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ESTABLISHMENT OF A PILOT PLANT FOR PESTICIDE FORMULATION

DP/MYA/80/011

UNION OF MYANMAR

Technical report: Findings and recommendations*

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 formulation and marketing of pesticides

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I. SUMMARY

Project Title: Establishment of a Pilot Plant for Pesticides Formulation.

Number: DP/MYA/80/011

Purpose of the project: To provide facilities for the formulation of liquid pesticides using locally available solvents as far as possible.

Objectives of the mission were to evaluate the progress of the project and to assist/advise on various aspects related to the implementation of the project with special attention to the Agenda and Conclusions of the Tripartite Review Meeting held in Yangon on 11 June 1991.

The expert was expected to review the outputs achieved, to identify major issues outstanding, to evaluate the status of ongoing activities with special attention to:

- co-ordination with the Ministry of Agriculture regarding the suitability and future demand of the formulations produced for use in Myanmar,
- issues of safety both in the plant and in the environment,
- possibilities of further development in the production,
- possibilities in further development of new formulae in the Formulation Laboratory.

When arriving to the site it was stated that the plant is already in regular operation having as major bottleneck the often lack of the electricity and the still very bad condition of the landroad connecting the plant with Hmawbi.

The activities started with the identification of major problems and went on by looking for proper solutions. Major problems were identified such as:

- the lack of an installed medical room in the plant with permanent medical assistance,
- non-satisfactory solution of the pilfer-proof packing,
- non-use of the local solvent,
- need of establishment of an incinerator,
- non timely availability of Foreign Exchange for the imports.

The present report gives a presentation and analysis on the overall status of the *project implementation with a review of activities aimed at elimination of the problems, promoting and co-ordinating in the progress of implementation of the project.* Two Project Identifications of consecutive nature are also presented.

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 Pharmaceutical Industries, who collaborated in various activities and assisted the consultant in his work. Particular mention is made of the efficient help of the six member team of senior staff in the project headed by U Win Kyi, National Project Director and U Mynt Swe, Project Manager. U Saw Mynt, Managing Director and U Ban Yi, Director of Planning, MPI, showed great interest in the work, gave the necessary guidance and were always ready for consultation and assistance.

Mr. Gerd Merrem, Resident Representative has a deep understanding of the goals set forth for the project and offered substantial support in reaching them.

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

Dr. Gaston Pierrard, FAO, Dr. Klaus Wagner, WHO, U Maung Maung Tin, M.A.S. and Dr. Win Lwin Nyunt, Health Department provided quick and efficient assistance in information and consultation during the mission.

ABBREVIATIONS AND ACRONYMS USED

CIC	Ceramic Industries Corporation
CTA	Chief Technical Adviser
EC	Emulsifiable Concentrate
FAO	Food and Agriculture Organization
FE	Foreign Exchange
FOB	Free on Board
G	Granules
GBP	British Pounds
GC	Gas Chromatograph
GDP	Gross Domestic Product
HPLC	High Performance Liquid Chromatograph
HYV	High Yield Variety
M.A.S.	Myanma Agricultural Service
MPI	Myanma Pharmaceutical Industries
MPPSE	Myanma Petroleum Products Supply Enterprise
PC	Personal Computer
PDS STLG	Pounds Sterling
PPPF	Pilot Plant for Pesticides Formulation
QC	Quality Control
RENAP	Regional Network for Pesticides in Asia and the Pacific
ROPP	Roll on Pilfer-proof caps
SK	Superior Kerosene
t	ton
TLC	Thin Layer Chromatograph
TPR	Tripartite Review
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization
UPS	Uninterrupted Power Supply
USD	US Dollars
UV	Ultra Violet
WHO	World Health Organization

II. HISTORY AND BACKGROUND OF THE PROJECT

The project 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 project is expected to switch over importation of liquid Pesticide Formulations into local formulation thereof using imported technical active substances and local solvents, moreover to develop new formulae for pesticides intended to be introduced into the country.

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. A new revised Project Document was prepared including liquid formulation facilities, ancillary equipment as well as laboratory with UNDP contribution of USD 2 148 950 and was approved in October 1987. SICPLANT (Italy) had been selected as sub-contractor and the equipment was delivered during 1989. The team of MPI started soon to move the machinery into the production building and assemble the equipment. The SICPLANT team arrived in February 1990 and took control of the implementation works. Performance Tests were carried out under "no-load" conditions from April 9 to May 29 and under "on-load" conditions from April 9 to June 8, 1990. The three day Performance Test Run took place on 12, 14 and 15 June 1990. During the test runs it could be 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 near to the present status 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.

However operating regularly there are still many gaps to be filled both in the production facilities, construction works and safety installations, from UNIDO UNDP and Government side alike. Activities to fill in those gaps are going on.

III. ACTIVITIES DURING THE MISSION

According to the provisions of the Project Document UNIDO hired Dr.I.Bendefy as Chief Technical Adviser to assist and co-ordinate the implementation of the project.

Dr.I.Bendefy served in Myanmar from 22 January to 12 March 1992. Counterparts to him were six of the senior staff of the Plant appointed by MPI and headed by U Win Kyi, National Project Director.

A. Project revision "S"

The Tripartite Review Meeting of the project which was held on 11 June 1991. made a series of recommendations to achieve the objectives in full. A recommendation of paramount importance is as follows:

To ensure environment protection and to safeguard plant operators' health an incinerator with proper technology and suitable size should be provided to process toxic waste materials regularly produced at the Pilot Plant. Due to the fact that the plant and the laboratory is expected to be dealing with more complicated formulations and handling new pesticides in the future, UNIDO has strongly recommended that additional equipment such as HPLC apparatus and UV Spectrophotometer be provided to the laboratory.

To fulfill these recommendations an increase in the budget by USD 357,123 became necessary during the preparation of recent Project Revision "S". The expert assisted in compilation of the request for submission to Headquarters and prepared Justification for Equipment as attached under II.

B. Laboratory, quality control activity

The purpose built laboratory for Quality Control of the formulations prepared by the Plant has been well set-up and can adequately cope with all present demands, assuming there is no major equipment malfunction. The expected extension of the range of products as well as the aim of providing ever instant availability of the most appropriate instrument made necessary to initiate the extension of the facilities by HPLC, UV Spectrometer and a basic TLC set up as described in the previous section. Two new refrigerators have already been provided by UNIDO, one of them with freezer compartment. The refrigerators arrived

without voltage stabilizer; it is recommended to provide it for each one to prevent them from damage.

The laboratory is run at the moment by two qualified chemists and three laboratory technicians. The same staff performs both the quality control and the formulation development activities. All the batches formulated in the plant are tested and the test result recorded in Certificate of Analysis. It is recommended to use printed forms for this purpose. Bottling of the batches takes place only after QC approval.

UNIDO provided a two month split mission of a Pesticide Quality Control Chemist in 1990/91 who gave findings and recommendations in his report (Report 5.).

However the senior staff was given an efficient training both prior to the start up and in-service, it is deemed necessary and appropriate to provide some similar follow up support to the laboratory, to give guidance when handling new chemicals or facing unforeseen circumstances.

Beyond that, as pointed out in the quoted Report 5., the three inexperienced chemists should attend a suitable training course arranged by RENPAP organization or by UNIDO involving contribution of some supplier companies.

PERKIN ELMER Company, being supplier of substantial instruments to the laboratory, has been contacted in order that a suitable course be organized for the senior staff in maintenance of GC instrument and training in use of HPLC, UV Spectrophotometer and TLC apparatuses. By assistance of Chit Chit Mynt, representative of Perkin Elmer Co. in Yangon it could be cleared that a training course for one fellow would cost USD 2000 for 10 working days to cover training engineers time and training materials; airfare, accomodation and food not included. Moreover this training would be due to a person with a background of knowledge in electronics. Accordingly Perkin Elmer Co. was requested to a) give a notice to PPPF about the visists of his service engineer, b) to organize a group training in Myanmar for all users of Perkin Elmer instruments c) include fellows of PPPF into any such group training d) to offer several days in-service training at the laboratory of the PPPF.

