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19609

DP/ID/SER.A/1569
21 April 1992
ORIGINAL: ENGLISH

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 M. G. Srivastava,
consultant in safety verification

Backstopping officer: B. Sugavanam
Chemical Industries Branch

United Nations Industrial Development Organization
Vienna

* This document has not been edited.

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EXPLANATORY NOTES

Only a few abbreviations have been used in the report.
These are explained -

A/C	=	Air Conditioner
DG	=	Director General
EC	=	Emulsion Concentrate
e.g.	=	For example
Engr.	=	Engineer
GC	=	Gas Chromatography
HPLC	=	High Pressure Liquid Chromatography
incl.	=	Including
KL	=	Kilolitres (1,000 litres)
Km	=	Kilometre
Lab	=	Laboratory
MD	=	Managing Director
Min	=	Minimum
MPI	=	Myanmar Pharmaceutical Industries
MT	=	Medical Treatment
NB	=	Nota Bene (Note carefully)
OK	=	Alright/Satisfactory
Ref.	=	Reference
SOP	=	Standard Operating Procedure
QC	=	Quality Control
UNDP	=	United Nations Development Programme
UNIDO	=	" " Industrial Development Organisation
Viz.	=	Namely

PART. I.

SUMMARY

The objective of the Return Mission was to review the implementation of the recommendations contained in the first TECHNICAL (Safety Verification) REPORT (1990) on the pilot plant for formulating pesticides at Hmawbi. The mission examined the reasons for delay in implementation, where applicable, and also identified additional safety needs based on the operating data of the plant over the last 1½ years. Opportunity was taken to coordinate with Mr. K.S. Johnson, Consultant on Environmental Safety, who was also on mission at the same time. Meetings were also held with the Myanmar Agricultural Services, Myanmar Pharmaceutical Industries and the United Nations Development Programme to brief them on the principal observations.

The report covers, item by item, the recommendations that have already been implemented. Comments on these are indicated where necessary. Similarly, the recommendations that still await implementation are tabulated and the key reasons for delay indicated against each. The aspects that require urgent attention of the senior management of the project include short commings of the bottling plant, lack of alarm system, inadequate sign posting, poor observance of rules on safety equipment & clothes, shortage of warehousing space, non-availability of fire engine & water reservoir, emergency treatment facility etc. Similarly effluent treatment & solid waste incineration facilities are conspicuous by non-installation. Only brief comments are made about the effluent treatment & solid waste disposal. Reference may be made to Mr. Jhonson's report for details.

Besides the old recommendations, the report identifies and elaborates upon other/additional areas requiring safety attention. These include inadequacy of warehousing space, environmental & fire hazards created by the poor condition of the linking road between Hmawbi town and the factory,

unsatisfactory upkeep of the site etc. During the mission, the need was felt for nominating one of the officers to oversee safety measures and communications. Recommendations are made for the same.

The licences & approvals under Factories Act and Fire & Explosives Act have been obtained for the pilot plant. However, the necessary registrations and licences under the Pesticides law will need to be obtained when it is implemented in 1992.

Considering the present status of safety recommendation implementation and new suggestions for safety equipment and systems, there would be need for further safety verification to ensure that no important recommendation or hazard area is left unattended.

ACKNOWLEDGEMENTS

I gratefully acknowledge the cooperation unreservedly extended to me by U Win Kyi (Director), U Myint Swe (General Manager) and all other officers of the Project during my mission. I am much thankful to U Ban Yi (Director of MFI) about his concern and reassurance for implementation of Safety measures as well as sharing his views on some of the problem areas.

The visit of Mr. Keith S. Johnson's (UNIDO consultant on Environment) coincided with mine and provided me an opportunity to closely coordinate with him on environmental safety measures. I am grateful to him for freely sharing his observations in other safety areas relevant for the pilot plant.

I record my grateful thanks to Mr. Rohinton Sethna, Senior Deputy Representative of UNDP for his interest in the mission and his useful comments and suggestions. I am thankful to U Hla Min, Programme Officer and Ms Angela of the Programme Section for their help. I also acknowledge the assistance of Ms Khin Sa Aye (Finance Section) and U Tin Htut (General Services Dept.).

Finally, I express my deepest appreciation to U Win Kyi for making excellent arrangements for my comfortable stay at Hmawbi.

PART II. OBJECTIVE & BACKGROUND

THE MISSION

The objective of the 'Return Mission' is to verify the implementation of the safety recommendations, adequacy of the measures established and recommendation of new steps at the pilot plant for the formulation of liquid pesticides set up at HMAWBI (near Yangon) in the Union of Myanmar by the Myanmar Pharmaceutical Industries (MPI) with the support of United Nations Development Programme (UNDP) and United Nations Industrial Development Organisation (UNIDO).

BACKGROUND

The author had earlier visited the project in 1990 when the civil construction and plant installation work were still in progress. Based on the site inspection, details of plant, equipment & services, the kind of pesticides involved and volumes of production, the author had made a set of 'safety recommendations' covering -

1. Operational Safety
2. Occupational Safety
3. Environmental Safety.

These recommendations are contained the UNIDO Document No. DP/ED/SER.A/1330 dated 23rd March, 1990.

It had been indicated in the first 'Safety Report' that the implementation of the recommendations must be carefully monitored and a further Safety verification carried out after the pilot plant has been in production for a few months. This was suggested not only to satisfy on the adequacy of the recommendations but also allow time for generation of relevant data on the volumes of toxic effluent and solid wastes and/or any new safety problems that may emerge and require appropriate measures.

The Pilot Plant has been in operation on a single shift basis regularly since June '90. The factory personnel have therefore acquired first-hand experience of producing the following quantities on the plant -

	1990/91 (Jan./Mar.)	(KL) 1991/92 (Apr./Oct.)
Diazinon 40 EC	50.8	-
Phenthoate 50 EC	42.6	57.8
Fenitrothion 50 EC	127.1	21.0
Endosulfan 35 EC	45.7	52.7
Cypermethrin 10 EC	71.9	63.6
<u>Total</u>	<u>338.1</u>	<u>195.1</u>

(The production plan for the whole year 1991-92 is 465 KL)

Therefore, the time is appropriate to carry out a verification of safety equipment and system and to develop additional recommendations, as & if required.

PART III : THE APPROACH

The main parameters adopted for safety verification at the Pilot plant are -

- a) Verification of the implementation of safety measures recommended (ref. 1st Safety Report - 1990) and ascertaining their adequacy/effectiveness.
- b) Identification of recommendations not so far implemented as well as determining new safety areas/aspects (if any) for making suitable recommendations.
- c) The Standard Operating Procedures and the standing orders which have already been issued for the manufacturing plants and the QC Laboratory (see Annexures 1, 2, 3 & 4).

The verification was carried out by on-site inspection of different activity areas in the factory and detailed discussions with the Managers/Supervisors in each case. In doing so, effort was also made to assess the hazard awareness and commitment of the plant personnel towards safety measures as well as suggestions for improving the

individual involvement in personal safety and that of the factory and environment. Finally, effort is made to assess the problem/s (if any) vis-a-vis the neighbouring community and new initiatives that may be taken by the project management to establish & strengthen rapport between the two.

The Return Mission coincided with the visit of Mr. Keith S. Johnson, the UNIDO consultant on Environment (ref. safe disposal of toxic effluent and solid wastes). The safety verification mission was closely coordinated with Mr. Johnson, Consequently, there is likely to be some overlap between the two reports. However, effort has been made to limit such overlap to the unavoidable minimum.

PART IV. IMPLEMENTATION REVIEW

The implementation of the Safety Recommendations (1990) was reviewed at the various functional areas and reasons for non-implementation of recommendations, if any was ascertained through discussions on site. Consequently, the review separately covers -

1. Recommendations already implemented
2. Recommendations awaiting implementation

For the sake of convenience, the verification is presented in form of charts for the two categories. It is hoped that this will assist in reference and monitoring by the Management.

