient. Urging the Government to take steps in the matter should continue.

* spindrier

Formulation facilities

The formulation facilities are aimed at the dissolving of various pesticide active substances in solvent or solvent mixture, admix emulsifiers in batch process and then filtered. After quality approval batches are bottled and packed in collective boxes. The facilities are consisting of:

- Main electric switch panel,
- Hot water supply,
- Hot chamber heating,
- Pressurized air supply,
- 3 local solvent storage tanks of 10 000 lit capacity each,
- Mixing unit of 3000 lit nominal capacity with overflow- and measuring tank,
- Two storage tanks of 3000 lit nominal capacity each,
- Filling tank of 1000 lit nominal capacity,
- Pipework with pumps, filters and valves,
- Filling line, consisting of
 - empty bottles' feeding rotating table,
 - filling station (4 filling heads),
 - automatic screw-capping machine,
 - labelling machine,
 - discharging board for the filled bottles.
- Scales,
- Drum decanter,
- Exhaust ventilator with scrubber,
- Standby portable pumps (two),
- Semi-automatic Filling Machine,
- Semi-automatic ROPP Machine,
- Drum crusher.

The Liquid Formulation Line equipped with the above facilities is capable of producing in one shift a quantity of 1 000 000 lit/year roughly, as it was foreseen at planning and in the subcontract respectively.

The facilities after being used for 2½ years are in good condition. The maintenance, except for the filling line, is satisfactory. The Filling Line is the most vulnerable part of the Formulation Plant which would deserve some more attention. There are often stoppages and other malfunctions at the filling machine, described in detail in Reports 6., 7. and 9. respectively and the situation is the same with the capping machine. This latter functions at the moment as semi automatic: the caps are placed by hand, only screwing on is automatic. Defect of the main air-valve was given as reason with statement that it cannot be repaired locally.

Considering these circumstances it seems necessary that the contractor's mechanic visits the plant for a thorough revision of the line stating parts deserving

change and fixing what is possible locally. It seems to be advisable further that similar visits should be included into the follow up project.

The bottling of the formulated products started first by filling bottles used in the MPI and in the meantime UNIDO spent substantial funds to provide new moulds to CIC in order to enable them to manufacture glass bottles specially designed for PPPF. When the first bottles came from CIC it turned out that the mouth-opening of the bottles is narrower than to allow the filling nozzles to enter. The nozzles had to be changed to slimmer ones by 2 mm and so now is no obstacle at the filling. Unfortunately the new nozzles were supplied by Sicplant with significantly more dense wire mesh filter than the original one. This change is considered to be the cause of the stoppages getting more frequent. SICPLANT was contacted to change the filters.

Still a number of the bottles had to be rejected due to bigger neck-part diameter below the windings not allowing the caps to fit properly. A discussion is foreseen with CIC in the matter. In the case they are unable to eliminate the problem, the defective bottles should be screened out prior to the bottling by use of a cap or an appropriate caliber thus preventing loss and contamination by filling and then discharging the pesticide from the defective bottles. The separated bottles should be sent back to CIC factory and changed for perfect ones.

It is worthwhile to mention that in connection with the packing a number of activities were necessary and have been performed until the project came to its present status, such as:

- selection of proper bottle including size, shape, closure,
- selection of proper cap including wads fitting in,
- design of proper labels in coordination with MAS,
- selection of proper size and outfit of collective boxes,
- design of printed marks on the boxes,
- selection of the proper closure for the boxes,
- solution of pilfer proofing.

The pilfer-proofing of the filled bottles was a serious requirement of MAS to avoid pilfering, faking the products and eventual accidents. Among options the utilization of Viskrings proved to be the cheapest but perfect solution which needs no investment to be introduced, had already been tested and accepted by MAS. Pilfer-proofing therefore can be considered as solved, Viskring cost should be calculated among the production cost components.

The introduction of ROPP capping system for the same purpose as an alternative would need substantial investment and cost/bottle would also be substantially more than that of Viskrings.

Works outstanding for the Formulation Plant

A number of changes, completions and modifications recommended during implementation to provide the work more safety and flexibility still need to be fulfilled. These have been collected and are presented below:

- a) A direct connection is needed for transferring liquids from drums through filter straight to the filling tank. This operation is needed when pesticides imported ready formulated need only to be bottled without going through the whole system.
- b) To minimize the risk of stoppages the cartridge filter between the blender and the storage tank should be changed into two sizes bigger one. The existing small one should be placed into the line: filling tank - filling station.
- c) A direct connecting pipeline (1" only) is needed from the 200 lit mixer to the Filling Station joining before it's filter (recommended under(b), not yet installed). This line will enable direct bottling of experimental batches.
- d) A broadmouth funnel made of stainless steel is needed for use in the lid opening of the 200 lit mixer in cases when working with solid active substances.
- e) The drum crusher will be installed by the plant management. It needs an even foundation, electricity supply and easy access by the forklift. Location will be near the Formulation Workshop.
- f) The two portable standby pumps are useless without connections. Missing are inlet & outlet pipes with respective rubber hoses as follows:

For movable self-priming pump FN 40

- steel inlet pipe 1½"	0,3 m
- rubber suction hose 1½" joining suction pipe	4 m
- non return valve 1½"	1 pc
- steel outlet pipe with 90° bend, 1½"	0,5 m
- rubber hose, outlet, for water 1½"	10 m

For movable self-priming pump CV 30

- steel inlet pipe 1½"	0,3 m
- rubber suction hose for solvent 1½" joining suction pipe	4 m
- non return valve 1½"	1 pc
- steel outlet pipe with 90° bend, 1½"	0,5 m
- outlet rubber hose for solvent 1½"	10 m

- g) Some emulsifiers need longer time to be heated for melting which may delay the production. In order to intensify the heating it is recommended to install a floor-heater in form of a tube railing connected into the hot water circuit.

- h) A glass window is needed into the pipeline connecting the mixer with the overflow tank in order to make eventual overflow visible. The work must be carried out with care as the pipe is connected to the mixer without a flange, welded firmly onto the side wall of the mixer.
- i) Installation of the semi-automatic Filling Machine. As the machine will most probably be used only occasionally it is purposeful to provide occasional connection only by a 8 meters long 1" diameter rubber hose (solvent-proof) with a flange at one end connected to the outlet on the filling tank and joining at the other end to the machine.
The Machine has two suction pipes with non return valves. These two pipes should be joined - the valves taken out - through a forking to the rubber hose.
This way it is hoped that the machine will operate in a closed system safely.

Safety in the Plant

Safety has been a leading consideration from the very start of the planning throughout the whole implementation. Even the ruling wind direction and the running down direction of the rainwater was taken into consideration when elaborating the layout of the plant. The mixing hall and the stores are spacy enough to store sufficient raw material and formulated product as well as handle them safely when formulating.

Also important is the proper organization, regular arrival and discharge of material not to overcharge the available space. In this respect the condition of the connecting road may implicate a danger mainly in the rainy season not allowing discharge of the formulated product.

To avoid risk of fire or explosion the manufacturing and storage area is mounted with sparkproof fittings and also proper earthing is provided.
Fire extinguishers are available at critical places and danger warning boards provided.

However there are a lot of measures still outstanding to be performed both in territory of Operational- and Occupational safety.

A very thorough Safety Verification Report (see Reports 3. and 8.), a summary of a return mission deals with the matter in detail, therefore the present report is restricted to the issues thought to be the most essential ones.