According to recommendation of Report 5. a standby emergency generator for automatic use in the event of a power failure has been supplied by UNIDO; it is still awaiting installation. The Report 6. adds: due to the often happening brakedowns of current the laboratory which is working on GLC and HPLC must have an UPS for at least 10 minutes battery power till the generator can provide electricity again. The same has to be said for the PC as a damage of the hard

disc means a loss of information. Therefore it is strongly recommended again to provide UPS for the laboratory.

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 the 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 that. Therefore it is recommended that together with the installation of the incinerator & waste-water treatment plant respectively literature, methodology and training be provided to the QC staff.

C. Laboratory; formulation development

The formulation development activity has the following targets:

1. Development of new formulae by inclusion of Superior Kerosene as replacement for imported solvent(s) into the original receipt.
Target: Increase of the local input.
2. Development of new formulae using active substances not yet formulated, originating from standard suppliers thereof.
Target: Expansion of product range.
3. Development of new formulae using active substances originating from alternative sources.
Target: Search for more economic but reliable sources of supply.
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.

1. The subject is treated separately under D.
2. It is shown in Attachement V. that M.A.S. has a regular demand in deltamethryn and fenvalerate. A previous information (see Report 3. Annex VI.p.2.) has foreseen also a demand in monocrotophos. The standard suppliers of the above products are: Sumitomo (fenvalerate), Hoechst/Roussel (deltamethryn) and Shell (monocrotophos) companies. M.A.S. consideres a company as a standard supplier in case there has been gained already several years' experience

through the application of the product imported in ready formulated form in Myanmar. It can be seen in the table in Attachment VII. that both standard and alternative suppliers have been contacted, some samples already received, formulated and given to M.A.S. for phytotoxicity & efficacy testing. As soon as the M.A.S. approval for the formulations will be available, the product range of the PPPF can be extended by the new products.

Sumitomo Co. provided samples also of its active substances esfenvalerate (Sumi Alpha) and fenprothrin (Danitol). These have been also formulated and sent for testing, however they are not yet included in the demand of M.A.S.

3. The active substances formulated at the moment in the PPPF are supplied exclusively by standard suppliers. These are shown in the table of Attachment VII. List of potential alternative suppliers has been evaluated, those considered to be the most reliable, selected. Some of those have already been contacted during the previous mission; several samples were received in the meantime, these were successfully formulated and the respective samples sent to M.A.S. for phytotoxicity & efficacy testing. Contacts with all the rest of the selected companies were initiated.

As soon as the M.A.S. approval for the above formulations will be available, quotations from the alternative suppliers may be requested and the most advantageous supplier(s) can be awarded by the orders.

4. During a previous mission a list of potential emulsifier suppliers had been provided (Report 2. Annex IX.) and suppliers contacted for samples. Several samples arrived and a continuous work is going on to develop alternative recipes. It is recommended to select successful recipes and by acquiring the required quantity of the respective emulsifiers to prepare 100 to 200 lit experimental batches of them to prove their suitability in the commercial scale production.

D. Make use of local superior kerosene

At the previous mission a range of formulation experiments were initiated (Report 3. Annex XII.) in order to include the locally available solvent, Superior Kerosene, into the receipt of each formulation and the relevant samples were given to M.A.S. for phytotoxicity testing. At a recent discussion M.A.S. stated that all formulations proved to be non phytotoxic (Attachment IV.) and therefore

there is no objection against the use of the same recipes in the commercial production (Attachment VI.). Steps were made in order to make use of the local solvent and save foreign exchange, as shown in Attachment VIII.

It is reminded that according to Report 2. Annex X. SK can be transported in road tankers of MPPSE preferably from a refinery which is the closest to Hmawbi. According to the calculation presented in Attachment VIII. the yearly demand might be 130 - 140 000 lit SK which should be produced and supplied in two lots. It has been checked with the Plant Management that the built in storage capacity of 30 000 lit extended by the available good condition empty xylene drums will allow to receive and store 70 000 lit SK at one time. It is recommended to clear appropriate space close to the SK storage tanks and provide access to it by the time the deliveries may start.

E. Construction works

Opposite to the production building, east direction, the construction of an open-wall, roof shaded store is going on intended to store imported solvent (xylene).

The construction of the lockers for the workers is planned in the coming budget year. Its location is south of the finished product store. It is recommended that the building should be sized in consideration of potential future extensions of the plant activities. The building should comprise room for storage of clean and contaminated clothing as well as laundry. The roof should be raised by one level over the ceiling with no walls around providing an airy space for drying 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.

The construction of a dining room opposite to the laboratory building is also planned as next. It is recommended that a kitchen should be included into the building with possibility of heating ready food and offering fresh food and beverages. Proper nourishment of the workers should be considered as a prevention against injuries by toxic chemicals.

The construction of the most essential part of the internal road has already been performed providing safe traffic for the forklift from its charging point in the Maintenance Workshop to the Liquid Plant and the stores. The construction will go on step by step reaching in this calendar year the entrance gate. It is

recommended that within this program a bridge suitable for forklift traffic should be built next to the kerosene storage tanks to allow access to the area recommended under D. for provisional storage of SK in drums.

The construction of a 30 000 gal capacity water reservoir for firefighting will start this year and will be performed in three steps. Its location is next to the water well.

The construction of an oil/solvent trap is going on placed in the trench of surface-water canal close to the fence before it leaves the plant.

The incinerator, which will be placed in the N/W corner of the plant, will need foundations and a shelter. The design for the construction thereof needs layout and design of the equipment showing loads and measurements.

Similarly the construction of a shelter and foundations for the waste-water treatment plant may also start only when the measurements of the plant will be available. This item will be placed on the west side, opposite the finished product store.

A similar however smaller house than the pumphouse had been recommended at the previous mission to house the standby generator for the sensitive equipment of the laboratory. This building still needs to be constructed. Location: north to the laboratory building. Justification see under B.

The layout of the plant showing the items described is presented in Attachment IX.

F. Energy supply

The plant gets its power supply from the National Network however with often shutdowns and a constant fluctuation of the voltage. The very frequent shutdowns can be overcome by the use of the plant's own diesel generator which has been installed in 1991. The generator can usually be started only later than ten minutes after shutdown and this pause causes big damage in analytical equipment and in PC, as it is also stated in Report 6. Therefore it is recommended to

- 1) provide the generator an automatic start,
- 2) install the small standby generator (under appropriate shelter, see under E.)
to supply reliable constant power just for the sensitive equipment.

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

G. Formulation facilities

The Liquid Formulation Line is capable to produce in one shift a quantity of 1 000 000 lit per annum roughly as it was foreseen in the plans and the sub-contract respectively. The facilities are in good condition, the maintenance is satisfactory. However the change & completions recommended during the test run to provide the work more flexibility still need to be fulfilled. It is also necessary to bring the two portable pumps provided for unforeseen operation or emergency cases to full standby condition. Missing are inlet & outlet pipes with respective rubber hoses. SICPLANT Co. had been advised to take care of the matter.

In order to intensify the heating of viscous emulsifiers it is recommended to install a hot platform in the heating chamber constructed in form of a tube railing connected into the hot water circuit.

According to recommendation in Report 6. the cartridge filter between the blender and the storage tank should be two sizes bigger. The existing small one should be placed into the line: filling tank - filling station.

H. Bottling & packing

Bottles

The bottles for the filling are produced by Ceramic Industries Corporation using the moulds (18 set) granted by UNIDO at a cost of up USD 30 000. At present 500 ml capacity bottles are produced only. The Filling Line is suitable to fill 1 lit capacity bottles as well, but that would make necessary the installation of a similar set of moulds at CIC again. This installation does not seem to be justified at the moment. The bottles should be coloured dark brown, but CIC can often provide transparent bottles only.

In many cases the mouth opening of the present bottles was more narrow than to allow the original nozzles to enter. The average internal diameter of the mouth opening is 16 mm ϕ . As a solution a new set of nozzles had been provided with an outside diameter of 14 mm ϕ only instead of the original 16 mm ϕ . With this modification all the bottles can be used without reject.

Unfortunately the new 14 mm ϕ 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 frequent stoppage of the filters recently. Consequently SICPLANT has been contacted in order to change the filters under guarantee terms into original mesh size ones.