During the verification, certain new areas emerged which deserve attention from safety view point. In some case, need for fresh emphasis was also felt. All these are dealt with in Part V.

A. RECOMMENDATIONS ALREADY RECOMMENDED

- A. 1. All the recommendations of the 1990 report were closely checked and where action has already been taken are listed in Annexure. V.

A.2 On the basis of this review, the progress of implementation can be summarised as under :

<u>Safety Type</u>	<u>Total No. of Recommendations</u>	<u>No. of Recomm. Implemented.</u>
Operational	74	29
Occupational	20	12
Environmental	5	2
Workers Health	6	3
General	12	8
Total	<u>117</u>	<u>54 (=47%)</u>

Thus, nearly half of the original recommendations have already been implemented which, considering the constraints, is a satisfactory level of achievement.

A.3 In Annexure (5) remarks are recorded against the individual item. The Management may carefully note these for further action to improve the effectiveness of the safety equipment/system installed. These remarks should also constitute a basis for further Safety Verification.

B.C RECOMMENDATIONS AWAITING IMPLEMENTATION

B.1 A number of the existing Safety Recommendations have not been implemented so far. All such cases are recorded in the following table. For convenience of comparison with the 1990 report, the old no. of the recommendation are indicated alongside.

B.2 The reason/s for non-implementation have been explored and are indicated in the chart.

B.3 In the column marked 'Action now Recommended' its importance and priority are indicated for the management to take special notice.

It is imperative, however, to emphasise that the implementation of all the recommendations in this chart is essential. Where the implementation has been delayed due to non-availability of equipment, the Project Management as well as the sponsors may examine options to procure and install them. In so far as the management of safety system/s is concerned proper attention of the site management is essential to ensure observance.

(See the following chart) -

IV (B) : RECOMMENDATIONS AWAITING IMPLEMENTATION

<u>(1) Safety Type</u>	<u>(2) Activity Area</u>	<u>(3) Original Reference</u>	<u>(4) Recommendation</u>	<u>(5) Reason for Delay</u>	<u>(6) Action now Recommended</u>
I. OPERATIONAL	GC Laboratory	(2)	Use of spark proof switches, sockets & plugs.	Not fixed in the entire area (excl. GC Room) due to need to import	Possibility of providing these to be examined (UNDP/UNIDO). Failing this, these items should be fixed in the gallery outside the rooms.
		(3)	Exhaust fans in the main lab. and Distillation Room (Switches to be fixed outside).	Non-availability of spark proof exhaust fans.	Must be imported.
		(4)	Boxing of the motor of fume chamber fan.	Not done due to need for cleaning up leaves etc. falling through the chimney.	a) The external mouth of the chimney should be covered with wire/nylon net. b) Motor to be boxed.
		(5)	Provision of Fire hydrant	Not fixed as there is no fire engine	See Part V.
		(6)	Raising gas discharge pipe by 2 M for better dispersion.	Fear of making the assembly unsteady due to height.	Top of the chimney to be ringed & supported with wire/iron rod to hold in position.
		(7)	Emergency shower & Changing Room	Only a standard shower is provided (considered adequate). Cupboard shifted to mixing plant.	a) Kit containing cotton wool, soft soap & eye cup to be urgently provided. b' Cupboards for storing street clothes etc. to be fixed.

(1)	(2)	(3)	(4)	(5)	(6)
		(11)	Effluent Treatment facility (flocculation & adsorption).	a) Activated charcoal not available b) Chemical treatment unit not yet provided.	(See Part V & Mr. Johnson's Recommendations)
		(12)	Signposting of gas generation room.	_____	Warning to be painted on the door glass
		(14)	"NO SMOKING" & NO OPEN FLAME" warnings on General Lab, GC Room, Distillation Room, HPL Room & chemical storage	Not done since these symbols have been fixed to the main entrance.	Sign posting of individual room is important. a) Fix warnings as listed b) Correct the 'No open flame' symbol (present one faulty).
		(15)	First Aid Box	Not procured	Must procure urgently & provide.
		(16)	Security/Entry	No action taken so far.	a) Fix "Restricted Entry" notice on main door of the building b) Staff to be provided 'YELLOW' name tags for identity (See Part V).

(1)	(2)	(3)	(4)	(5)	(6)
		(17)	Fire Alarm	Not fixed as fire truck is yet to be arranged.	In the absence of Fire Truck alarm bell even more essential. ('Ad interm' electric call bells may be fitted).
Mixing Plant		(7)	'Skull & cross Bone' & 'High voltage' warning symbols on the door of transformer room.	Not fixed as these are already fixed to the transformer equipment (inside the room).	a) Warning signs to be visibly posted on the door. b) "Restricted Entry" notice also to be painted on the door.
		(9)	Provision of collection tray under the inlet pipe of the storage tank of the mixing plant	No specific reason	Must be placed immediately the leak is noticed.
		(10)	i) Fixing of exhaust fans ii) Lowering the smoke detectors.	i) Non-availability of sparkproof fans. ii) No specific reason (Perhaps overlooked)	i) Arrangements to provide suitable exhaust fans. ii) Must be brought down on light aluminium pipes to 12 - 15ft from ground.
		(12)	Separation of power circuit to the mixing vessel and providing an extra fuse inside a locked box	Not done on as this circuit already has a separate fuse on the main control panel. (NB : All fuses on the pannel are unlocked & interchangeable).	Serious Omission. <u>MUST TAKE IMMEDIATE CORRECTIVE ACTION</u> as it can involve serious/fatal accident (Also see Part V)

(1)	(2)	(3)	(4)	(5)	(6)
		(13)	Sign posting with "No smoking" & "No open flame" symbols.	Not done again since one sign each has been painted on the main entrance. (Reminder value of the warnings is overlooked)	1) Warnings <u>must</u> be posted both in the mixing plant & bottling plant areas. 11) A system be introduced to check that workers do not carry lighters/match boxes etc. in the work area.
		(14)	Emergency/Fire Alarm	Apart from an alarm provided with the transformer no alarm is provided in the plant areas.	Electric alarm bell to be fixed. (Indicated use of gong is not a satisfactory alternative).
		(16)	'First Aid' Box	One box procured but is with production manager.	First Aid Box to be fixed at a place easily accessible to workers.
	Bottling Plant	(18)	Fix exhaust Fan	Non-availability of spark proof fans.	Exhaust Fan to be imported & fixed.
		(19)	"No smoking" sign	(For same reason as in the mixing plant)	Warning signs to be fixed.
		(20)	Decontamination of bottles from spilled toxic liquid. (Provision for washing or mopping).	Not provided, (The spillage problem had been anticipated & a wash tent recommended).	The defects in the filling & capping equipment to be corrected (<u>See Part V</u>).

(1)	(2)	(3)	(4)	(5)	(6)
		(26)	Security/Entry Restrictions.	Not sign posted & No identity system for workers	i) Post "Restricted Entry" sign. ii) All workers on both plants to be provided with "RED" name tags.
		(27)	Emergency Exist	Presently a small door near the heating room is provided. This unsafe & inadequate.	The main door behind the bottling plant to be made the "emergency exit" and marked appropriately.
Imported Solvent Warehouse		(1)	Exhaust fans &	Spark-Proof Fans not available	Plan to establish a new xylene warehouse with wire mesh walls for ventilation. <u>(Also see Part V)</u> .
		(2)	Switches etc. to be fixed.		
		(4)	Safe Stacking height. (Xylene drums stored 4 high. Workers have to climb to roll it on the fork lift).	Due to arrival of large shipment of xylene AND inadequate storage space.	Additional warehouse to be built as the problem of large consignments will continue.
		(8)	Smoke detectors	Due to need to import.	Not required if the proposed new warehouse is built soon.
		(9)	"No open flame" and "No Smoking" warnings	Not fixed as "inflammable" sign already posted	Both the warning signs MUST still be painted on the gates.
		(10)	'Drain Channel for floor washings (a requirement of the Factories Act.).	Effort to correct the slope of the floor was not possible due to ramp at the gate.	The washings should not be fed into rain water drain. A "catch pit" should be built in the godown floor. The collected washings should be removed by buckets to effluent treatment tank. (The same applies to the new xylene warehouse).