The construction of the lockers for the workers connected with provision of working dresses in the required number (each worker has only two at the moment) and the organization of the machine-washing in the lockers' building has a high priority in order to stop employees entering the premises in street clothing because of non availability of clean working clothes in sufficient number and also stop practice of washing contaminated clothes by hand.

A firefighting engine should be acquired to standby at the plant near the fire-fighting water reservoir.

The installation of the Medical Room - available in the Laboratory building - is the responsibility of the Government including the appointment of a fulltime Medical Officer. Very little happened for the installation (running water, a chest with some medicines, a table instead of bed, a desk with a chair and a stretcher have been provided) and even the originally agreed room was changed for a smaller one, which in the CTA-s opinion is not adaequate.

It should be mentioned that with the transfer of the project from MPI to MAS there is no limitation any more due to the medical doctor in Asbestos Factory under Ministry of Industry I. being under another Ministry. Therefore the staff - preferably one doctor and one nurse - should be provided by Ministry of Agriculture. A recommendation for the equipment of the Medical Room is presented under Attachment VII.

The formulation of higher toxicity products, such as monocrotophos (for which formulation development work has already been done) is also foreseen in the future plans of MAS. Due to its higher toxicity (p.o.LD₅₀/rat: 8-23 mg/kg;dermal LD₅₀/rabbit: 354 mg/kg) it is recommended that the formulation of it or any product of the similar level of toxicity should not start until

- all the malfunctions of the bottle filling station will have been fully eliminated,
- the reject bottles' problem will have a satisfactory solution.

The above two issues mean such a level of risk to the operators which might be tolerated only while formulating products of a toxicity of the present level, but the formulation of more toxic materials needs more strict requirements of safety.

Safety of the Environment

All measures must be taken so that no kind of toxic effluent leaves the Plant. All the physical facilities and instructions for procedures to perform the above are and are being provided respectively as shown below.

Toxic fumes are extracted by ventilator and absorbed in a scrubber. The absorbing liquid is checked from time to time and changed as necessary. The saturated liquor rendered to be changed can be treated in the Waste Water Treatment Plant. The scrubber is in service, control is regular.

Liquid Effluent originating from cleaning of the floor, changing the scrubber liquor or the washing of the contaminated clothing is collected in a waste water lagoon and will be treated at the Waste Water Treatment Plant. The purified water may be released to the ground to be evaporated. Saturated absorption material can be fed into the incinerator.

The Waste Water Treatment Plant stands already on its place and awaits installation.

For the solid waste material a high temperature incinerator will be installed within this year, which will have a capacity substantially higher than all the solid waste collected in the Plant. The incinerated material can be treated like communal waste. Subcontract for the incinerator has been completed, preparation of the site is going on. It will be situated in the N/W corner of the Plant, which is considered to be the most favourable from the point of view of prevailing wind directions to prevent inflammable vapours to be carried close to the incinerator.

The responsibilities to run the Environment Safety facilities properly are shared between the Formulation Plant and the Laboratory. The Production Manager takes care of the operation of the facilities and the Laboratory controls the effluents for limits of contamination.

By these installations it is considered that the environment safety is satisfactorily secured. For details see Reports 6., 7. and 8.

III. OBJECTIVES ACHIEVED OR LIKELY TO BE ACHIEVED IN THE NEAR FUTURE

The Project has practically achieved all the objectives set forth shown by the commercial size output produced since the Performance Tests were carried out in June 1990. The contradiction of the above statement with the numerous issues and problems yet to be solved or implemented as enumerated in the previous chapter is explained by the fact that the project has achieved its performance under the present conditions at a constant higher level of risk and against difficulties which must day by day overcome by the management.

A. Formulation Development

Reverting to the targets dealt with under II.B. it can be stated that

1. The Laboratory has successfully developed formulae containing SK at the maximum possible ratio which does not yet have any adverse effect to the quality of the product. This work was done with all the five products now in production. The work performed was recorded in a Technical Report by Mr Saw Mooler. The respective experimental samples have been tested and received approval from MAS, see the letter in Annex VIII. Two batches each of Endosulfan 35 EC and Fenitrothion 50 EC have already been produced according to the mentioned recipe and distributed. It is intended to do so with the further products and assuming no adverse comment to switch over fully to the SK formulation. Further formulations should therefore immediately be elaborated by the use of SK or mixed solvent respectively.
2. Next targets for the extension of the formulated product range are active substances esfenvalerate, fenvalerate and monocrotophos. Samples of active substances were acquired from Sumitomo and Shell companies respectively, the formulations developed and experimental samples handed over to MAS for testing. Results are to be expected soon.
Next work on schedule is local formula for deltamethrin, active substance sample being acquired from Roussel-Uclaf company.
3. The search for alternative sources of active substances for formulation has started promisingly. Bharat Pulverizing Mills Indian company provided samples of active substances of endosulfan, cypermethrin and fenvalerate. The quality of endosulfan proved not to be satisfactory, but the other two proved to be perfect. The respective formulae have been developed, handed over to MAS for testing and got approval. That means that at a next occasion quotations may be requested from Bharat Co. as well.

At his previous visit the CTA initiated contacts with numerous foreign companies manufacturing active substances needed for the formulation in order to acquire samples of their chemicals (see Annex VII. in Report 9.). Unfortunately this attempt brought no significant response up to now, but this line should not be dropped, but even followed until alternatives for all active substances cannot be established.

4. In the search for alternative emulsifiers three companies were contacted: Berol (Norway), Nippon Kayaku (Japan) and Tensia (Belgium).

Berol products could not be used successfully.

Newcalgene emulsifiers of Nippon Kayaku proved to be suitable in formulation of four products in manufacture but not with cypermethrin. Experimental samples of the four have been handed over to MAS for testing and received approval.

Tensia recently provided a greater supply of their emulsifiers and now formulation development will start with these products as well. The quantity supplied is enough to prepare also 100 lit batches in the experimental mixer.

As a summary it can be stated that the Formulation Development activity is going on up to requirements, targets are clear, procedures have been developed, thus the objective may be considered as achieved.

B. Production Quality Control

It is presented in Annex V. that since installation up to 31.12.1992 the Pilot Plant for Pesticide Formulation produced altogether 330 batches composed of the five products approved. Of all those only two were found to be defective. The defect was stated: emulsion stability of batches No.119/92 and 152/92 of Endosulfan 35 EC was not satisfactory. The quality was rectified by admixing some more emulsifier and the resulting batches were within specification.

There has been still little opportunity to practice control of effluents however no major constraint is expected in this field either. At present practice can be done only on samples drawn from the scrubber or the waste water lagoon.

It can be stated as a summary that the Production Quality Control activity is exerted properly and acting up to requirements. Including also future tasks, the set objective may be considered to have been achieved and very likely to be achieved in the next future respectively.

C. Formulation of Liquid Pesticides

All the production which has been performed within the project provided perfect quality formulation of the five active substances and after handing over to MAS was used purposefully for crop protection. The present needs of MAS are still lower than the full capacity of the Formulation Plant and various reasons, mainly the lack of sufficient FE granted made it impossible to formulate even the total needs of MAS.

The production is presented from performance testing up to 31.12.1992 compared to the average yearly demand estimation of MAS in a table under Annex VI. This was provided by the Plant Protection Service in early 1992 with the remark that no substantial changes are expected from one year to another. The very low performance of the last period (not yet completed) is due to the shortage in FE granted for the purchase of raw material. It can also be learned from the table that as soon as MAS approves the new formulations (see under III.A.2.) the possibility of the formulation thereof will increase the coverage of the capacity.