However a number of the bottles has to be rejected due to bigger or improper outside measurements of the head & windings which does not allow the caps to be fitted. It is recommended to discuss this issue with the CIC in order to minimize the reject because this defect can be revealed only after the bottles have been filled. So the defective bottles must be emptied and collected as contaminated waste causing thereby unwanted contamination.

Plastic caps

The plastic caps are produced by the Plastic Factory No.3., made of polyethylene with the size: diameter 34 mm ϕ , height 24 mm, with internal windings, fitting well on the bottles. The wads are fitted in prior to the capping by manual work in the plant. The fitted in, elastic wads provide perfect closure of the bottles. These caps are well suitable to be processed by the capping machine.

Bottle filling station

The bottle filling station works most of the time without major problems however a number of faults while functioning gives cause for concern both in respect of contact and vapour exposure risk to the operators and the reliable functioning of the equipment. At present all the installed sections of the line are in operation including the

- rotating table for the feeding of the empty bottles,
- filling station (4 filling heads),
- automatic screw-capping table,
- labelling machine,
- discharging board for the filled bottles.

The faults observed in the filling line are:

- premature withdrawal of filling nozzles from the bottles before completion of the liquid discharge cycle,
- stoppage of the filter in the nozzles which causes incomplete filling of the bottles and afterward dripping on the outsides of the bottles, or overflow of the material due to foaming. This fault needs frequent cleaning of the filter causing high exposure to the operators,
- jerking action of the conveyor belt causing product loss from the filled bottles. Sometimes the bottles are toppled over with further loss and contamination,
- delayed withdrawal or not even levelling of the nozzles causes retaining of the bottles on the conveyor belt with frequent toppling over.

All these malfunctions cause serious contamination on the outside of the bottles as well as the conveyor belt both inside and outside of the closed compartments followed by spillage on the floor. Therefore it is recommended to the plant management to take more care of the cleaning of the cartridge filters to minimize the risk of stoppages' occurrence and to SICPLANT to pay special attention to the above at the final works provided under guarantee terms. It is also recommended to control the wear occurred in key parts during the nearly two years of operation.

Pilfer-proofing

The pilfer-proofing of the filled bottles is a serious requirement of M.A.S. to avoid pilfering, faking the products and eventual accidents. There are two options to cope with this request:

Option (1) is the use of the Self-Shrinking Cellulose Bands e.g. the brand "VISKRINGS". Viskrings are tubular bands of cellulose material contained in a special preservative solution. This solution suspends the natural shrinking action of the VISKRINGS until they are applied. After application the VISKRINGS dry out and shrink tightly to the surface contours of the bottle head, exerting a continuous clinging action.

This type of pilfer-proofing has already been tried and applied successfully at the Plant. 200 000 VISKRINGS were ordered and applied, M.A.S. found the solution as satisfactory. The cost of the closures was GBP 2101 in full, that is GBP 10,5/1000 bottle. This was used on the provisional bottles with provisional caps. For the standard bottles & caps in use a new quotation was requested which reads: "Plain white opaque VISKRINGS dia 34 mm x 24 mm height, PDS STLG 6,99/1000 FOB (we assume this is the size you require or this is actual size of cap to be sealed). Freight and handling 200 000 and 500 000 pcs PDS 280, 1 million PDS 390, delivery 6 wks from receipt of L/C."

That means that the cost is GBP 8,39 or 7,55, or 7,38/1000 bottle depending on the size of the order.

VISKRINGS offer an immediate and economic solution for the pilferproofing, acceptable even for M.A.S., therefore it is recommended to order VISKRINGS without delay, because they may be used also after ROPP caps will have been introduced as emergency solution in case of breakdown.

Option (2) is the use of ROPP capping system applying aluminium caps with perforation at the lower part, windings and final closure at the bottom being rolled on after it is positioned on the bottle. UNIDO provided a semi-automatic ROPP machine for the plant which arrived to the site the before last day of the mission in the field and was not yet installed.

It is important to note that the unit is not suitable to be fitted in into the filling line, supposedly its capacity is also inferior to that, therefore it can be considered only as a demonstration unit to process minor quantities for special purposes.

It is a still outstanding issue to select the appropriate caps for the machine. There are examples in the country of ROPP capping in the food and beverage industry, but the caps used for the closure of mineral water bottles are not suitable for the purposes of the PPPF because of two reasons:

- the height of the cap is 18,5 mm only instead of the required 28 mm
- the perforation of the cap cannot be called a perforation at all.

After an attempt to open a bottle of mineral water it is clear, that a pesticide needs a different quality cap. It has been stated that it can be available from private manufacturers, but there was no time enough to control the matter.

It is very likely that this solution will be less economic than the use of Viskrings.

The machine should be provided with a preferably mobile cabinet connectible to the central vapour suction system.

Semi-automatic Filling Machine

UNIDO provided a Semi-automatic Filling Machine for the Plant which can serve as an emergency solution in case of breakdown of the filling line or to solve the bottling of some minor quantity production even independent from the regular production.

The Filling Machine has been constructed for operation from drums or open containers. After evaluating various solutions of the material supply with the Plant Management the following conclusion was met:

Since the operation of the plant the overflow tank has not yet been used in any case, therefore it can be separated from the manufacturing line. It will be necessary instead to provide it with suitable inlet and outlet pipelines as follows:

Inlet:

- Connection should be provided from the transfer pump discharging the mixer into the "overflow" tank.

- Connection should be provided from the drum decanting pump (used for solvents) into the "overflow" tank.

Outlet:

As the Machine will be used occasionally only it is recommended to provide occasional connection only by a 8 m long 1" diameter rubber hose connecting the bottom valve of the "overflow" tank with the Machine through an Y shaped forking, to join to both suction pipes of the filling machine.

Remark: after these changes the installation of the acrylic cylinder window at the overflow tank can be omitted from the completions foreseen.

The closure of the bottles filled on this machine can be organized by either of the capping machines depending on the actual circumstances of the production program. It is important, that the machine be provided with a preferably mobile cabinet with connection to the central suction.

Collective packing

The bottles are packed by 3 x 4 in strong cardboard boxes with partition walls and additional bottom layer. The boxes arrive first to the CIC where they are used to carry the empty bottles. General signs e.g. "This side up!" are preprinted on the boxes, other information is on a printed label identic to ones on the bottles.

Opposite to the views expressed in Report 4. there seems no need to change the present form of the collective packing. Concerning to provision of a more informative label it is preferred instead to print informative text on the back side of attractively designed leaflets and put of these 12 in each box. The size of the bottles is considered to be insufficient to carry greater label and it is also not recommended to decrease the size of the characters on the label.

J. Transport and telecommunication

Internal transport

The most critical section of the road within the plant where the forklift truck used to run has already been constructed as firm concrete road. Next budget year the work will continue and it is planned to reach the entrance gate.

Vehicles

The present set of vehicles consists of two trucks (6,5 t each), one light truck (1,5 t), one Jeep and one microbus (8 persons+driver). It is recommended to complete the set by one additional truck (4 t).

Access road

Since the implementation of the project started each report written complains about the condition of the road connecting the plant with Hnawbi. Even the last TPR Meeting Report recorded it but until now there is no sign of any action for the improvement however this is a very substantial Government Contribution. A letter was written asking the Resident Representative of UNDP to make steps in the matter (Attachment X.) in order the construction works start as soon as possible and e.g. at least one section firm asphalt road within the boundaries of the very busy Wanet Chaung be constructed.

Telecommunication

It was stated by the plant management that the Plant will have a telephone line connection to Yangon within several months. This is a very important achievement both from management and safety aspect. It is important to install extensions within the plant at each workplace from where emergency calls might be necessary, including e.g. the water-pumphouse, the electric substation as well, however there is no continuous workplace there.

K. Production and possibilities for the extension of activity

The table shown in Attachment XI. presents the figures of production at PPPF in 1990-91⁺ and 1991-92⁺ broken down by products and compared to the demand of M.A.S., presented in Attachment V. It can be seen that the plant produced 75,1% and 91,1% respectively in the two years compared to the demand in already approved products. It could be stated that as soon as the two further products' samples will have been approved by M.A.S. and the necessary FE will be available, the Plant is capable to fulfill the total requirements. Even at present it is not the shortage of capacity, but the shortage in FE that did not allow to reach the 100% performance of the demand. Although per cent figures show high performance the Plant is not yet running at full capacity. If sufficient funds were available the demand could be set higher, it had been stated, but because this is not very likely two recommendations are suggested to utilize the not yet covered capacities:

- (a) There are cases when M.A.S. imports directly ready formulated liquid pesticides because of urgency or other reasons. In such cases it is recommen-

⁺Budget Years starting at the 1st April, ending at the 31st March next year.

ded to order the products in barrels instead of bottles/cans and let them bottled at the PPPF. Through this organization savings are possible additionally.