(1)	(2)	(3)	(4)	(5)	(6)
	Finished Product Warehouse	(1)	Exhaust Fans (Switch/es outside)	Not fixed as spark proof fans need importing	Arrangement to produce should be made.
		(2)	Damaged & soaked or leaking cartons to be stored in bins until disposal.	Not done ; Stored on the floor; causes contamination of the warehouse floor.	Bins/plastic troughs to be provided for holding damaged cartons.
	Local solvent Battery		-	-	<u>(Not presently in use but expected to be commissioned shortly)</u>
		(2)	Sign posting for "No open flame" & "No sparking vehicles"	Due to non-use	Signs to be posted before starting use.
		(4)	Emergency alarm.	Not fixed	Essential ; Must be fixed
	Power Substation	(7)	Danger sign posting viz. "Skull & cross bone" and " High Tension" on the wall facing the mixing plant	Not done	Must be done as extra precaution.
		(9)	"No Entry" sign on the gate	Not posted	Must be done
	Maintenance Workshop	(1)	Battery charging area near the Engineers cabin is not segregated from the rest.	No specific reason	Separate the area with a low wall or wooden railings.
		(4)	Entry Restriction	No Provision	Staff to be provided with <u>green</u> name tags
	Lump House		Nil	Nil	Nil

(1)	(2)	(3)	(4)	(5)	(6)
	Scrubber	(3)	Treatment tank for the Scrubber waste	Not installed (waste presently stored in a separate evaporation tank)	Need to establish common effluent treatment facility (<u>See Mr Johnson's Recommendations</u>).
<hr/>					
I..	OCCUPATIONAL SAFETY				
	Laboratory Personnel	(1)	Working dress (full trousers & full sleeve shirts)	Not provided. (Staff use Street clothes).	(This is an undesirable practice. Work clothes to be left behind). a) Work dress to be provided. b) Cabinet for storing street clothes fixed
		(4)	Receptacle for contaminated clothes (dress, apron etc.)	Not provided	A bin to be placed in the shower area to hold contaminated clothes pending laundering.
		(5)	First Aid Training to at least 2 staff from the Laboratory	Not yet organised	Must be arranged quickly
	Mixing & Bottling Plant	(4)	Receptacle in the emergency shower room for dumping pesticide drenched clothes	Not provided	Should be provided near the shower.
	Personnel	(6)	a) First Aid Training (min. two persons from these plants)	Not done so far	To be organised quickly.
			b) Emergency kit to be provided in the shower	" "	" "

(1)	(2)	(3)	(4)	(5)	(6)
	Other Areas	(1)	Working dress (warehouses)	As persons working in the warehouses belong to the production plant, separate dress not provided	O.K.
		(3)	Nose pads to be used when working in the solvent, raw material & finished product warehouses.	Not practiced.	Must be enforced and nose pads provided.
(WORKERS HEALTH)	General	(1)	Medical Treatment Room with Doctor/Qualified nurse.	Room provided but no equipment or whole time physician/Nurse. (See Part V)	a) The treatment room <u>must</u> still be equipped with: <ul style="list-style-type: none"> i) Hospital Bed ii) Oxygen cylinder with tubes & hood. iii) Shock therapy intra venous drip and saline etc. iv) Antidotes v) Struture vi) Gastric lavage items. b) Paramedical training to one or two staff members.
	Health Monitoring		a) Pre-employment health. check including cholinestrase tests (to establish individuals 'Normal')	Cholinestrase level not established as Hmawbi Hospital does not possess facility	Cholinestrase level must be established before new employee starts work

(1) (2) (3) (4) (5) (6)

b) Post employment checkup on quarterly routine basis (incl. cholinestrase test)

1) Presently done once in 6 months. (Dates of previous tests 26.6.90, 9.11.90 and 10.6.91). This is claimed to be due to problem of getting a doctor from Yangon.

1) Quarterly check of Cholinestrase for workers directly exposed to pesticides (viz. Mixing & bottling plant and Laboratory personnel) is essential.

ii) Persons showing a drop in cholinestrase by 20% or more (over the individuals normal) are shifted to other jobs but recovery is not monitored thereafter.

ii) The cholinestrase and blood picture of such persons must be monitored min. once a month until recovery to the normal level.

c) Maintenance of individual HEALTH CARDS.

Presently consolidated medical reports are kept in a file. Individual health cards not opened.

Health cards must be maintained for each individual starting from the pre-employment checkup. Cards to be kept updated.

(1)	(2)	(3)	(4)	(5)	(6)
III. ENVIRONMENTAL SAFETY	QC Laboratory	(a)	Deactivation Tank for toxic liquid effluents	No treatment facility established. Even activated charcoal bed not provided. (charcoal needs to be imported).	i) Effluent Treatment facility is essential (to be established) ii) Treated effluent to be transferred to evaporation tank or used for irrigating the garden. iii) Sludge to be taken out during summer months and kept for incineration.
		(b)	Settling & evaporation tank	Provided but not adequately protected against rain water.	
	Mixing & Bottling Plants	(a)	Deactivation tank for liquid effluents from the two plants & the scrubber.	Comments as above	As above. (A common effluent treatment facility will be adequate).
		(b)	Settling & evaporation Tank	Comments as above	-Action as above (ref. QC Lab).
	Incinerator		Incinerator to be provided for safe disposal of mopping saw dust, sludge, soaked cartons etc.	Incineration facility not yet established. (There is no cement kiln in the neighbour hood).	Incinerator is essential (To be imported) See Part V for location & comments.

(1)	(2)	(3)	(4)	(5)	(6)
IV. GENERAL	a) Fire Fighting	(i) I (ii) I	Fire engine & Reservoir/ hydrants.	Engine not yet obtained (doubts expressed on availability). Hence no reservoir built	i) Fire engine is essential. MUST be stationed in the factory ii) Overhead water storage is small; hence a water reservoir (For least 45 min. working of fire engine).
		(-)	Disposal of waste water from fire fighting	Such water is bound to be contaminated & should not be allowed to flow out of the factory premises.	Provide a sluice gate/ stopper in the main drain so that this water is held back and pumped into a special lagoon to be built in the north west corner of the site.
		(-)	Buckets of sand.	To control localised fires in the solvent warehouses & finished product godown	To be provided urgently. These buckets are best located on the wall near the entrance.
		(-)	Training in fire fighting	Not yet organised. (The task of fire fighting is assigned to security guards).	Arrangements to be made for training by the State Fire Service (incl. use of Fire extinguishers).

(1)	(2)	(3)	(4)	(5)	(6)
b)	Disposal of Empties	(1)	Empty xylene drums and Jerry cans of emulsifiers	-----	(Some Durms being used internally & balance sold to the soap factory).
		(ii)	Empty drums of Tech. grade pesticides.	(Being washed with xylene and caustic then cut & flated manually into plates Being stored)	These plates, lids, bottoms & rings are unsafe for any other use. <u>Should be sold to a smelting unit.</u>
		(iii)	Empty Carton of glass bottles	(Are so designed as to be later used for packing finished product)	A commendable arrangement for carton disposal.
c)	Education of Neighbouring Community	-	Informing the neighbouring village community about the toxicity etc. has been done by via the Village Council.		See comments under Part V.
		-	No steps, taken yet to advise the community of the elementary precautions to be taken in the event of an accidental fire or leakage in the factory (This must constitute a part of the emergency plan).		-Do-

PART V. NEW AREAS & RECOMMENDATIONS

It had been anticipated in the first Safety Report that once the plant has been operated for some time, newer problem areas may surface and these would require attention. During the Return Mission a number of such areas have been identified. These are commented upon in this chapter. Some of older recommendations are also covered here for emphasis through detailed comments.