The profitability of the production has been discussed with the management as well. This is calculated after the sales of the given period and therefore data necessarily cannot fully correspond to the production data. Established data were available for the first two periods only. Profitability is characterized by the profit generated during the tested period and the Operating Ratio showing the ratio of production costs to the revenue after the sales. Respective data are shown in Annex VI.

It should be mentioned here that even during the short period of activity of the project some experience could be gathered how far the purchasing policy can influence the profitability. Prices achieved in direct purchases proved to be definitely more economic than those achievable through barter business. It is recommended therefore that direct purchases should be preferred to barter business.

Discussions conducted with representatives of WHO revealed that in the territory of vector control such as the WHO Antimalaria Programme there is a serious interest to exploit the possibility offered by the Plant to formulate active substances e.g. malathion for the needs of the Programme.

Summarizing it can be stated that as far as the physical possibilities are concerned the Formulation Plant has achieved its objectives: it is suitable to produce formulated liquid pesticides for the needs of MAS and WHO as well using local inputs like SK, glass bottles etc., introducing new technical knowledge into the country and by promoting agricultural yields contributes to the general welfare of the country. For evaluation of savings see Annex XII.

IV. FINDINGS AND LESSONS LEARNED

A. Demand for the products

However the general wish of the public is shifting towards minimizing pesticide use in agriculture there are yet no sufficient alternative methods available to prevent produce from deterioration prior to or after harvest. Thus in the framework of Integrated Pest Management there is substantial demand for pesticides of which the greatest proportion is liquid formulations. This provides a firm base for placing the products of the Pilot Plant for Pesticide Formulation.

Actual demand in Myanmar is shown in Annex V.

B. Site and Facilities

The site had been situated at a quite remote place abt. 30 miles from Yangon which influences the management of the Plant in many aspects. The plant site itself presents a good shape provided gardening and landscaping is continued properly. Large areas not yet built on can quickly appear neglected if not regularly maintained. The same applies for the residential area closeby. It is also important to keep rainwater canals always clear. Where passages are built through them, the free flow of the water must be ensured by fitting large diameter concrete pipe underneath the passage. Weeds are to be cleared from the canals before rainy season.

The layout is clear and practical, keeps manufacturing and storage areas apart from laboratory, office and other premises. Buildings are well constructed and spacy.

Machinery and equipment are well arranged and sufficient for the activities provided the outstanding items will be supplied, fitted and placed. Maintenance is to be strengthened for the filling machine. If some elements of the line work only manually that will result in a bottleneck which does not appear now that production has been slowed down due to shortage in raw material, but which will become important when full capacity is needed.

The 12 empty containers which were used for the transportation of the equipment are standing in the courtyard. They are worth much more than to be used for storage of waste paperbags and other miscellaneous items. They should be cleaned, repaired and sold, the price incurred being recirculated into the project for fulfillment of any of the outstanding recommendations.

C. Using the plant up to full capacity

Already the performance tests have shown that the Liquid Formulation Plant is capable of producing pesticide formulations bottled up to its nominal capacity provided all necessary raw-, packing- and auxiliary materials are available in the required quantities; transport thereof as well as of the ready formulated output is organized regularly. This has yet never been the case until today due to shortages in various materials first and FE later. Some products above the original five ones are still awaiting approval. In such circumstances therefore there is little significance calculating percentages as to how far the project has achieved its targets as financial rather than physical limitations are the major factor.

Whatever will be the availability status of FE in the future two possibilities were recommended already in Report 9. to utilize more of the Plant capacity:

- a) There are cases when MAS imports directly ready formulated liquid pesticides because of urgency, limited quantity or other reasons. In such cases it is recommended to order the products in barrels instead of bottles or cans and let them bottled at the PPPF. This organization makes even savings possible.
- b) WHO has been contacted and notified about the possibility that their needs in liquid pesticides for vector control might be formulated by PPPF, only granting the available FE for the importation of the necessary active substances and emulsifiers is needed.

D. Product Quality Assurance

From the beginning till the present the project has provided only perfect quality formulations. In case of any defect the product is not allowed to be further processed and correction measures are performed.

E. Product Development

The management of the Laboratory has been well trained in Formulation Development and results achieved provide evidence that the work can be done successfully. This applies mainly to liquid formulation.

It has been stated and shown in Report 9. that 500 t/year use of Diazinon 10 G granular pesticide against rice pests is regular in Myanmar. Earlier investigations made it clear that the mineral carrier can be made available in the required quantity. The necessary technology and equipment was dealt with in Report 1. Findings of the report should be re-checked and feasibility elaborated.

When evaluating the possibility of the extension of the present formulation capacity by a Granular Formulation Unit it should be noted that the following components are already readily available at the Plant:

- Plant site with infrastructure including offices, maintenance,
- Well trained senior staff (one addition needed),
- Laboratory, building & equipment,
- Store for imported raw material,
- Installations for environment protection.

A respective Project Identification is presented under Annex IX.

F. Safety of Work and Environment

Safety measures, installation and equipment had been planned carefully and implementation controlled by more Expert visits. Safety can be brought up to the required level provided

- all prescriptions and recommendations are being kept and enforced respectively by the management,
- the outstanding items will be constructed, supplied and performed respectively of which the following deserve separate mentioning:
 - a) Construction of lockers for the workers including machine-washing of the working dresses;
 - b) Installation of a fire-engine;
 - c) Installation of the Medical Room;
 - d) Installation of the Waste Water Treatment Plant;
 - e) Installation of the Incinerator;

G. Organization, Management

According to observations during return missions the plant is managed by the senior staff members in an optimum way, however it is mandatory that all the recommendations of previous missions as well as visiting consultants be performed fully. Special stress should be put on the issues concerning safety in the Plant and to the environment. In this respect the senior staff should always show a good example e.g. not going into the working area in street clothing.

It is understood that the prevailing living conditions in the Plant including the residence area are not attractive enough to keep qualified workers at the workplace for long. This is a crucial point, because for running the Plant safely and successfully it is important to build up a permanent staff at each level. The Plant Management provides much support to the employees in accommodation, transport, etc., but it is thought that further measures, such as offering better catering in a

works canteen, to create something alike a Social Club at the residence area to hear music, watch the TV or to do some sports. Inviting a small private shop be installed in the residence area selling basic articles could make the life more attractive for everybody. Here is the place to repeat the claim for a proper road for the access, because it is not enough to think about the goods to be transported only but the traffic possibilities for the personnel should be considered as well.

Concerning the dependence on higher authorities the practice has been that Ministry of Industry No.1. exercised the control, support and guidance for the Plant allotting broad autonomy to the National Project Director. Considering that the project is the first example of its kind in Myanmar, it is encountering interdisciplinary aspects regularly and serves not local or regional but National demand and interest, after having been transferred to Ministry of Agriculture, MAS, the control, guidance, financial and other support should best be provided from the management of MAS in Yangon at deputy Gen. Manager level in close cooperation with Plant Protection Service, as necessary. From this setup of organization and further provision of the previous autonomy it is hoped that the most efficient operation of the Plant can be attained.

H. Training

The senior staff was provided with substantial training abroad prior to implementation of the project and in-service training by the sub-contractor and Consultants respectively during implementation. Further training is deemed appropriate in connection with laboratory instruments application as well as maintenance of the Filling Line. Both cases could preferably be solved as in-service training in the framework of the follow up project.