- (b) WHO has been contacted and notified about the possibility that its needs in liquid pesticides for vector control may be formulated at the PPPF by granting the available FE for the importation of the necessary active substances & emulsifiers (see Attachment XII.).

L. Safety aspects

Plant and Environmental Safety was given a major attention by providing several consultant visits, the findings and recommendations of which, including two detailed Safety Audits were recorded in relevant Reports 6., 7., 8. and 9. These are partly overlapping and too numerous to be repeated here but it is supported to follow all those recommendations seriously. Some issues however need to be pointed at:

Medical room, medical assistance

It had been agreed already at a previous mission that a ground floor room in the Laboratory building will serve as medical room, but no steps were yet made for its installation. It has been agreed now with the Plant Management that the room will be installed in short with the necessary furniture and tools, a hand-wash basin with running water tap be fixed in the south'west corner and the door be provided with red cross sign and inscription: "Medical Room".

Concerning the medical assistance a letter was written to U saw Mynt, managing director of MPI, see together with his reply in Attachment XIII.

WHO was also contacted in the matter with the request to give advice to the installation of the room, follow up the monitoring of occupational health and assist in providing a proper training to the medical staff member(s) to be appointed (see Attachment XII.).

Incinerator

It has been described under A. that the installation of a proper size and technology incinerator has been decided which will work at 1100°C with a residence time of 2 seconds. There were doubts at the side of the Plant Management whether endosulfan active substance residues remaining in the drums emptied can be decomposed fully under these circumstances. An expert opinion had been requested in the matter and that confirmed that endosulfan drums should be triple rinsed

with xylene and incinerated. Incineration at 1100°C should in this case not have any residue left.

Safety Data Sheets

The suppliers of pesticides have the duty to provide Safety Data Sheets aside each consignment. It is recommended that Safety Data Sheets should be required with each consignment. Beside that it was discussed with the Head of the Laboratory how a Safety Data Sheet should be prepared and that it should be controlled with the manufacturing company.

Production of higher toxicity products

As it has been mentioned the formulation of monocrotophos active substance is also foreseen within the future plans of the M.A.S. Due to its higher toxicity it is recommended, that the formulation of it or any product of the similar level of toxicity should not start until

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

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

M. Potential for formulation of granules

As it has been stated in the minutes of the discussion with M.A.S. in Attachment IV., the use of pesticides in Myanmar includes about 500 t/year Diazinon 10 G granules. A granules formulation unit was originally included into the first study on the Project (see Report 1.). It was agreed that a brush up of the facts included in the above original Feasibility Study will be made. The conclusion of it can be summarized as follows:

Mineral carrier

Mining Corporation No.3. produces in its mines bentonite, fireclay and limestone. Limestone is available in min. 500 t/year quantity in a size of 0 - 20 mm as a reject (assumably it must be cheap). The potential of the further crushing and sieving to gain a uniform 0,8 to 1,0 mm size fraction needs further check. Mining Corporation No.3. promised to provide 2-2 kg sample of each mineral which will

manually be crushed, sieved and than might be tested on suitability. Test methods are given in report 1., Annex XII. p. 85.

Another idea was to use river sand. River sand is available from small private entrepreneurs only, therefore the availability in uniform size and quality is questionable, with no mentioning of the moisture to be evaporated. Therefore the first option seems to be more viable.

Technology and Equipment

The technology and the selection of the equipment described in the Report 1. still can form the base of planning however with an increased capacity matching the actual demand. When sizing the capacity only the dry seasons of the year should be considered for the production to avoid excess need for evaporation of the moisture. This will mean a capacity of about 100 t/month = 5 t/day.

Packing

The packing of the granules is suggested in fill & weld type machine fed with locally available 0,1 mm plastic sheet (or tube). 5 kg bags are recommended which can collectively be packed by two or three in multiply paper bags closed by sewing machine.

Implementation

However the present project when starting contained the implementation of the granular formulation as well, this component has been dropped and no funds are available at the present. The Government sets hope in support from Japan, Nichimen Co., considering that it is supplier of the ready made formulation and the most potential future supplier of the active substance for the Diazinon granules. Considering all the above it is suggested that a new project should be initiated involving potentially offered support of the Japanese party as well. For the above a Project Identification is presented under Attachment XIV. Nichimen Co. was contacted in the matter and requested to provide assistance in identification of the suitable mineral carrier.

N. Management and follow up

According to the observations during the mission the plant is managed by the *senior staff members in an optimum way, however it is mandatory that all the recommendations of the previous missions as well as visiting consultants be performed fully. Special stress should be put on the issues concerning safety in the plant & environment.*

The plant shows a good shape, the maintenance is satisfactory, the buildings are in good condition and the careful gardening gives a good general impression. However in the dry season the dried up weeds should be collected more frequently to minimize fire risk.

A next further important strive should be for the management to do their best in order to increase the coverage of the capacity. Some possibilities concerning this aim were suggested under K. Further to that it is important to cut avoidable administrative time delays. According to the experience up to now the FE needed for the production is available with delays and this can make the formulation of the demand for M.A.S. in time impossible. This could press M.A.S. to import urgently needed items directly - a loss from the capacity coverage. Therefore it is suggested that the Management of MPI first: put a greater stress on the acquisition of FE in time and second: to start sending out inquiries - without obligation - and collect offers well before FE is available to enable immediate orders at the best sources as soon as the funds will have been granted.

At the present mission a series of contacts were initiated with various foreign firms in order to diversify importation sources and thus improve the economy of the production. This will lead to regular correspondence with such firms. The present quality of correspondence, the aspect of the letters is very poor and not sufficient to give the foreign company the impression of PPPF as being a reliable and competent business partner, however 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 be given a good to remember individual name. As it is difficult to get a qualified typist to work in Hmawbi, two of the staff members should be sent to an intensive course to be trained in typewriting, to give the letters a proper format and some basic training in English.

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 accomodation, 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 do sports, to let 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 importance of the 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.

However well trained is the senior staff of the plant, two years' experience is considered not to be sufficient to leave the Project after termination without any further support. Therefore it is suggested to initiate a new Project with the aim to provide further support to the just initiated activities for the next at least five years. Project Identification is presented for the above under Attachment XV.

O. Termination of the project

The project DP/MYA/80/011 is approaching to be completed. There is the wish to terminate the Project this year, 1992. Therefore it is thought useful to mention the major issues still to be done from UNIDO/UNDP side until full completion:

Installations:

- (a) Semi Automatic Filling Station,
- (b) ROPP capping machine,
- (c) Incinerator,
- (d) Water Treatment Plant,
- (e) Laboratory instrument extension (HPLC, UV Spectrometer, TLC).

Consultant visits:

- (1) Consultant in safety should repeat his visit after (c) and (d) will have been installed.
- (2) Consultant in Quality Control should repeat his visit after laboratory instrument under (e) arrived in the site.
- (3) Consultant in maintenance and operation of bottling machines is recommended to visit to install (a) and (b) as soon as proper caps for ROPP are available.
- (4) CTA visit is suggested for Sept/Oct. 1992.

It is considered very likely that some of these items, mainly (c) and (d) will not be completed within 1992. For this case it is suggested that follow up thereof should be provided within the framework of the suggested consecutive project (Attachment XV.)

RECOMMENDATIONS

Ad III.B.

- Quality Control Consultant should visit the plant as soon as the additional equipment (HPLC, UV Spectrometer) arrives.
- The installed new refrigerators should be provided with voltage stabilizer.
- Printed forms should be prepared for Certificate of Analysis.
- Training possibility for the junior chemists should be consulted with RENPAP organization.
- One staff member should attend each RENPAP workshop.
- Perkin Elmer training possibility should be optimally utilized.
- The standby generator should be installed as UPS for the sensitive instruments.
- Training & literature in waste management should be provided for the laboratory in connection with the installation of the Waste Water Treatment Plant & Incinerator.