1.0 WAREHOUSING

In the interest of safety the working areas in the plant and the warehouses need to be kept free for movement. Similarly, stacking height (specially of heavy drums) has to be kept within the safe limits.

During the mission, it was noticed that not only the warehouses were overpacked but also the xylene drums were stacked 4-high. Similarly, the available space in the mixing plant was being used for finished product storage leaving very little space for movement. These are hazardous practices and could lead to accidents. The situation is claimed to have been imposed due to slack pesticide demand and arrival of a sizeable consignment of xylene. As similar situation can arise over and over again and specially when the production volumes increase (eg. 465 KL in 91/92, 450 KL in 92/93 & 480 KL in 93/94) the shortage of warehousing space will become more acute. This emphasises the need for extra warehouse/s.

I was informed by the Director MFI, that there is a plan to build a separate xylene warehouse with walls partly made of steel mesh to ensure good ventilation. When implemented, the existing Imported Solvent Warehouse may be used for finished product. (The existing arrangements for empty glass bottles may continue).

1.1. Recommendation

Proposed warehouse should be built expeditiously.

2.0 SECURITY

The earlier recommendation for a system to prevent unauthorised entry into the operating and hazardous areas has not been implemented. This may be because the total no of staff & workers on site is only small (6 officers, 24 permanent staff and workers and 30 casuals). However when there are arrivals/departures of stores or builders men, there are new faces. The numbers are also likely to increase with the expansion of production. Hence there is need to immediately introduce an identification system and ensure that entry into restricted areas is by permission only.

2.1 Recommendation

2.1.1. All staff and workers of different activity areas should wear name tags of separate colours, for example :-

- Mixing & packing plant personnel - Red tags (with name)
- Laboratory personnel - yellow tags (")
- Workshop & warehouse personnel - Green tags (")
- Office staff - white tags (")
- Security men - Black tags. (")

2.1.2. No person from one activity area should be allowed into the other without the permission of the concerned manager/supervisor.

3.0. HOUSE KEEPING

During the mission, the standard of house keeping was found to be inadequate eg. in the mixing plant area, the receptacle for drum caps (both xylene and insecticide concentrate) was overflowing. Obviously, it had not been cleared for several days. Similarly near & under the packing plant, spillages of formulated insecticide had not been removed for many days. In the warehouse, damaged bottles (in cartons) had not been decanted and insecticide was found seeping into the floor.

3.1. Recommendation

3.1.1. It is imperative that all work areas must be cleaned up and tidied at the end of the last shift of the day (persently working on one shift only).

3.1.2. The responsibility of good house keeping (a safety requirement) is that of the activity manager (e.g. Production Manager for the mixing & bottling plant). General Manager should periodically inspect all areas and take steps where necessary (Also see recommendation for Safety Officer).

4.0. APPROACH ROAD

At the time of the 1st Safety verification, it was indicated that the link road between Hmawbi town and the Pilot Plant will be metalled shortly. During the present mission, it has been found that approx 12 Km of this road are still unattended and full of large pot-holes. This road is highly unsafe for loaded lorries carrying combustible solvents or toxic pesticides. During the monsoon when the potholes will not be visible, the risk of over turning, spillage and pollution is exacerbated.

4.1. Recommendation :

The matter should be taken up at the highest level in the Government and every effort made to get the remaining 12 Km metalled (asphalt top) before the 1992 monsoon.

5.C. FIRE HAZARD

At present, a serious threat of accidental fire exits due to -

- i) Profuse growth of tallgrass and other weeds in the entire unbuilt area in the factory premises (see Annexure VI). These weeds will dry up in ensuing winter and summer providing easily combustible material for an accidental fire. This problem is particularly serious due to storage of large quantities of inflammable solvents and finished products. Apart from fire risk, this also makes the factory look shabby.

ii) Similarly, the area outside the fence is overgrown with grass and bushes. These will also dry. A cigarette or lighted match stick thrown outside the fence by a pedestrian could spread fire into the factory.

5.1. Recommendations

- 5.1.1. All the wildgrass and weed growth inside the factory fence should be slashed and safely disposed off. (If required to burn, it is ideally done outside the factory & at a safe location).
- 5.1.2. A fire break should be provided outside the fence. For this purpose all the weeds (grass and shrubs) should be cleared in a 10 M band around the factory.
- 5.1.3. A water reservoir in the quadrangle between office block and mixing plant (For location See Annexure 6) should be built urgently. The capacity of the reservoir should be 30,000 gallons or more (to be verified with the local Fire Service Dept).
- 5.1.4. Simultaneously, the fire engine must be procured and made available on site.
- 5.1.5. Security staff should be trained in fighting localised accidental fires with fire extinguishers, sand etc.
- 5.1.6. Provision of a lagoon (behind the mixing plant: see Annexure 6) to hold the waste water ex fire fighting operation. This water being contaminated with toxic pesticides/chemicals should not be allowed to drain out.

6.0 LANDSCAPING OF SITE

At present, apart from some trees (cashew & flowering shrubs etc.) planted near the main entrance of the factory, the entire site looks uncared for. Even the approaches to the manufacturing plant and QC lab are overgrown with weeds. However, this site has potential to be landscaped and attractively planted. A well kept site has healthy influence on workers & community. In patches, vegetables like brinjals (aubergine), Chillies & tapioca besides

sesamum (an oilseed) are being cultivated. This is a highly undesirable practice in a pesticide factory. Such crops are liable to carry pesticide contamination.

6.1. Recommendations

- 6.1.1. Areas for planting of flowering trees and bushes should be identified. Planting material to be selected in consultation with the Horticulture Dept.
- 6.1.2. The road aprons and the available space in the central quadrangle to be planted with the available wide leaf lawn grass (crab grass?).
- 6.1.3. In the proposed reservoir, water lily or lotus may be grown.
- 6.1.4. The practice of cultivating vegetables and oilseeds inside the factory premises must be discontinued forthwith.

7.0 ENVIRONMENTAL SAFETY

Every pesticide manufacturing site has to pay attention to two environments -

i) Internal environment

Comprising the area inside the factory premises e.g. manufacturing plants, laboratory and common areas. Here the atmospheric contamination has to be monitored and corrective measures taken promptly. This is in addition to the safe disposal of toxic effluent and solid wastes to prevent land & water contamination.

ii) External environment

In the normal course this would include air, land and water within one Km distance around the factory site. These also need to be monitored on a predetermined time table in the normal course and immediately in case of an accidental leak etc.

7.1. Recommendations

The factory presently generates approx 100 CuM of toxic effluent and nearly 200 Kg. of toxic solid wastes (saw dust, cartons, effluent sludge etc.) per annum. For their safe disposal, following steps are necessary -

- a) Installation of Carbo-Flo type of effluent treatment unit (flocculation & adsorption).
The subsequent waste water to be used for irrigating factory garden.
- b) Installation of an incinerator to burn solid wastes at 1200-1400°C. (Composting of contaminated saw dust is also worth evaluating).

For detailed recommendations, see Mr. K. Johnson's report.

7.1.1. Internal Environment

Inside plants/Laboratory etc. - Draeger Tubes to be provided to check on the toxic fumes and vapours before or during the shift (if required) to ensure that safety limits are not crossed.

One static monitor may be provided for special monitoring in the plant & laboratory. This equipment will be particularly necessary in the X Lab when HFIC is set up. If there is a build up of fumes/vapours, these must be exhausted. (This will also apply to dust extraction when granular insecticide production is established).

7.1.2. The atmospheric contamination outside the plants/warehouses/laboratory should be checked at least once during the day.

7.1.3. Records of atmospheric contamination must be maintained site/areawise in appropriate forms or a register.

7.2. EXTERNAL ENVIRONMENT

For a plant like this, the risk of atmospheric pollution outside the premises is limited but the risk of soil & water contamination may not be ruled out. It is therefore recommended that -

7.2.1. Whenever there is high contamination of internal atmosphere of the factory, the level of contamination in 1 Km radius around the factory must be monitored and recorded.