It is also thought timely to think about replacements for the senior staff as training for such positions cannot be performed within a short period. Training for staff members either selected from the junior staff or recruited from outside should commence as soon as possible not to endanger the smooth management of the Plant. In this respect Ministry of Industry No.1. might still give support to the project, as it cannot be expected that industrial engineers could be recruited in territory of Ministry of Agriculture.

As soon as the Medical Room is provided with permanent staff they should be trained by Occupational Health Unit, Yangon.

J. Participation in National, Regional Organizations

It is advisable that the Plant Management receives direct information and may have opportunity to participate in matters concerning pesticide formulation, distribution and use. Therefore one senior staff member should be invited into permanent or ad-hoc committees dealing with such matters as appropriate. Similarly one senior staff member should always participate in RENPAP meetings, conferences.

K. Lessons learned

It was a proper decision that the Laboratory - both Formulation Development and Production Quality Control - be operational by the time the test runs started. That made possible the continuous operation joining to Test Runs.

Many delays were caused by the fact that the establishment of the infrastructure only followed the implementation works. There was no ready telephonenumber, internal road, National Network-based electricity available which resulted in slowdowns in implementation and extra expenditure while overcoming the difficulties.

Thorough training programme followed by in-service training provided a skilled staff of senior management and this is a key point concerning the further run of the project.

Locally formulated pesticides bearing local language labels serve the distribution of information towards end-user farmers.

Using the local solvent in experiment showed decrease of phytotoxicity as well as human toxicity of the products, decreased inflammability and can bring savings of F.E.

The well established Formulation Development activity is the foundation of the further development of the Project.

V. RECOMMENDATIONS

A. Laboratory

Urgent recruitment is needed for two junior chemists.

Training possibility for the junior chemists should be consulted with RENPAP organization.

PERKIN ELMER Co. should be contacted concerning maintenance and training.

Training and literature in waste management should be provided for the Laboratory staff & also operators in connection with the installation of the Waste Water Treatment Plant & Incinerator.

The installed 2 new refrigerators should be provided with voltage stabilizers.

Over-sink wall mounted water heater should be provided.

Nitrox apparatus needs to be repaired.

The scale for the experimental mixer should be replaced having divisions in lb instead of kg.

Experimental samples given to MAS should have a careful follow up.

Spare-parts, replacement for minor equipment & chemicals should be ordered regularly

The Formulation Laboratory should ~~test~~ the available mineral samples on suitability as carrier for Diazinon Granules.

Printed forms should be used for Certificate of Analysis.

B. Formulation Plant

Sufficient quantity of empty xylene drums should be ready to receive 30 - 40 t SK.

The items under "Works outstanding for the Formulation Plant" should be performed fully (page 12/13).

A very skilful mechanic should be given as main task the maintenance of the Filling Line. SICPLANT mechanic should visit the plant once a year giving advice and training in maintenance, fixing whatever possible on the spot, revising and completing the list of spare parts. Two weeks of the outstanding 2 m/m SICPLANT consultation should be used urgently for this purpose.

VISKRINGS should be ordered and thus pilferproofing should be provided continuously.

The use of SK receipts should become a common practice.

The 12 containers should be sold and price recycled into the project.

Leaflets should be printed for each product with attractive design on one side, with detailed use and safety instructions reverse. Put in each box one for each bottle.

C. Safety

Proper condition of the manufacturing facilities is the No.1. requirement in Plant Safety. Give maximum attention to proper maintenance.

Lockers for the workers comprising also laundry should be constructed.

The laundry should be provided with washing machine.

Reject bottles should be selected prior to be filled.

For emergency calls internal telephone extensions should be established.

Suitable mobile suction cabinet connectable to the central suction system should be provided for use with the Semi-automatic Filling Machine or the ROPP machine occasionally.

The Medical Room should be equipped with full furniture, equipment and medicines.

Permanent staff - one doctor and one nurse - should be provided for the Medical Room.

Medical staff should be given regular training in treatment of pesticide poisoning.

Incinerator should be installed for toxic solid waste destruction.

Waste Water Treatment Plant should be installed.

Firefighting engine should be acquired.

Higher toxicity products should be produced only when perfect condition of the Filling Line ensures filling/capping in a closed system under suction without interfering manually.

Recommendations of reports 7. and 8. should be observed.

D. Services

The standby generator should be provided with automatic start.

A second tube well should be established.

The Jeep should be replaced.

One additional truck should be provided.

Telephone line should be installed.

Firm landroad should be built with asphalt coverage from Hmawbi to the Plant.

The social services should be improved both in the Plant and in the residence area, as explained under IV.G.

E. Management and follow up

The Plant should be given a good shape, the maintenance should be strengthened, the buildings be kept in good condition and by careful gardening give a good general impression. Mainly in the dry season the dried up weeds should be collected frequently to minimize fire risk.

Items outstanding for construction, listed under II.D, page 8/9, should be completed as soon as possible.

Increase coverage of the capacity. In order to do that it is recommended that direct imports of formulated pesticides should be ordered in barrels and bottled at the Plant. Similarly the demand of WHO in liquid pesticides should be formulated locally using the FE allocated for importation of the ready formulated material for the purchase of raw materials (active substance, emulsifiers and xylene as needed). Minor consignments imported ready made may also be bottled from the barrels.

Cut avoidable administrative delays. Experience shows that FE needed for the purchase of raw materials is mostly available with delays and this can make impossible to formulate the material in time. This could press MAS to import urgently needed items ready formulated - a loss from capacity coverage. Therefore it is recommended that the management starts sending out inquiries - without obligation - and collect offers from various companies well before FE is available to enable immediate orders from the best sources as soon as the funds are granted.

It is recommended to prefer direct purchases from selected suppliers to barter business which is less efficient economically and leaves less flexibility in

choosing the most appropriate sources.

It is recommended to keep always reasonable reserves of emulsifiers to avoid bottlenecks in the production.

It is recommended to seek Government approval to the extension of tax exemption granted for pesticides also to raw materials (solvent, emulsifiers) used for their formulation.

At the previous mission a series of contacts were initiated with various foreign firms in order to diversify importation sources (see Report 9) and thus improve the economy of the production as well as to gather more and more technical information. This should continue in regular correspondence with such firms. However the present quality of correspondence, the aspect of the letters is very poor and insufficient to give a foreign company the impression of the PPPF as being a reliable and competent business partner, although this is very important at international contacts. Therefore it is recommended that PPPF should have a new, carefully designed letterhead, clearly printed on good quality paper. The PPPF should also be given an easy to remember individual name, let an emblem be designed as well. As it is difficult to get a qualified typist to work in the Hmawbi Plant, two of the office staff members should be sent to attend typist course to be trained in typing and how to give a letter a proper format. Some basic training in English for more staff members would also be due, otherwise the usefulness of the Library is limited to the senior staff only.

The training of the senior staff members took several years. It is considered timely that some junior staff members, selected from the staff itself or recruited from outside should start to be trained as replacement ready for any case at least one person for the Laboratory and another for the Formulation Plant.

As the Project is serving National interest and supplies for the demand of the whole country it is considered to be appropriate to render the Plant to central Management of MAS at Deputy Managing Director level in close cooperation with Plant Protection Service and by providing reasonable autonomy to it.