Ad III.C.2.

- The Plant Management should follow up the results of the samples given to M.A.S. and in case of approval take the necessary steps for inclusion of the new product into the scope of production.

Ad III.C.3.

- Correspondence with the contacted companies should have follow up.
- Arriving samples should be formulated and given to M.A.S. for testing.

Ad III.C.4.

- Successful formulations need scale-up and evaluation for economy.

Ad III.D.

- The Plant Management should follow up the matter until acquisition of final approvals for the use of local SK and then make use of it.
- A proper space next to the SK tanks should be cleared for the storage of SK in drums, with access provided for forklift traffic.
- Sufficient quantity of empty xylene drums should be ready to receive 30-40 t SK.

Ad III.E.

- At the construction of the lockers/laundry the building should be sized in consideration of potential future expansion. It should comprise room for storage of clean and contaminated clothing. The roof should be raised by one level over the ceiling with no walls around to provide airy space for drying wet clothes.

- The laundry should be provided with a washing machine to stop hand-washing of contaminated clothing as soon as possible.
- At the construction of the dining room a kitchen should be included.
- The shelter for the standby generator should be constructed.

Ad III.F.

- The diesel generator should be provided with an automatic start.
- A second tube well should be established.

Ad III.G.

- The two portable pumps should be completed with inlet & outlet piping.
- A hot platform should be installed in the heating chamber.
- 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.
- The overflow tank should be separated from the main technological line, provided with inlet from both the main blender and the drum decanting pump, that the tank serves to feed the Semi-automatic Filling Machine. Due to this change the insertion of an acrylic cylinder into the inlet pipe should be cancelled.
- A flexible rubber hose connection should be provided from the overflow tank to the Semi-automatic Filling Machine joining via Y forking to both suction pipes.

Ad III.H.

- SICPLANT should provide under guarantee terms a set of four filters to the recently provided 14 mm ϕ nozzles with original density of the wire mesh.
- CIC should be contacted in order to eliminate the supply of reject bottles.
- SICPLANT should seriously investigate and eliminate the malfunctions observed.
- SICPLANT should control the wear during the production up to now, revise and complete the list of spare-parts needed.
- VISKRINGS should be ordered immediately and thus pilferproofing should be provided continuously.
- Appropriate, suitable size and properly perforated caps should be selected and provided for the ROPP machine.
- ROPP machine should be installed and trial production performed. The trial production should be enough to establish the capacity of the machine.

- The Semi-automatic Filling Machine should be installed and during a trial production the attainable capacity should be established.

Ad III.J.

- The laying of the internal roads by firm concrete layer should continue.
- One additional truck (4 t) should be provided for the PPPF.
- Higher level contacts should be initiated in order that a firm asphalt road be built from the Plant to Hmawbi as a Government Contribution. It is preferred to start the construction with the section crossing Wanet Chaung.
- Telephon extensions should be established at each manned or only occasionally manned workplace from where emergency calls might be necessary. Future workplaces should also be considered in this respect.

Ad III.K.

- Appropriate intervention is recommended at competent Government Members in order to secure the necessary Foreign Exchange for the purchase of the active substances and other raw- and auxiliary materials to be imported in due time allowing the necessary time span for the importation and formulation of said materials to fulfill the demand of the Agriculture in time.
- Direct imports of M.A.S. should be imported in barrels and bottled at PPPF.
- Demand of WHO in liquid pesticides should be also formulated locally using the FE allocated for ready imports on the purchase of raw materials.

Ad III.L.

- The ROPP machine should be provided with a preferably mobile suction cabinet connectable to the central suction system.
- The Semi-automatic Filling Machine should also be provided with a preferably mobile suction cabinet connectable to the central suction system.
- The Medical Room should be provided with the following furniture & equipment:
 - 1) hand-wash basin with running water tap, fixed in the south/west corner of the room,
 - 2) one desk,
 - 3) one small table,
 - 4) five chairs,
 - 5) one bed,
 - 6) one stretcher,
 - 7) one chest for medicines,
 - 8) one personal scale,
 - 9) one blood pressure meter.

- Constant medical assistance should be provided for the PPPF.
- Medical Staff should be given regular training in treatment of pesticide injuries.
- Incinerator should be installed for toxic waste destruction.
- Safety data sheets should be collected from the suppliers of active substances.
- Higher toxicity products such as e.g. monocrotophos should be produced only after the full elimination of exposure risks existing, as given under H.

Ad III.M.

- The potential for the formulation of granular products should be investigated.
- The Formulation Laboratory should test the mineral samples.
- Mineral samples with test results should be given to Nichimen Co. and evaluation be requested.

Ad III.N.

- Inquiries for the active substance should be initiated well before orders are due.
- The appearance of the PPPF in the international correspondence should be upgraded.
- The social services should be improved both in the plant and in the residence area.
- The Plant Management should be given follow-up support in the form of a new Project.

Ad III.O.

- Eventual outstanding issues should be taken care of within the frame of a follow-up Project after the termination of the present one.

INSTITUTIONS AND PERSONS CONTACTED

United Nations Personnel

Mr.Gerd Merrem	Resident Representative
U Htin Aung	Programme Officer
Dr.Gaston Pierrard	Chief Technical Adviser, FAO
Dr.Klaus Wagner	W.H.O.Representative to Myanmar

Myanma Pharmaceutical Industries (MPI)

U Saw Mynt	Managing Director
U Ban Yi	Director, Planning
U Than Tin	Asst. Dir., Planning

Project Personnel

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

Myanma Agricultural Service

U Maung Maung Tin	Project Director, Plant Protection Project
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Department of Health

Dr.Win Lwin Nyun	Deputy Director, Occ Health Unit
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NICHIMEN Co.

Mr.Michitaka Yoshida	General Manager
U Kyaw Sein	Manager

PERKIN ELMER Co.

Chit Chit Mynt	Representative to Myanmar
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JUSTIFICATION FOR EQUIPMENT

1. Additional equipment to the value of US\$290,000 is included in this revision. These fall into two categories, as shown below :
 - a) Incinerator for the PPPF
 - b) Laboratory equipment
2. Incinerator for the Pilot Plant for Pesticides Formulation

When the project was originally approved it was decided to provide design for building a small brick built incinerator for burning the waste. However during the nearly one decade since the first planning was made environment protection has been given much more attention and high priority due to collected evidence on potential adverse effects of toxic effluents and improper waste disposal. Therefore due to the up to date requirements of environment protection and considering the high temperature needed for burning toxic waste it was agreed to provide a fully operational incinerator with proper technology and suitable size with facilities for scrubbing the exhaust fumes coming out of the incinerator. As the demand for pesticides is likely to increase and the fact is also given, that some unused pesticides will be generated and considering the possible expansion to make granules and other formulations, it was agreed at the last TPR meeting to provide the incinerator within the framework of the subcontract by utilizing potential cuts in the outstanding services of sub-contract.

Under the sub-contract the establishment of the formulation plant is completed and operating satisfactorily. It is possible to save US\$71,250 in the sub-contract by reducing 5 m/m of sub-contractor's services and use the funds for buying an incinerator. SICPLANT International, sub-contractor provided soon after TPR meeting two options with costing for consideration :

Option A : Incinerator reaching a temperature of 1050°C with 2 seconds residence time for waste at this temperature but without cooling the burnt gases and without scrubbing devices at a cost of US\$ 178,470.

Option B : Incinerator reaching a temperature of 1100°C with similar residence time for waste at this temperature but with cooling the burnt gases and with treatment device including scrubbing at a cost of US\$ 346,470.

After the reduction of 5 m/m services by the sub-contractor and after taking into account some savings from other budget lines, the total sub-contract will have to be increased by US\$260,000.

UNIDO has decided to go for "Option B" mainly because of the increased concern for proper treatment of waste and also taking into consideration that the demand for crop protection chemicals will be on the increase and the incinerator could be used to cover long term requirements and process waste generated at the end-user of the products and returned as well.