7.2.2. As a routine measure, atmospheric contamination outside the factory monitored every alternate month (to cover all seasons) and samples of soil and water taken to determine the level of contamination.

7.2.3. All the above data should be properly recorded in a register by the General Manager or Safety Officer.

The above data and steps taken to improve the situation may be shared with the village council/opinion

leaders to instil trust & confidence.

(In this context, reference may also be made to the Environment Consultant, Mr. K. Jhonson's report).

8.0 BOTTLE FILLING LINE

There is considerable amount of spillage of formulated product mainly from 2 sources -

- i) Filling Equipment - The filling probes withdraw prematurely. This leads to spillage & surface contamination of all bottles.
- ii) Capping Unit - The turn table of the capping unit has jerky movement occasionally causing spillages from the filled bottles.

As a consequence, despite a resptacle along the bottling line, there there are spillages on the floor. Furthermore, the contaminated bottles get packed into cartons. This is a potential source of exposure of the consumers & dealers. (Ref. earlier recommendation for "shower tent" on the packing line).

8.1. Recommendation

The problems of adjustment of timing/speed of probe plunger and smooth movement of turn-table may be referred to the contractors (SICFLANT) for correction. Meantime steps must be taken to wipe the bottle surface clean of the toxic contaminant before putting into cartons.

9.0. STAFF & COMMUNITY EDUCATION

It is a safety imperative that staff and the neighbouring community are made aware that although the plant processes toxic chemicals, it has taken all reasonable safety measures. The SOP and safety instructions have already been issued. Besides, I am advised that neighbouring community has been informed of the nature of activity of the factory through the 5-member village council. (None of the factory staff is a member of the council).

9.1. Recommendation

It is necessary to formalise the communication system both internally and externally. The following methods are suggested. However, they may be appropriately modified to suit the local culture/needs -

- 9.1.1. The factory workers & staff should be invited for a short meeting once every quarter to discuss the upkeep, safety measure implementation, training needs etc.
- 9.1.2. Suggestions from the workers to improve operations and safety should be invited. Any suggestion accepted and implemented by the management should be rewarded.
- 9.1.3. Suitable occasions should be found to invite the village council members and the main opinion leader/s of the village to the factory and shown around the safety measures installed. Later, the same channel may be used for communicating the precautions/safety measures to be taken by the community in the event of an unlikely disaster (Fire, explosion etc.).

10.0. GRANULATION PLANT

The Project managers mentioned the possibility of establishment of manufacturing facility for granules and water dispersibles. Manufacture of such dry formulations will involve dust hazard requiring additional safety measures.

10.1. Recommendation

This aspect must be borne in mind both in the location of plants, workers safety equipment/systems as well as prevention of environmental pollution and dust explosion.

11.0. MEDICAL TREATMENT

The MT Room has been provided in the laboratory building. However, the proposal for a doctor/trained nurse on site has not been approved. Instead, the help of the medical officer of the nearby Asbestos factory has been offered.

Despite the above, arrangements have to be made for the 'on spot' attention or First Aid for accidental physical injury and chemical toxicity (through inhalation, splashes etc.).

11.1. Recommendation

- 11.1.1. For this purpose, the basic equipment of the MT Room (incl. ANTIDOTES) is essential.
- 11.1.2. At least two persons (one each from the manufacturing plant and Q.C. Laboratory) should be trained as soon as possible in "emergency medical attention." The help of Nursing Training Institution OR Red Cross in Myanmar should be taken.
- 11.1.3. The MT Room should be equipped with min. essential facilities e.g. bed, oxygen cylinder and administration gear, antiseptics, bandages, splinters for immobilising fractures AND antidotes for the different pesticides processed in the factory. Toxoids & injectibles may also be stored in consultation with the Doctor.

12.C. HEALTH MONITORING

Reference has already been made to the pre-employment normal cholinestrase level of the individual so as to serve as reference scale for post-exposure checks. Since the cholinestrase level is liable to fluctuate under normal conditions, it is best to fix the norm on the basis of min. 3 tests. Post employment test should be carried out at least once every 3 months for people directly exposed to pesticides and at 6-monthly intervals for the rest.

12.1. Recommendations

Some important actions in this regard are -

- 12.1.1. Persons whose cholinesterase level drops by 20% or more of the normal should be transferred to a safer activity (3 such cases have already been recorded in the pilot plant).
- 12.1.2. The health check including cholinesterase of such persons MUST continue once every month (or earlier if advised by the Doctor) until full recovery.
- 12.2.0. Presently, the cholinesterase testing facility is only available in Yangon. Sending patients to Yangon (and also all the staff for routine check) is impractical. Sending capillaries of blood samples drawn at the plant to Yangon will also involve min. 4-5 hours delay which is undesirable. In view of this local testing facility needs to be created.

12.2.1. Recommendation

The cholinesterase testing can be done in the QC. lab, if they are provided a centrifuge and an UV Photospectrometer or a colorimeter. This must be considered urgently.

12.3.0. HEALTH CARDS

Maintenance of a separate health card for each employee of the plant is essential. The card is an easy reference document for the attending physician and is simple to maintain.

12.3.1. Recommendations

The system should be started without delay.

13.0. MANAGEMENT OF SAFETY

This is by far the most important aspect of safety plan. The monitoring & coordination of safety measures in a pesticide plant must be assigned to a nominated officer who will be accountable in the matter. During the mission, it was found that the implementation is presently left to the individual activity head resulting in insufficient emphasis on

safety measures in different areas despite the fact that standing orders and standard operating Procedures have been issued (Annex I, 2, 3 & 4).

The first thing that I must emphasise is that the managers and officer are not above safety measures. Officers are expected to lead by example as far as safety is concerned. They are therefore expected to observe all the laid down norms which they expect the staff & workers to follow (ref. standing orders). Secondly there must be a nominated/designated officer to oversee and coordinate all aspects of safety within and outside the factory needs emphasis. This officer should therefore have the aptitude & status to influence his peer group into compliance of norms.

13.1. Recommendations

- 13.1.1. All Officers and Managers to themselves observe the dress norms and other safety measures.
- 13.1.2. Each Officer and manager to check and ensure tidiness and hygiene in the workplace at the end of the days work.
- 13.1.3. They must carry out surprise checks in regard to safety and security rules and take action/report to higher authorities against default or wilful violation of standing orders.
- 13.1.4. At present there is no whole time job for a Safety Officer. However, in order to highlight the management intention to enforce safety measures, it is desirable to formally nominate one officer as "SAFETY OFFICER", which task will be additional to his existing responsibilities.

The remit of the Safety Officer will be to coordinate and monitor safety measures and tidiness in all activity centres as well as the rest of the factory area.

The Safety Officer will be responsible for proper record maintenance of the health and environmental monitoring. He will provide the interface with the state authorities of the various safety laws.

The Safety Officer will also be the front man vis-a-vis the neighbouring community and responsible for a healthy rapport with them.

He may be sent for a suitable training in the function.

Finally, it is emphasised that the Safety officer will draw his authority (by delegation) from the Project Director/General Manager. Therefore the latter officers will remain responsible to oversee safety activities.

The suggestion to nominate & train a Safety Officer was discussed and agreed with the Environment Expert, Mr. K. Johnsons report may be referred in this context.

14.C. SAFETY AUDIT

The system of 'Safety Audit' has been outlined in the First Safety Report. Despite the plant operation for nearly 1½ years, no formal audit has been carried out so far.

14.1. Recommendations

14.1.1. The system of safety audit should be introduced during the next slack season OR in any case before the next planned maintenance shut down. In this context, it is emphasised that the technical Safety Audit Team must include at least one non-associated engineer to eliminate personal bias. The team must closely go into the plant design as well as the operational aspects to pinpoint areas of weakness and potential hazard. It must also recommend alterations required to eliminate the anticipated hazard/s.