However well trained is the senior staff of the Plant, some more than two years' experience is considered not to be sufficient to leave the Project after termination fully without any further support. In addition to that it is clear from the foregoing that numerous issues remained outstanding in various phases, the completion of which would certainly need examination and advice from consultants and

experts. Therefore it is suggested to initiate a new project under title: "Strengthening the Formulation Activities at the Pilot Plant for Pesticides Formulation" with the aim to provide further support to the just initiated activities during the next at least five years. Project Identification is presented under Annex X.

Finally as it seems to be very feasible that the formulation activity of the Plant could easily be extended with a Granular Formulation Unit as explained under IV. E. page 20. This extension could give further support to MAS by cutting imports of 500 tons/year Diazinon granules to importation of 50 tons of active substance only. Therefore it is suggested that a new project under title: "Extension of the formulation activities at the Pilot Plant for Pesticide Formulation" should be initiated involving potentially offered support by Nichimen Japanese company. The project should be confined to the new line only, infrastructural components being already available. Project Identification is presented under Annex IX.

A C K N O W L E D G E M E N T

The consultant wishes to acknowledge the whole-hearted cooperation extended by the management and the staff of Myanma Agriculture Service, who collaborated in various activities and assisted the consultant in his work. Particular mention is made of the efficient help and warm hospitality of the team of the senior staff in the Project headed by U Win Kyi, National Project Director and U Mynt Swe, Project Manager. U Maung Maung Tin, MAS, provided great help being always ready for discussions.

Dr Klaus Wagner and Dr Tom Prvulovic, WHO, showed great interest in the project and offered valuable assistance.

Especially great help was to work together with Mr B. Crozier, consultant in Quality Control providing continuous assistance by sharing his views and offering advice.

U Htin Aung, Programme Officer, UNDP, followed the activities with continuous attention, provided the necessary guidance and support together with the whole UNDP staff.

ABBREVIATIONS AND ACRONYMS USED

CIC	Ceramic Industries Corporation
CTA	Chief Technical Adviser
EC	Emulsifiable Concentrate
FAO	Food and Agriculture Organization
FE	Foreign Exchange
G	Granules
GC	Gas Chromatograph
HPLC	High Performance Liquid Chromatograph
MAS	Myanma Agriculture Service
MPI	Myanma Pharmaceutical Industries
PPPF	Pilot Plant for Pesticides Formulation
QC	Quality Control
RENAPAP	Regional Network for Pesticides in Asia and the Pacific
ROPP	Roll on Pilfer-proof caps
SK	Superior Kerosene
TPR	Tripartite Review
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization
UV	Ultra Violet
WHO	World Health Organization

INSTITUTIONS AND PERSONS CONTACTED

United Nations Personnel

Mr. Jehan Raheem	Resident Representative
Ms. Monina Magellanes	Head, Programme Section
	Backstopping Officer, UNIDO
U Htin Aung	Programme Officer
Mr. B. Crozier	Consultant in QC, UNIDO
Dr. Klaus Wagner	WHO Representative to Myanmar
Dr. Tom Prvulovic	WHO Public Health Administrator

Myanma Agriculture Service (MAS)

U Tin Hlaing	Managing Director
U Soe Mynt	Deputy General Manager
Dr. Mya Maung	Project Director
U Tun Lwin	Deputy General Manager
U Maung Maung Tin	Deputy General Manager (Head, Plant Protection Service)

Project Personnel

U Win Kyi	National Project Director
U Mynt Swe	Project Manager
U Aung Min	Planning Manager
U Saw Mooler	Head, Laboratory
U Mon Tin Win	Asst. Head, Laboratory
U Saw Win	Head, Production
U Nyo Lay	Head, Maintenance

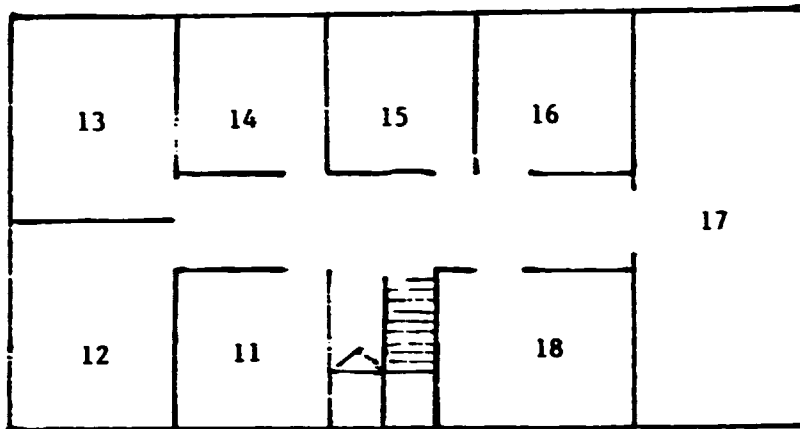
Nichimen Co.

Mr. Jun Maruno	General Manager, Yangon Branch
U Kyaw Sein	Manager

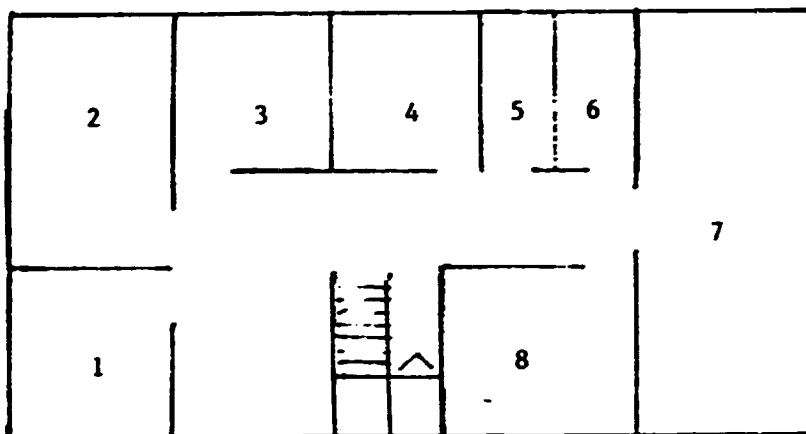
REPORTS QUOTED IN THE TEXT

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I. Bendefy, 18 July, 1984.
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I. Bendefy, 31 January, 1990.
3. Safety Verification Report.
M. Srivastava, 23 March, 1990.
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B. Crozier, 20 February, 1991.
6. Technical Report on Management and Safety of PPPF.
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K.S. Johnson, 6 February, 1992.
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M. Srivastava, 21 April, 1992.
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I. Bendefy, 8 May, 1992.
10. Summary of Tripartite Review Report.
11 June, 1991

LAYOUT OF THE LABORATORY



First floor plan



Ground floor plan

LEGEND:

- | | | | |
|------------------------------|-----|---------------------------------|-----------|
| 1. Medical Room | A/C | 11. HPLC Room | A/C |
| 2. Store Room | | 12. Office | A/C |
| 3. Office | A/C | 13. Library | A/C |
| 4. Toilet & Emergency shower | | 14. GC Room | A/C & D/H |
| 5. Water Distillation | | 15. Toilet & Emergency shower | |
| 6. Cool Store | A/C | 16. Balance Room | A/C & D/H |
| 7. Lecture Room | | 17. General Laboratory | A/C |
| 8. Office | | 18. Equipment & glassware store | |