3. Laboratory equipment

Initially the analytical laboratory was given only the basic analytical equipment which was sufficient to cope with the requirements connected with the originally planned range of products. There is one major analytical instrument, a Perkin Elmer 8500 Gas Chromatograph (GC). It is fully operational but in the event of its failure there is no alternative method of analysis for the active ingredient in the prepared formulation, which is essential both to control the process and for the release of the production for sale.

A significant part of the formulations prepared is based on synthetic pyrethroids; if alternative sources of the technical materials are sought (for economic reasons), confirmation of the isomer ratios is essential and can only be done satisfactorily by HPLC (High Pressure Liquid Chromatograph). An HPCL isocratic system should be purchased. This would provide a basis for alternative methods for the determination of the active ingredient.

Deltamethrin and fenvalerate are proposed as new active substances to be formulated in the PPPF, these are synthetic pyrethroids like cypermethrin which is already formulated. The individual members of this class of compounds all have several optical or diastereoisomers which can vary tremendously in their insecticidal efficacy. Specifications for the purchase of the technical material for formulating will have to cover this point and the QC laboratory must be able to verify the isomer ratio of both the incoming technical product and the outgoing formulation. The present analytical equipment capacity does not enable this to be done. There are two alternatives : Capillary Column (GC) or HPLC. The Perkin Elmer 8500 GC has a split/splitless capillary injection system fitted (but no instructions for use) and a capillary column is available. These Capillary Columns are very expensive and can be easily degraded and made ineffective if not treated carefully. The use Capillary Column (GC) would increase the reliance on the one major piece of instrumentation and in the event of a breakdown would lead to long delays before a service engineer could repair it the use of HPLC would avoid both these drawbacks and is the preferred option.

Other alternatives for other active ingredients : UV/Visible Spectrophotometer and a basic TLC (Thin Layer Chromatograph) set-up, should also be provided. To cover these purchases BL 42-00 should be increased by US\$30,000.

REPORTS OF CONSULTANTS QUOTED IN THE TEXT

1. Terminal report. I.Bendefy, 18.July, 1984.
2. Technical report. I.Bendefy, 31.January, 1990.
3. Technical report. I.Bendefy, 15.August, 1990.
4. Technical report. H.T.Rahaju, 21.November, 1990.
5. Technical report. B.Crozier, 20.February, 1991.
6. Technical report. R.Teuber-Weckersdorf, 14.January, 1992.
7. Technical report. K.S. Johnson, 6.February, 1992.
8. Technical report. M.Srivastava, 23.March, 1990.
9. Technical report. M.Srivastava, November, 1991. (not yet edited)
10. Technical report. B.Crozier, July, 1991. (not yet edited)

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Minutes of the discussion with Ministry of Agriculture,
Plant Protection Service

The discussion took place in Yangon at the Head Office of the Plant Protection Service on 28.1.1992. in presence of:

U Maung Maung Tin	Project Director, Plant Protection Project, Myanma Agricultural Service
Dr. Gaston Pierrard	CTA, Pest Management FAO.
Dr. Istvan Bendefy	CTA, Pilot Plant for Pesticides Formulation
U Win Kyi	National Project Director

Matters concerning the Pilot Plant for Pesticides Formulation were discussed.

MAS stated that the present Plant Capacity which is around 1.000.000 l/year at one shift work is plenty to cover the actual demand in liquid pesticide formulations which is estimated around 600.000 l/year. Breakdown of the same is shown in attachment.

The quality of the production is satisfactory, only the packaging of the goods needs improvement. This is well known to the Plant Management and they do their best to improve the packing.

A series of experimental formulations were prepared during the test run of the project containing Superior Kerosene as solvent component. MAS confirmed that these experimental formulations were tested on phytotoxicity and no phytotoxic phenomenon did occur. Therefore MAS has no objection that these formulae shown on the attached table be used in the regular production allowing considerable savings in imported solvent.

It was discussed that the next objective in the formulation development will be to prepare experimental samples from active substances of alternative suppliers. The same procedure should be followed that the samples will be sent to MAS for analytical control and phytotoxicity testing. After successful testing they will be released for importation and regular production.

MAS gave information that aside the liquid formulations about 1.000 t/year solid formulations are used in the country of which roughly 50% is wettable powder formulation, another 50% consists of granules, mainly diazinon 10 G. The importation of granules means importation of 90% mineral carrier which could certainly be provided locally. Therefore MAS expressed deep interest that the production capacity of the Pilot Plant be extended by a production line of Granular Formulation.

Dr. Bendefy promised to forward the matter to UNDP/UNIDO and make first assessment on the feasibility.

Signed on the date as above by:

U Maung Maung Tin



Dr. Istvan Bendefy

Dr. Gaston Pierrard

U Win Kyi

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Actual demand of liquid pesticides in Myanmar

as estimated by M.A.S. in 1992.

<u>Ser.No.</u>	<u>Product</u>	<u>Quantity (litres)</u>
1.	Endosulfan 35 EC	100 000
2.	Cypermethrin 10 EC	75 000
3.	Deltamethrin 2,5 EC *	75 000
4.	Fenvalerate 20 EC *	75 000
5.	Phenthoate 50 EC	100 000
6.	Fenitrothion 50 EC	100 000
7.	Diazinon 40 EC	75 000
Total demand :		600 000

* Products still in development, not yet in production

1. FORMULATION RECEIPTS USED IN THE LIQUID FORMULATION PLANT

Sr. No.	Product name	FF/4	MS	SC/224	RE/70	V/497	REOPLAST	XYLENE
1.1	Cypermethrin 10 EC	4.4	3.6	--	--	--	--	up to 100 %
1.2	Fenitrothion 50 EC	4.5	--	--	5.5	--	--	up to 100 %
1.3	Endosulfan 35 EC	--	--	5.0	--	--	1.0	up to 100 %
1.4	Diazinon 40 EC	3.0	2.0	--	--	--	1.0	up to 100 %
1.5	Phenthoate 50 EC	3.0	--	--	--	7.0	--	up to 100 %

2. FORMULATION RECEIPTS DEVELOPED INCLUDING SUPERIOR KEROSENE

Sr. No.	Product name	FF/4	MS	SC/224	RE/70	V/497	REOPLAST	Mixed solvent	Xylene/Kerosene ratio
2.1	Cypermethrin 10 EC	4.8	3.3	--	--	--	--	up to 100 %	45 / 55 %
2.2	Fenitrothion 50 EC	4.5	--	--	5.5	--	--	up to 100 %	60 / 40 %
2.3	Endosulfan 35 EC	--	--	5.0	--	--	1.0	up to 100 %	50 / 50 %
2.4	Diazinon 40 EC	3.0	2.0	--	--	--	1.0	up to 100 %	30 / 70 %
2.5	Phenthoate 50 EC	3.0	--	--	--	7.0	--	up to 100 %	45 / 55 %

Summary and status of contacts to suppliers.

Active substances: SUPPLIERS	in production					in development				
	Endosulfan	Phenthoate	Fenitrothion	Diazinon	Cypermethrin	Deltamethrin	Fenvalerate	Monocrotophos	Esfenvalerate	Fenpropathrin
SUMITOMO CHEMICAL CO. LTD.			*				(*)		(*)	(*)
NICHIMEN CHEMICAL CO. LTD.		*		*						
HOECHST AG. (& Roussel)	*					*	+			
I.C.I. LTD.					*					
SHELL INTERNATIONAL CO. LTD.					+		+	(*)		
CIBA GEIGY CO. LTD.				*				+		
BHARAT PULVERIZING MILLS CO.	(+)				(+)		(+)			
ATABAY AGROCHEMICALS & VET.					(+)					
MAKTESHIM AGAN CO. LTD.	+			(+)				+		
RALLIS INDIA LTD.			+		+		+	+		
JIN HUNG FINE CHEMICALS CO.			+					+		
KOREA EXPLOSIVES CO. LTD.	+	+								
GHARDA CHEMICALS LTD.					+					
UNITED PHOSPHORUS LTD.					+		+			

Symbols used: * regarded as standard supplier of

+ regarded as alternative supplier of; the Company contacted to provide experimental sample.

() experimental sample received, successful formulation performed, formulated sample handed over to M.A.S. for phytotoxicity & efficacy testing.

Dated: Hmawbi, 18 March, 1992.

To

The Resident Representative of UNDP,
United Nations Development Programme
Yangon.