14.1.2. The audit team must also check on the Standard Operating Procedure and suggest improvements.

PART VI. C O N T A C T S

MYANMA PHARMACEUTICAL INDUSTRIES

U Ban Yi - Director
U Myo Lwin - National Coordinator of RENFAP

PESTICIDE FORMULATION PROJECT

U Win Kyi - Project Director
U Myint Swe - General Manager
U Saw Win - Production Manager
U Saw Mooler - Quality Control Manager
U Aung Min - Planning Manager
U Nyo Lay - Maintenance Engineer
U Mon Tin Win - Assistant Laboratory Manager

PLANT PROTECTION (MAS)

U Maung Maung Tin - Deputy General Manager (Plant Protection)
U Thein Htay - Assistant Manager (Plant Protection)

UNITED NATIONS DEVELOPMENT PROGRAMME (UNDP) YANGON

Mr. Rohinton Sethna - Senior Deputy Resident Representative
U Hla Min - Programme Officer
Daw Khin San Aye - Finance Section

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANISATION (UNIDO)

Mr. Keith S. Johnson - Consultant on Environmental Safety.

PESTICIDE FORMULATION PLANT (HMAWBI)

PRODUCTION DEPARTMENT

STANDARD OPERATION PROCEDURE (SOP)

In pesticide formulation plant, the machineries and equipments must be operated after checking, according to the following procedures.

Before operating, check the control panel room whether the voltage is 380 volts or not. If the voltage is full, the switches on panel must be done according to the following procedures.

SWITCHES ON CONTROL PANEL

- | | | |
|----|--------------------------------------|---|
| 3A | PI | Presently not in use |
| 3B | TO MIXER
P2A
KERSENE PUMP | First move the main switch from off to on position. Keep the selector switch at remote position. Turn on the key. |
| 3C | TO MIXER
P2B
KERSENE PUMP | First move the main switch from off to on position. Keep the selector switch at remote position. Turn on the key. |
| 3D | FROM MIXER
P5
PRODUCT TRANSFER | First move the main switch from off to on position. Keep the selector switch at remote position. Turn on the key. |
| 3E | 200 L
MT2
MIXING TANK 2 | Move the main switch from off to on position. Keep the selector switch at remote position. Turn on the key. |
| 3F | AC I
AIR COMPRESSOR | Move the main switch from off to on position. Keep the selector switch at local position. Press the black color button. |
| 3G | P3
XYLENE PUMP | Move the main switch from off to on position. Keep the selector switch at remote position. Turn on the key. |

- | | | |
|----|-------------------|---|
| 3H | P4 | Move the main switch from off to on position. |
| | ACTIVE INGREDIENT | Keep the selector switch at remote position. |
| | PUMP | Turn on the key. |
| 3I | EP 2 | Move the main switch from off to on position. |
| | ELECTRIC PANEL 2 | keep the selector switch at local position. |
| | | Press the black color button. |
| 4A | TO FEED TANK | Move the main switch from off to on position. |
| | P6 | Keep the selector switch at remote position. |
| | TRANSFER PUMP | Turn on the key. |
| 4B | SCRUBBER | Move the main switch from off to on position. |
| | | Keep the selector switch at local position. |
| | | Press the black color button. |
| 4C | BATTERY CHARGER | Not in use |
| 4D | P 1 | Move the main switch from off to on position. |
| | HOT WATER PUMP | Keep the selector switch at remote position. |
| | | Turn on the key. |
| 4E | 3000 L | Move the main switch from off to on position. |
| | MT I | Keep the selector switch at remote position. |
| | MIXING TANK I | Turn on the key. |
| 4F | CF I | Move the main switch from off to on position. |
| | VENTILATION FAN | Keep the selector switch at local position. |
| | | Press the black color button. |
| 4G | SPARE | Not in use |
| | BOILER | Move the main switch from off to on position. |
| | | Keep the selector switch at remote position. |
| | | Turn on the key. |

REMARK : After finishing the works, turn all the keys into normal position and all the main switches into off position.

1. After doing all the switches in control panel room, first the scrubber must be operated at least 5 minutes before entering the production building. Move the small switch from 0 to 1 position at the switch board near scrubber plant. Then press on the start switches of two motors for fan and circulating pump.
2. Before using hot water boiler, first check the water condition in storage tank. If the water is sufficient, turn on the switch to 'M' position for heaters and also turn on the switch to 'M' position for hot water pump.
3. The workers are to enter the production building after exhausting of fumes and gases about 15 minutes.
4. Before formulation of various kinds of pesticides, first the emulsifiers must be preheated for about 3 hours.

The following procedures must be used for formulation of EC.

(Example : FENITROTHION 50 EC)

1. A. Firstly, 1st quantity of xylene to be charged is to be weighed on the scale platform and transfer by pump P² the quantity of solvent into the measuring vessel MVI. Keeping sufficient quantity of xylene to clean the pipe line after charging ingredient and emulsifiers.
- B. Switch on the impeller of the mixer MT I.
- C. Discharge the solvent from the measuring vessel MVI into the mixer MT I.
- D. Using the same loading method as above and the pump P4 transfer the active ingredient from the drum to the mixer MT I. Pump some amount of xylene to clean the pipe line of active ingredient.
- E. Also transfer emulsifiers (FF/4 & RE/70) to the mixer MT I and pump remaining xylene to clean the pipe line.
- F. After 1 hour mixing, take sample and send to laboratory for testing.
- G. Transfer the formulated liquid to filling tank (FT I) to produce finished product after receiving QC report.

INSTRUCTIONS PROCEDURES TO BE OBEYED WHEN FORMULATION AND PRODUCTION
OF PESTICIDES

1. The following materials must be kept ready at the raw material stores, ware house and production building.
 - Fire extinguisher
 - Sand
 - Saw dust
 - Brooms
 - Spade
 - Containers for waste
2. The following instructions must be obeyed when entering the buildings keeping pesticides.
 - A. The exhaust fans must be operated at least 5 minutes in the building.
 - B. If the exhaust fan is not available, keep the door open for 15 minutes.
 - C. Nobody must enter the building alone. At least one must accompany him.
 - D. Only those authorised must enter the building.
 - E. If handling the pesticides, use rubber hand gloves.
 - F. If cleaning the spillages, use suitable protective clothing.
 - G. During clean-up operations, do not work windward.
 - H. Do not wash away spillages with water, use saw dust for absorbent and carefully sweep up and put into a marked drum or plastic bag for disposal.
 - I. The ordinary & contaminated broken bottles must be kept separated. The contaminated bottles must be washed with caustic soda solution before disposal.
 - J. Don't smoke near & surrounding the building and never eat and bring foodstuffs.

THE FOLLOWING INSTRUCTIONS ARE TO BE OBEYED

BY WORKERS WHO HANDLE PESTICIDES

(FLANT)

1. Before entering the production department scrubber must be operated at least five minutes.
2. Workers must change into working cloths before entering their work place. Clothing must be re_changed after finishing.
3. While formulating and producing pesticides, workers must wear necessary proective clothing, such as helmets, aprons, goggles, masks, gloves and boots etc.
4. Whenever clothing becomes contaminated, it must be removed immediately.
5. If spillages occur on human body, wash contaminated skin thoroughly with soap and water by using shower.
6. If pesticide gets into the eyes, wash eyes immediately by using eye washing equipment.
7. Only those persons desiganated must operate the machines.
8. Smoking and eating is not allowed in and near stores and ware house and also in production department and laboratory.
9. Machinerics & equipments and floors must be washed once a week.

STANDARD OPERATING PROCEDURE : LABORATORY

To get a regular product quality and to have a safe analysis method it is necessary to follow a firm operating procedure. Thus this standard operating procedure was notified to every staff who concern to the analytical works.

1. Sampling

- (a) When any sample have to be done it is necessary to used appropriate equipments including scoop, thieves and pumps or syphon.
- (b) The amount of sample should complete an acceptable quality level (AQL) This must be well recorded.
- (c) Samples are to be taken from every consignment of active material, solvents, adjuvant and packing material.
- (d) For sampling during product each batch should have a sample of once in intermediate and once while packing the product.
- (e) Care attention must be paid to cleaning of sample equipment and container to avoid cross contamination.
- (f) All sample have to retained for at least 2 years. So labling and test results should be kept properly for reference.