A/C = Air Conditioned
D/H = Dehumidified

MAJOR EQUIPMENT OF THE LABORATORY

Sr.No.	Description	Supplier	Model	Qty	Value US\$	Received
1.	Abbe refractometer	Fischer (Japan)	LR.45302	1	1 299	1985
2.	Rotavapore condenser	Buchi	RE-111/A	1	187	1985
3.	Analytical balance	Sartorius	1702 MP 8	2	2 413	1985
4.	PH meter	Corning	140	1	356	1985
5.	Balance	Ohaus	760	1	96	1985
6.	Water bath	Galencamp	Grant SE 15	1	300	1985
7.	Flash point apparatus	SETA (England)	ASTM D93-IP34	1	582	1985
8.	Flash point apparatus	" "	ABEL PEH-670-M	1	1 047	1986
9.	Sieve shaker	Ende Cotts Ltd.	SW19-3BR	1	811	1986
10.	Gas Chromatograph	Perkin Elmer Co.	8500	1	31 977	1988
11.	Nitrox nitrogen gen.	Nitrox Ltd.	ANG 750/1	1	5 175	1989
12.	Balance	Melter	PM 4000	1	2 253	1990
13.	Basic TLC start kit	Spectroline	Q/22 SN-5	1	1 200	1991
14.	Spectrophotometer	Shimadzu	UV - 160 A	1	12 735	1992
15.	HPLC instrument	Shimadzu	LC-9	1	31 977	1992
16.	Electronic typewriter	IBM	6784	1	986	1989
17.	Plain paper copier	Canon	NP 3225	1	3 464	1989
18.	Desktop overhead proj.	AVD - USA	3 M 2170	1	658	1992
19.	Slide projector	KODAK	S-AV 1030	1	565	1992

DATA OF THE PRODUCTION AND DEMAND

Sr.No.	Product	Unit	Demand	P r o d u c t i o n			T o t a l	
				1990 - 91	1991 - 92	1.4-31.12.92	th.lit	batches
Approved formulations								
1.	FENITROTHION 50 EC	th.lit	100	127.1	107.0	47.1	284.2	
		batches		53	43	20		116
2.	DIAZINON 40 EC	th.lit	75	50.8	55.4	-	106.3	
		batches		22	20	-		42
3.	PHENTHOATE 50 EC	th.lit	100	42.6	57.9	0.3	100.8	
		batches		18	22	1		41
4.	ENDOSULFAN 35 EC	th.lit	100	45.7	128.4	31.9	205.9	
		batches		17	47	11		75
5.	CYPERMETHRIN 10 EC	th.lit	75	71.9	63.6	-	135.5	
		batches		32	24	-		56
T o t a l :		th.lit	450	338.1	412.3	79.3	829.7	
		batches		142	156	32		330
Not yet approved formulations								
6.	FENVALERATE 20 EC	th.lit	75					
7.	DELTAMETHRIN 2.5 EC	"	75					
Grand Total :		"	600					

DATA ON SALES

Sr.No.	Product	S a l e s			
		1990 - 91		1991 - 92	
		Quantity th.lit	Value m Ky	Quantity th.lit	Value m Ky
1.	FENITROTHION 50 EC	121.74	11.46	93.31	8.95
2.	DIAZINON 40 EC	50.83	3.36	27.50	2.83
3.	PHENTHOATE 50 EC	42.14	3.39	52.55	4.34
4.	ENDOSULFAN 35 EC	23.56	1.33	81.84	4.89
5.	CYPERMETHRIN 10 EC	58.56	5.55	70.85	6.84
6.	Other incomes		0.18		0.38
Total			25.27		28.31
Cost of Production :			15.71		17.78
Overhead expenses :			0.18		0.60
Profit :			9.37		9.84
Operating Ratio :			62.92 %		65.13 %

FURNITURE & EQUIPMENT FOR THE MEDICAL ROOM

General:

Hand-wash basin/running water	One chest for medicines
One desk	One bed
One small table	One stretcher
Five chairs	One personal scale

For First Aid:

Soap	Scissors
Towel, paper tissues	Bedsheet
Notebook with pencil or pen	Warm blanket
Plastic or rubber gloves	Various size steril white gauze packs
Closed waste-box	Various size plain bandages
Plastic bags	Cotton wool packs
Eye rinse glass	Ammonia pad
Plastic glass	Safety pins
Vomit dish	Prepared sterile dressings
Washing dish	Adhesive dressing strip
Bucket	Perforated Film Adhesive dressings
Tablespoon, teaspoon	(PFA dressings)

Activated Carbon (Carbo Medicinalis)
 Salty laxatives:Glauber's salt(Natrium Sulfuricum)
 Bitter salt (Magnesium Sulfuricum)
 Bicarbonic Soda (Pulv. Natrium Bicarbonicum)
 Boric Acid solution (Sol. Acidum Boricum)
 Magnesium Oxyde (Pulv. Magnesium Oxydatum)
 Hypermanganic salt (Kalium Permanganicum)
 Bentonite
 Fuller's earth

For professional tratment:

Syringes & injection needles (for single use)
 Clinical themometer
 Blood pressure meter & stetoscope
 Reflex hammer
 Gastric lavage set (plastic funnel, rubber hose, glass connection, gastric lavage probe)

Inj. Atropinum sulfuricum
 Inj. Algopyrin
 Inj. Seduxen
 Inj. Furosemid
 Inj. Calcimusc
 Inj. Depersolon
 Inj. K-Strophantosid
 Inj. Diaphillin venosum
 Inj. Natrium nitrosum
 Inj. Vitamin K
 Inj. Papaverinum hydrochloricum
 Inj. Coffeinum natrium benzoicum
 Inj. Lidocain
 Inj. Glucosum

Pesticide Analytical Laboratory
Plant Protection Section
Myanma Agriculture Service
YANGON

15 November 1991

To:

U. Naung Naung Tin,
Deputy General Manager,
Plant Protection Section,
Myanma Agriculture Service,
Yangon.

Subject : Phytotoxicity Test Result

Phytotoxicity test of 50% EC Fenitrothion (kerosene used as formulation solvent) from Hmawbi Pilot Pesticide Formulation Plant was conducted at Pesticide Analytical lab last August 1991. Detailed test findings are as below.

1. Test Cultivar

- a. 2 week old cucumber
- b. 2 week old stick bean
- c. 2 week old kenaf

2. Plot Size

2 ft x 21 ft for each treatment

3. Spray Concentration

200 gm Fenitrothion/acre (double A.I. amount of recommended maximum dosage)

4. Application Rate

Spray was prepared and applied at the equivalent volume of 60 gallons per acre.

5. Control

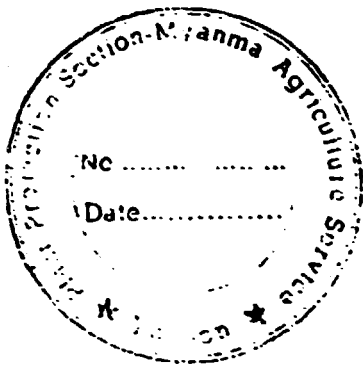
- a. same age and plot size of test cultivars
- b. First control plot was treated with same volume of water
- c. Second control plot was treated with same concentration and volume of 50% EC Fenitrothion formulated with xylene

6. Results.

Probable scorching on treated plots were observed until Day-1 after spraying. No scorching on treated cultivars was observed.