Dear Sir,

Re: Project MYA/80/011 Pilot Plant for Pesticide Formulation.

I wish to call your kind attention to the fact that among the objectives set forth for the above project it has a priority to achieve savings in foreign exchange by increased use of local inputs, among them solvents for the formulated products.

According to the wish of M.A.S. and in lack of local formulae it had been decided to start the production with standard raw materials which are expected not to cause any phytotoxicity to the cultivated crops. Two years of commercial use of the products formulated by the PPPF justified the above decision.

In 1990 I initiated the development of receipts for each product by the inclusion of Superior Kerosene produced by Myanmar Petrochemical Enterprise. Samples of same were handed over to M.A.S. for testing on phytotoxicity. At a recent discussion M.A.S. stated that all the formulations proved to be non phytotoxic and therefore there is no objection to use the same receipts in the commercial production. The content of the discussion is set forth in Minutes and will be included in my report.

To show the potential savings by the introduction of the receipts concerned the following table has been prepared:

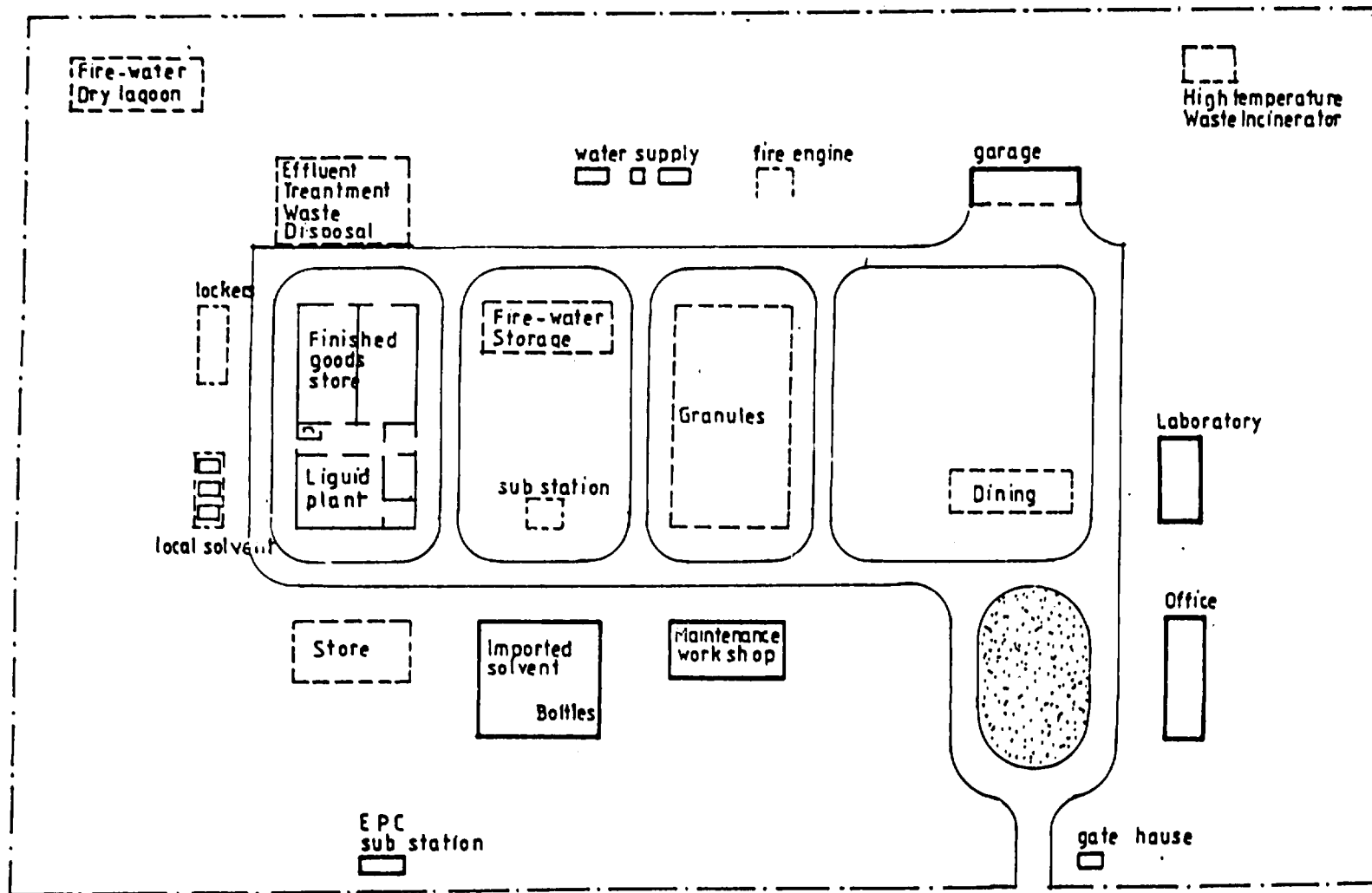
Product	M.A.S. demand (lit.)	Solvent component (lit.)	Kerosene substitute (lit.)
Phenthoate 50 EC	100 000	40 000	22 000
Fenitrothion 50 EC	100 000	40 000	16 000
Diazinon 40 EC	75 000	40 500	20 250
Endosulfan 35 EC	100 000	59 000	41 300
Cypermethrin 10 EC	75 000	61 425	33 780
Total:	450 000	240 925	133 330

According to the figures in the table by the introduction of the receipts including Superior Kerosene instead of importing the full amount of xylene (240 925 lit) it will be enough to import 107 595 litres only, the balance being substituted by 133 330 litres of Superior Kerosene. The saving which is estimated to be at an order of USD 50 000 will allow to import further raw materials and increase the output of the plant, for which the capacity is available.

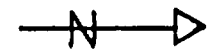
Considering the above I request you to make the necessary steps in order to acquire all the necessary approvals from the competent authorities to provide the PPPF the green light to use Superior Kerosene receipts and start saving as expected from the project.

Yours truly


Dr Istvan Bendefy
C. T. A.



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



Attachment X.
Dated Hmawbi, 25 February 1992

To

The Resident Representative of UNDP
United Nations Development Programme
Y A N G O N

Dear Sir,

Re: Project MYA/80/011 Pilot Plant for Pesticide Formulation

The above project is approaching to be completed and handing over to the Government of Myanmar for regular operation. The Tripartite Review Meeting in 1991 discussed outstanding issues of the implementation and outputs to be produced before the next Tripartite Review. Most of the items listed in the Detailed Project Workplan within UNDP/UNIDO responsibility have been performed or are being performed. Even an Application for the Extension of the Project Budget is under way in order to fully meet the Government Expectations.

I quote PART A 3.(g) ix) of the Summary of the TPR Report as saying:

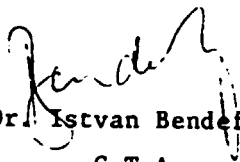
It is recognized that the 7 miles of unpaved road leading to the pilot plant from the town of Hmawbi needs to be upgraded entirely. Proper roads are extremely important from economic and safety points of view, to transport empty glass bottles to the plant and bottled pesticide formulations to the Myanmar Agricultural Service. MPI to follow up with Ministry of Construction.

It is written in the report of Mr. Teuber-Weckersdorf that the road was completely impassable during the last rainy season. I can observe the day by day deterioration of the road at present due to frequent traffic by heavily loaded lorries transporting stone. There is no sign of any preparation for the construction of a proper firm road.

Considering that it is a major concern of UNIDO/UNDP to hand over a sustainable Project it seems to be very urgent and has a primary importance to take steps in the matter. Therefore, because this is beyond my competence, I request you to meet competent Government Officials and draw their attention to the importance of the matter. It can be seen in Yangon area that road construction can be done here very quickly and efficiently, only the competent person's decision is needed. In my opinion this step should be made as soon as possible, still before the allocations for the next budget year in Myanmar will finally be decided.

I thank you for your efficient assistance in the matter in advance.

Yours truly


Dr. Istvan Bendefy
C.T.A.