2. Analytical and Physical test method.

Most of the methods are comply the FAO and CIPAC methods.

It must be considered under three heading.

- (1) Methods for determining the contact of the active ingredient in technical and formulated products.
 - (2) Physical test method.
 - (3) Methods for determining the level of formulation adjuvants and contaminated.
- (a) Since Chromatographic methods are the most popular method of the specified methods should be follow. Whenever determining the active content in both technical and formulated products.

STANDING ORDER FOR LABORATORY

All the staff and personel who assigned in the laboratory would follow this standing order in order of hygiene and safty.

- (a) Laboratory coat and safty specticle should be worn where ever necessary.
- (b) Eating, drinking, and smoking in the laboratory strickly prohibited in the laboratory area.
- (c) All toxic and hazard material should be handle inside the fume cupboards.
- (d) If any spillage it must be dealt immediately, using inert absorbent materials. (eg. saw dust)
- (e) All concentrate toxic, solvent base waste must be disposed in special place and store in the safe place before disposed.
- (f) It should be used proper equipment at proper place wherever it should be avoided making confusion due to using improper equipment.
- (g) Methods for determination are as follow:-

Active ingredients content	GC Method
Density	CIPAC MT 3
Acidity or Alkalinity	CIPAC MT 31
Water content	CIPAC MT 30
Emulsion Stability & Re-Emulsification	CIPAC MT 36.1.1
Heat stability	CIPAC MT 46.1.3
Flash point (Abel Method)	CIPAC MT 12

(b) Physical test is a part of specific it is necessary to be done to both ingredients and finished products.

They are:-

- (1) Appearance test
- (2) Density
- (3) Flash point
- (4) Emulsion stability
- (5) Water content
- (6) Storage test

(c) Specified methods needed in some case to check the level of formulation adjuvants. The major contaminant of interest from a formulation viewpoint is usually water. The method should be used is the Karl Fischer titrimetric procedure.

RECOMMENDATIONS ALREADY IMPLEMENTED

(1) TYPE OF SAFETY	(2) ACTIVITY AREA	(3) ORIGINAL REFERENCE	(4) R E C O M M E N D A T I O N	(5) R E M A R K S
1. OPERATIONAL	QUALITY CONTROL LAB.	(1)	Separation of power phases	Separation has been done in some areas as per Electrical Engr's advice.
		(3)	Air conditioner in general lab	Air conditioner fitted.
		(8)	Removal of refrigerator from the store	Done.
		(9)	Hand operated Fire Extinguishers	4 nos provided.
		(10)	LFG/Butane Gas Cylinder	Since gas is used only once or twice a year, the cylinder is not stored in the laboratory. No action needed.
		(11)	Effluent collection & disposal	<p>a) The reagents & testing wastes are collected in a plastic can and stored away for disposal.</p> <p>b) Rinsing & washings are drained out from the sinks and piped to the evaporation tank.</p>
		(12)	Ventilation of Gas Generation Room.	Air conditioner is operated during the operation of the equipment. (Windows are not opened to avoid entry of dust). This is adequate.

(1)	(2)	(3)	(4)	(5)
		(13)	Removal of spillages of pesticide concentrates, solvents or mixtures	This is being done with saw dust (presently stored in drums for incineration OR composting as required in future ref. Mr. Johnson's report .
		(14)	Sign Posting ('No smoking'/'No open flame' etc.).	While cautionary notices have been put up on the front gate of the laboratory, appropriate sign posting of individual rooms must be done.
	FORMULATING & PACKING PLANT	(1)	Risk of Flooding	In addition to the normal drain, extra storm drain has been provided round the manufacturing plant to take care of excess water during monsoon.
	(Boiler room)	(2)	Sealing of window	Done
		(3)	Pressure guage & safety valve on water heater	Fixed
		(4)	Safety valve on air compressure	Fixed & checked
		(5)	Cable tunnel cover	Wooden covers fixed
		(6)	Fire alarm	Fixed near the transformer room entrance
		(7)	Danger warning boards	These have been fixed inside the room. However, the 'High voltage' & 'Skull/Cross bone symbols to be also painted on the door of the room.

(1)	(2)	(3)	(4)	(5)
	(Mixing Plant)	(8)	Acrylic resin paint on floor	Painted during maintenance shut down in April '91.
		(11)	Lights, switches & sockets	Spark proof - OK. (Flourescent tube lights have been fixed).
		(15)	Floor, traps & drains for washing of spillages etc.	Provided (catch pits covered with wooden board). Washings drain into the channel leading to evaporation tank.
		(16)	First Aid Box (Formulation plant)	Box is kept in Production Manager's room. To be fixed in the operation area for easy access.
		(20)	First Aid Box (Bottling plant)	The one in the mixing area is adequate. Therefore, separate box on mixing plant not essential.
		(22)	Spark Proof switches etc.	OK
		(23)	Collection of accidental spillages with saw dust.	(NB : See comments in Part V)
	Imported Solvent Warehouse	(3)	Spark proof switches etc.	OK
		(5)	Stacking for proper turn-round (Stacking height- See Part IV B)	OK - Separate bays for each consignment.
		(6)	Decantation of leaking drums	OK

(1)	(2)	(3)	(5)
		(7) Solvent leak/spillage removal	OK
		(8) Singnposting of warnings	'No smoking sign' on the entrance only. Hence 'No open flame' symbol to be painted.
	Finished Product Warehouse	- Fire Extinguishers Smoke Detectors Fire extingishers	Foam type provided (4 nos.) OK OK (4 nos.)
	Solvent Tank battery	(NOT PRESENTLY IN USE AS APPROVAL OF KEROSENE SOLVENT FROM MAS IS AWAITED).	
		(2) Warning - Sing posts	'No smoking fixed' 'No flame 'No engine sparks' to be fixed.
		(5) Fire Extinginshers	Foam type (4 nos.) provided.
		- Dyke wall (approx 3' high)	Built to hold solvent in the event of leakage.
	Power Substation (33-11 KV)	(1) Transformer	properly earthed
		(2) Lightening arrestor	" "
		(3) Cable tunnel	Covered with wood plank
		(4) Smoke Detectors.	4 nos. fixed
		(5) Hand held fire extingisher	Provided
		(6) 'High Tention' & 'Skull & Crossbone' sign	OK