(Saw Say Paw)

Deputy Supervisor
Pesticide Analytical Laboratory



GOVERNMENT OF THE UNION OF MYANMAR
Myanmar Agriculture Service, Plant Protection Section
PESTICIDE ANALYTICAL LABORATORY

QUALITY CONTROL CERTIFICATE
Number: 1/92

Description of consignment: Myanmar Pharmaceutical Industries
(Supplier: MAP Pacific Services Pte Ltd Singapore)

Batch number(s):

Designation of sample: 50% EC Fenitrothion

Laboratory registration No of the sample: 30/92

The sample was taken by: M Ph I

Date of sampling: 17-7-92 Date of analysis: 29-7-92

Remarks on the condition of the sample:-

RESULTS:

Physical properties:

Emulsion Stability Test ; Passed

Chemical properties:

Active ingredient content: 50% ± 0.5%

Impurities/ by-products tested:-

Herewith it is certified that the quality of pesticide product tested:

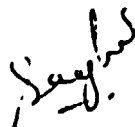
(a) is in conformity with the quality specification

(b) does not comply with the quality specification because:

The submitted sample is in conformity with the claimed AI concentration

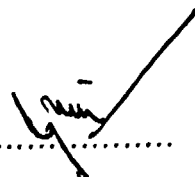
Recommendation on use restrictions:

Date: 10-8-92


.....

Pesticide Analytical Laboratory

Analytical Chemist
Pesticide Analytical Laboratory
Plant Protection Section
Myanmar Agriculture Service
Yangon, Myanmar.


.....

Plant Protection Section

Deputy General Manager
Plant Protection Section
Agricultural Extension Division
Myanmar Agriculture Service
Yangon, Myanmar

PROJECT IDENTIFICATION

Project Title: Extension of the formulation activities at the Pilot Plant for Pesticide Formulation.

Purpose of the Project: The project is part of the Government's Integrated Pest Control Management aimed at keeping the country at its relatively pest-free conditions while increasing and intensifying the commodity crops' cultivation as well as increasing the yield of paddy crop, which is a substantial staple food of the country and contributes to exports providing foreign exchange.

The Project is to establish a Pilot Plant for granular pesticides' formulation, the functions of which are:

- (a) A capacity to supply granular pesticides in minimal but sufficient quantity to the Plant Protection Division by developing receipts for granular pesticides appropriate and applicable to the target crops and to their ever changing pest complex.
- (b) A Pilot Formulation capacity to supply MAS of the Ministry of Agriculture and Forests about 500 t/year granular pesticide for paddy crop (Diazinon 5 G) and for other crops.

Justification of the project: Within the framework of a previous project (DP/MYA/80/011) the basic feasibility of the project had been positively assessed in 1984. Opposite to the capacity of 240 t/year suggested originally - by assuming forecasted growth of the market - the present demand has been stated by MAS as being 500 t/year.

The mineral carrier, which is needed for the formulation and makes out 89 - 94 % of the product, is available in the country. The local formulation offers considerable savings in foreign exchange by cutting imports to 6 - 11 % in weight and taking in account that at such low percentage imported products the transport cost makes out a substantial part of the import price.

The Project can be implemented as an extension of an existing and operating Pilot Plant with the advantage that the following components are already available and need no, or only slight extension:

- Plant site with infrastructure, including offices, maintenance,
- Well trained senior staff (one addition needed),
- Laboratory, building & equipment,
- Store for imported raw material,
- Installations for environment protection.

Background: Agriculture dominates the Burmese economy, accounting for nearly 40 % of GDP, over 60 % of the raw materials for industrial production, almost 70 % of employment and 85 % of exports. The national 20 year Development Plan (1973-1993) foresees an annual growth rate of 5.9% in GDP and 4.8% in agriculture. The revitalization of agriculture, which makes it possible has been a major achievement but the sector still operates below capacity. Thus Agriculture remains the first priority, both to meet domestic demands and to increase export earnings.

To realize these goals a strategy was designed to increase the per acre yield of high potential crops and this strategy was first applied to rice with the introduction of High Yield Varieties as well as improved cultivation - harvest and post harvest - practices.

The departure from the traditional varieties with their long developed resistance to pests as well as the intensification of the production increases susceptibility of the plants to insect damage and plant diseases. It is to be expected that with further progress in output through greater use of HYV, irrigation, fertilizers, double cropping, effective pest control will become a crucial factor to the success of the agricultural development.

The pesticide usage in the year 1990/91 was estimated by MAS at 600 000 litres of liquid formulations, 500 t of powder- and 500 t of granular formulations and it has remained at approximately the same level in the past years. However, improvement in plant protection will require increasing inputs of pesticides and future annual usage is expected to grow constantly.

In order to acquire the experience necessary for the planning and operation of full scale commercial production based on the utilization of locally available carriers a Pilot Granular Formulation Unit is to be established. It is expected, that the operation of the pilot plant will also contribute to the promotion of the use of local minerals, in this special case by further processing of presently discarded material in support of the agricultural sector.

A Pilot Plant for Pesticide Formulation equipped with facilities for liquid formulation has already been established and operating successfully thus providing evidence of the feasibility and usefulness of the suggested project.

PROJECT IDENTIFICATION

Project title: Strengthening the formulation activities at the Pilot Plant for Pesticides Formulation.

Purpose of the project: The project is part of the Government's Integrated Pest Management programme aimed at keeping the country at its relatively pest-free conditions while increasing and intensifying the commodity crops' cultivation as well as increasing the yield of cotton needed by textile mills and that of paddy crop, which is a substantial staple food of the country and contributes to exports providing foreign exchange.

The Project is to provide backstopping to the Pilot Plant for Pesticide Formulation by

- visits of consultants and experts in various fields,
- seeking for training possibilities for the personnel,
- supporting the Plant with provision of minor equipment, chemicals & spares,
- providing support in maintenance,
- supplying up to date literature & information
- follow up outstanding activities of Project DP/MYA/80/011.

Justification of the project: Within the framework of a previous project (DP/MYA/80/011) a Pilot Plant for Pesticide Formulation has been established. The Pilot Plant represents a brand new line among industrial branches in Myanmar. Information about the nature, characteristics and uses of pesticides including the hazards involved to both humans and environment was earlier available only at the sector of Agriculture. However the establishment and start up of the Plant was successful, considering the many aspects to be observed when managing such plant, which is a first example of its kind in the country, whatever good training the senior staff was given, two and half years of experience cannot be considered as sufficient to leave the plant and the management without any support.

The Formulation Laboratory has got a program to develop new formulations in cooperation with the Plant Protection Project, MAS. The program includes:

- development of new formulae by inclusion of SK as local solvent,
- development of new formulae using active substances not yet formulated,
- development of new formulae with active substances from alternative suppliers,
- development of new formulae using new types of emulsifiers.

The plant management has to initiate and maintain numerous contacts with foreign firms, suppliers of active substances, emulsifiers and other chemicals both at the phase of development in order to collect as much technical information from those firms as possible and at the phase of ordering their products.

The Plant is expected to approach to its planned full capacity which needs more and more careful planning and coordination of the production. There will also be needed to scale up new products' formulation developed in the Laboratory.

It will be necessary to gain practice in the operation of equipment installed at the very last phase of the project.

In all the above activities the following kind of support is considered to be justified:

- visits of consultants in Quality Control and Formulation Development,
- visits of consultant in Formulation Plant Management and Safety,
- visits of consultant in maintenance and repair, as appropriate,
- visits of non resident CTA, as appropriate,
- provision of training for senior and junior staff, as appropriate,
- provision of technical literature,
- supply of minor chemicals, equipment, spare-parts for the Laboratory,
- provision of minor spare-parts, equipment for the Pilot Plant.