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DATA OF THE PRODUCTION AND DEMAND

(litres)

Sr. No.	P r o d u c t	D e m a n d	P r o d u c t i o n	
			1990-91	1991-92
Approved formulations:				
1.	FENITROTHION 50 EC	100 000	127 122	107 064
2.	DIAZINON 40 EC	75 000	50 832	55 350
3.	PHENTHOATE 50 EC	100 000	42 576	57 876
4.	ENDOSULFAN 35 EC	100 000.	45 666	126 116 (41 852) *
5.	CYPERMETHRYN 10 EC	75 000	71 910	63 594
total:		450 000	338 106	410 000
Z of demand:			75,1	91,1
Not yet approved formulations:				
6.	FENVALERATE 20 EC	75 000	-	-
7.	DELTAMETHRIN 2,5 EC	75 000	-	-
Grand Total:		600 000		
Z of full demand:			56,3	68,3

* Still outstanding at 1st March, to be produced till 31st March.

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Dated: 24 February 1992

M I N U T E S

of the discussion held at the Representative's Office of the World Health Organization, Yangon on 24 February 1992.

PARTICIPANTS :

Dr. Klaus Wagner	WHO Representative
Dr. Win Lwin Nyunt	Deputy Director (Occupational Health) Department of Health
Dr. Istvan Bendefy	Chief Technical Adviser, UNIDO
U Win Kyi	National Project Director, for MPI

Subject : Matters concerning Pilot Plant for Pesticide Formulation (MYA/80/011)

Information was given from the Project side that the Plant is already in regular operation and may offer savings of foreign exchange if pesticides needed in vector control were formulated locally and only active substances and additives imported.

Advice and assistance was requested in order to have a properly installed medical room in the plant and a doctor or nurse there to regularly take care of occupational health and eventual accidents.

A member of the Medical Profession could give advice regarding the toxic effects of pesticides and detect early signs and symptoms of the toxic effect, thereby early intervention could be undertaken so as to prevent serious sequel. The doctor or nurse would also be able to look after the other health problems. The Occupational Health Unit would be willing to train the doctor or nurse regarding early diagnosis and treatment of pesticide poisoning.

(Contd. on Page 2)

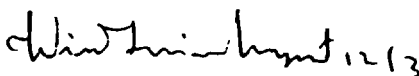
The WHO Representative explained that Occupational Health is one of the national programmes supported by WHO. The funds allocated for that are already committed for various project components so that no financial contributions for establishing the proposed medical room can be made available. But it would be useful to contact the National Project Manager of the Occupational Health Project in order to get his advice as regards the content of the work to be carried out by the respective health staff in the pesticide plant. This contact would be arranged with the assistance of the WHO office.



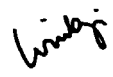
Dr. Klaus Wagner
WHO Representative to Myanmar



Dr. Istvan Bendefy
Chief Technical
Adviser, UNIDO



Dr. Win Lwin Nyunt
Deputy Director
(Occupational Health)
Department of Health



U Win Kyi
National
Project
Director
for MPI

KW/ab

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Dated: Hmawbi, 10 February 1992.

MYANMA PHARMACEUTICAL INDUSTRIES

Attn. U Saw Mynt
Managing Director
Y A N G O N

Re: Medical Assistance.

Dear Sir,

The Pilot Plant for Pesticide Formulation operating under MPI is using toxic chemicals and solvents which are inflammable and toxic, consequently all the output of the production bears the same hazards beyond general ones connected to any industrial operation. Due to this fact all the employees including management and laboratory employees are at the full time exposed to those hazards. Therefore an attention higher than at general industries should be paid to the safety of the full staff. In this respect aside of providing individual protective devices/clothing, ventilation etc., the presence of a well trained medical officer has a primary importance in the plant. Some cases of health injuries which already occurred underline the urgency of this matter. Your urgent and efficient action is kindly requested in order to give this factory an exceptional consideration in this respect and a full time medical officer or qualified nurse be employed as soon as possible. The medical room for his/hers accommodation has been provided in the project. I am always ready to discuss details of the subject.

With distinguished regards


Istvan Bendefy

C.T.A.

MYANMA PHARMACEUTICAL INDUSTRIES

REFERENCE 1511(3)/13-Saia(S)/163

DATE 24th February, 1992.

Mr. I. Bodefy
Chief Technical Advisor (CTA)
for the Pesticide Formulation
Plant. (UNIDO)

Dear Sir,

Re : Medical Assistance

We thank you for your letter regarding advise on a full time medical officer or qualified male nurse to be employed in our pesticide formulation plant and would like to inform you that according to our ministry's regulation only one medical team is allowed to assign duties to the factories which are located in the same limited area. One medical team has already been formed in neighbouring Asbestos Cement Plant and we could share it whenever we need.

Therefore we are now trying to get sanction from our authority to appoint one male nurse as soon as possible.

Yours Sincerely,

(SIGNED)

for the Managing Director
(Ban Yi - Director)

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 aiming at keeping the country at relatively pest-free conditions while increasing and intensifying commodity crops cultivation as well as increasing yields of paddy crop which is 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 pesticides in minimal but sufficient quantity to the Plant Protection Division to carry out field testing of new granular pesticide formulae and/or against new pest strains.
- (b) A capacity to supply to the M.A.S. 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 M.A.S. as being 500 t/year. The mineral carrier 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 slight extension only:

- (1) Plant site with infrastructure,
- (2) Installations for environment protection,
- (3) Office & Laboratory building,
- (4) Laboratory equipment (slight extension),
- (5) Store for the imported raw material,
- (6) Well trained senior staff (one additional person).

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 this 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 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 disease. 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 programme.

The pesticide usage in the year 1990/91 was estimated by M.A.S. 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 diluents 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 Control Management aiming at keeping the country at relatively pest-free conditions while increasing and intensifying commodity crops cultivation as well as increasing yields of paddy crop which is 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 in various fields,
- seeking for training possibilities for the personnel,
- supporting the Plant with minor equipment, chemicals & spareparts' provision.
- providing up to date literature & information.

Justification of the project: Within the framework of a previous project (DP/MYA/80/011) a Pilot Plant for Pesticides Formulation has been established. The Pilot Plant represents a brand new line among the industrial branches in Myanmar. Information about the nature, characteristics and uses of pesticides including the hazards involved to both humans and environment was available earlier 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 a plant, which is a first example in the country, whatever good training the senior staff was given, two years of experience cannot be considered sufficient to leave the plant and the management fully without support.

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

- development of new formulae by inclusion of Superior Kerosene as local solvent,

- development of new formulae using active substances not yet formulated,
- development of new formulae using active substances originating from alternative suppliers,
- development of new formulae using new types of emulsifiers and/or other auxiliary materials.

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 be needed also 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 that above activities the following kind of support is considered to be justified:

- 1) Visits of consultant(s) in Quality Control and formulation development,
- 2) Visits of consultant in Formulation Plant Management,
- 3) Visit of consultant in maintenance and repair, as appropriate,
- 4) Visit of non resident CTA, as appropriate,
- 5) Provision of training for senior and junior staff as appropriate,
- 6) Provision of technical literature to keep the knowledge of the staff up-to-date,
- 7) Provision of minor chemicals, equipment for the laboratory,
- 8) Provision of minor spare-parts, equipment for the Pilot Plant.

Background: Agriculture dominates the Myanmar 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 this 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 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 disease. 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 programme.

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 project.

The pesticide usage in the year 1990/91 was estimated by M.A.S. 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 is estimated to be higher by about 50%. By taking advantage of the savings through the local formulation and considering the strive for improvements in the plant protection 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.

UNIDO Substantive Comments

The report gives in detail the status of the pesticide plant and includes various proposals to solve some of the bottlenecks associated with filling of bottles, quality of glass bottle supplies, site maintenance, improvements to quality control laboratories, constant power supply and disposal of waste.

As the project is to be completed this year, the implementation should be speeded up to make the plant acceptable when handed over to the project authorities.

The report also contains a project concept for establishing a granular formulation unit and this depends on the Government's interest and UNDP's support prior to submitting a project proposal. This could be included on an overall programme approach for safer formulations (granules are safer than dust) and for increasing food production and also include rodenticide plant for public health improvements.

The various annexes attached to this report clearly indicate that the expert made all attempts to improve safety aspects related to the safety of the plant.

Once the project revision is approved, UNIDO will take up the necessary measures to complete the project. If the project revision is delayed, the project cannot be operationally completed in 1992.