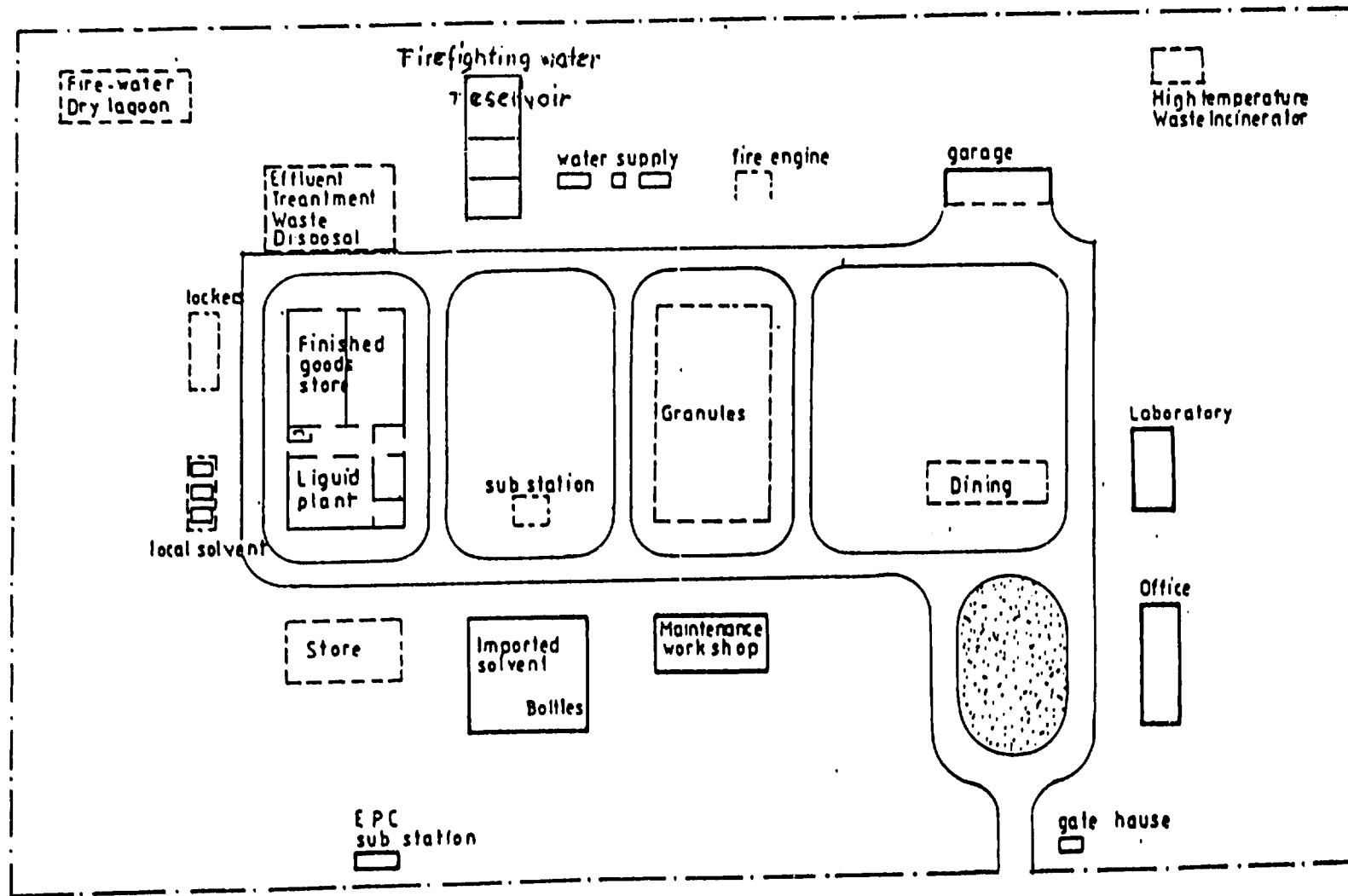
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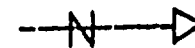
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A Pilot Plant for Pesticide Formulation equipped with facilities for liquid formulation has already been established and operating successfully thus providing evidence for the feasibility and usefulness of the project.

The pesticide usage in the year 1990/91 was estimated by MAS at 600 000 litres of liquid formulations, 500 t of powder- and 500 t of granular formulations. This is the demand which can be covered by foreign exchange, the full demand was estimated to be higher by about 50%. By taking the advantage of the savings through the local formulation and considering the strive for improvements in the plant protection that all will lead to constant growth of annual usage of pesticides. This supports the suggestion that the smooth running of the freshly established Pilot Plant for Pesticide Formulation should be ensured by follow-up assistance in the first several years of operation.



PESTICIDES FORMULATION PLANT / HMAWBI /
 lay-out plan
 scale 1: 10 000



SUMMARY EVALUATION OF POTENTIAL SAVINGS

The project offers two ways, how to decrease expenditures in FE:

- maximum utilization of local inputs,
- depress the prices of imported materials.

The local inputs cover the full scope of packing material: glass bottles, plastic screw caps, collective boxes, labels; exception is "VISKRING" seal which ensures pilferproofing and is not available locally.

Of the raw materials:

- active substances are sophisticated chemicals, for the synthesis of which the conditions are not yet ready in the country.
- emulsifiers are of the same nature and represent only negligible quantity, therefore it is not economic to consider local production thereof.
- solvents represent the only line of raw materials where local input is practical. Work done in this respect is described under III.A.1. To show the potential savings by full use of the receipts developed the following table is presented:

Product	M.A.S. demand (lit)	Solvent com- ponent (lit)	Kerosene substitute (lit)
Phenthoate 50 EC	100 000	40 000	22 000
Fenitrothion 50 EC	100 000	40 000	16 000
Diazinon 40 EC	75 000	40 500	20 250
Endosulfan 35 EC	100 000	59 000	41 000
Cypermethrin 10 EC	75 000	61 425	33 750
Total:	450 000	240 925	133 330

The depression of the active substances' prices will be possible as a result of successful development work described under III.A.3 for generation of alternative sources of these raw materials. Collection of various offers from alternative suppliers will enable the management to evaluate world market prices and buy at the most competitive one.

UNIDO COMMENTS

The terminal report gives a brief run down of the history from the early days when the concept started to the final establishment of the liquid pesticide formulation plant.

The successful operation of the plant producing pesticide formulations according to FAO specifications is an important milestone for UNDP/UNIDO technical assistance. From the report one could notice the emphasis shifting from formulation technology to quality, safety and waste disposal as an integral part of the whole project. In addition, the report provides advice on continuous support from the Government in proper maintenance of personal protective equipment (PPE) quality control unit and production line. Most of the recommendations for the laboratory and the plant are to be carried out on a regular basis with annual budget provided in local and foreign currency.

Once the waste water treatment, incineration facilities and drum crusher are installed, the plant should be able to manage its waste within the plant itself and regular monitoring by trained personnel is essential.

The recent changes in the management of the plant and the interest from WHO for using the plant for public health outlets would promote inter-agency co-operation among UNIDO/FAO/WHO to make use of the plant for the benefit of food security, health for all in the country.

This report should be considered as terminal report 1 and the final report from the sub-contractor would be terminal report 2.