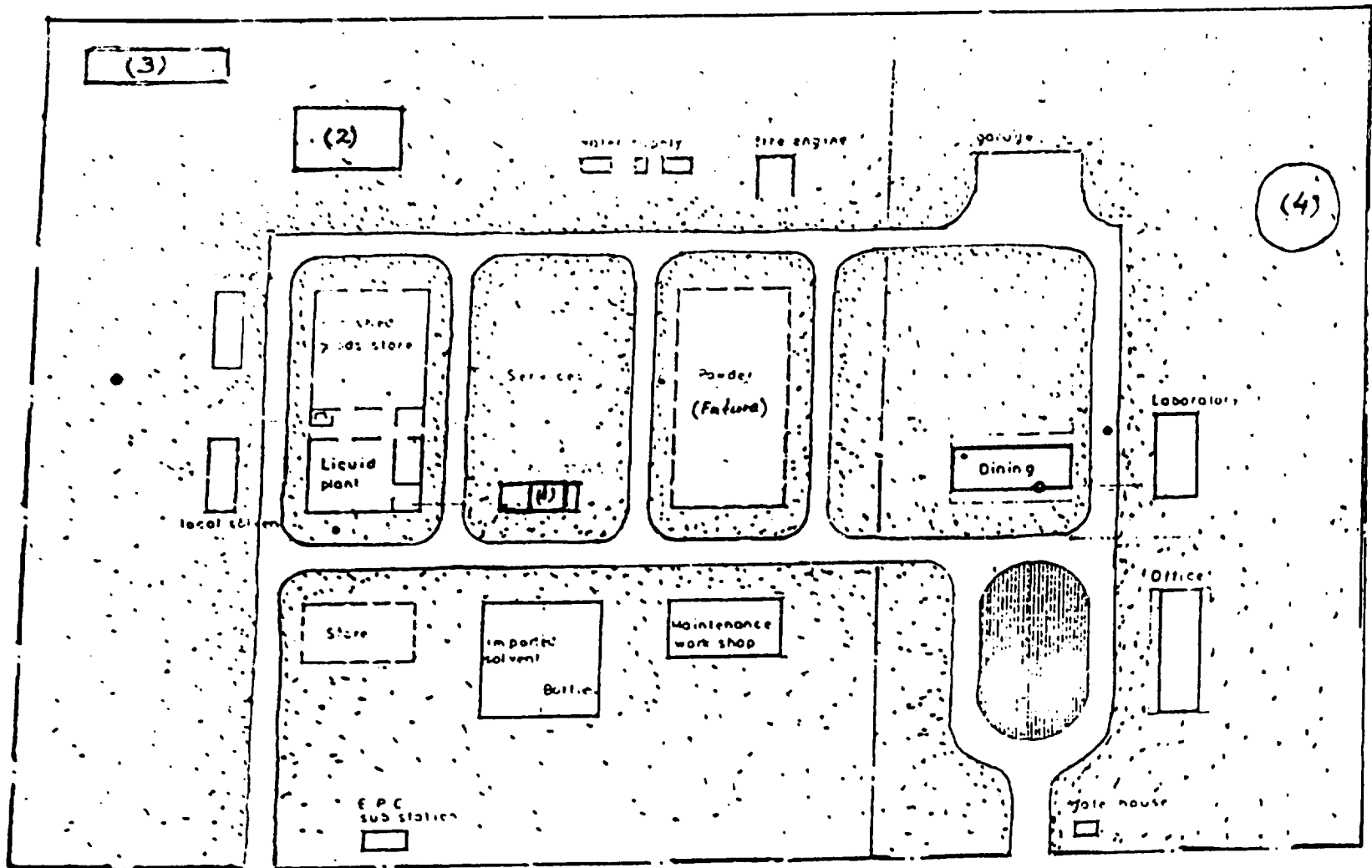
(1)	(2)	(3)	(4)	(5)
	Glass Bottle Warehouse	(1) (2)/(3)	Stacking Handling of breakages	OK OK (Broken bottles being stored . To be sent to glass factory).
		(4)	'No smoking' sign/Fire Extinguisher	Provided.
	MAINTENANCE	(1)	Battery charging area	Provided in a corner. However , desireable to segregate it.
		(2)	Rubber/Folymer tiles under the forklift during charging	A plastic sheet is being used OK if replaced when damaged.
		(3)	Fire extingisher	Provided
	PUMP HOUSE	-	OK	
	SCRUBBER	(1)	Cage cover on belt drive	Moulded plastic cover fixed
		(2)	Disposal of scrubber waste	Fed into an evaporation tank
II.	OCCUPATIONAL MIXING & SAFETY PACKING PLANT	(1)	Working Dress	Boiler suits - OK
		(2)	Protective Items :	
			Rubber gloves	Provided
			Shoes	Rubber gum boots
			Goggles	Provided to operators
			Gas mask	Provided to perators only
			Helmet	Mixing plant personnel
			Apron	" " operator
		(3)	Emergency shower	Shower unit with eye wash fixed.
		(5)	Washing from shower room etc.	(No clothes bin) Channeled into evaporation tank

(1)	(2)	(3)	(4)	(5)
	QUALITY CONTROL LAB	(1)	Working Dress	Lungi & shirt (tucked in) - Unsatisfactory (See IV B)
		(2)	Protective items Rubber gloves Shoes Goggles Nose pads/Gasmask Apron	Provided
		(3)	Emergency shower	Ordinary bath shower BUT cotton/soft soap/Eye cups not provided.
		(5)	Shower room waste	Channeled into evaporation tank.
	OTHER AREAS	(1)	Working Dress	Lungi & Shirt - Unsatisfactor. (Workshop-Boiler suit provided).
		(2)	Leather Gloves (Warehouses & workshop)	Provided
		(4)	Shoes	-Do-
		(5)	Welding shield	Provided
		(6)	First Aid Box	Workshop- Provided (Warehouses not provided)
		(7)	Changing Room facility	Provided in mixing plant only (See IV B)
		(8)	Work clothes laundering	Washed in house (washings channeled to the evaporation tank)

	(1)	(2)	(3)	(4)	(5)
III.	WORKERS HEALTH	a) MEDICAL TREATMENT	(1)	Treatment Room	Provided in the DC Lab (See Part V)
		b) HEALTH MONITORING	(1)	Health Check	Started in June '90.
	C. Diet		Milk & Banana for Manufacturing & laboratory Personnel.	One cup of milk provided daily.	
IV-	ENVIRON- MENTAL SAFETY	Formulation Plant + Scrubber DC Laboratory	(b)	Settling & evaporation tank	Established (Brick & cement walls & floor) size 30' x 20x3' with plastic sheet cover (Capacity 70 CuM)
			(b)	Settling cum evaporation tank	Established (Size 15' x 10' x 3') with plastic sheet cover

(1)	(2)	(3)	(4)	(5)
V.	GENERAL	Disposal of empty drums		
		i) Xylene	i) Open storage for Reuse or sale	i) Some xylene drums are reused internally, balance supplied to soap factory.
		ii) Tech. Insecticides	ii) Washing with xylene & then caustic soda.	ii) Drums are cut & flattened. Sheets & hoops stored in the Imported solvent warehouse for disposal
		(-) Emulsifier cans	Washed	Reused internally Used for storing finished product.
		(-)		
	(d)	Neighbouring Community	Information about plant activities hazards & preventive measures.	There is a 5 member village committee. The committee members have been informed of the plant activities & products. (Hazards/Precautions not explained).
	(e)	(Mixing & Bottling Plant)	Operation Manual & code of conduct	Issued (See Annex. 1) Issued (See Annex 2)
		(Quality Control Laboratory)	a) Standard operating procedure b) Standing orders	Issued (See Annex 3) Issued (See Annex. 4)

(1)	(2)	(3)	(4)	(5)
(f)		Safety Implementation		Managers/Officer responsible for individual activity site. (Overall responsibility is that of Project Director) - See Part V
VI.	SAFETY AUDIT		System not yet introduced	(See Part V)
VII.	ACCIDENT REPORTING		(As per the Myanmar Govt. rules).	Has not been necessary since commissioning.
VIII.	FACTORY SITE UP-KEEP		i) General cleanliness of site	See Part V
			ii) Maintenance of internal roads	
			iii) Up-keep of remaining area.	



Annexure (6)

- A) SUGGESTED LOCATIONS
- 1) Water Reservoir for Fire Engine
 - 2) Evaporation tank for treated effluent
 - 3) Lagoon for water ex-fire fighting
 - 4) Incinerator
- B) WEEED PROBLEM AREA



Approved by _____ (B)

DISCUSSIONS WITH MYANMAR AGRICULTURAL
SERVICES ON 27.11.91

Present :

U Maung Maung Tin	: Dy. General Manager (Plant Protection)	I + +
Dr. Thein Htay	: Asst. Manager (Plant Protection)	+ MAS +
U. Myint Swe	: General Manager Pesticide Project (MFI)	
Mr. K. Johnson	: UNIDO Consultant on Environment	
Dr. M.G. Srivastava	: UNIDO Consultant on Safety.	

U Maung Maung Tin confirmed the full satisfaction of MAS with the bottle design, outer packing, transit safety upto consuming points & the quality of pesticide (formulated) products supplied by the pilot plant. Their other comments were as follows :-

- 1) The future level of demand of products vis-a-vis capacity utilization; U. Maung Maung Tin informed that in 10 years time the tech. grade pesticide requirement is likely to grow to 10,000 Tm from the present 250 Tpa. This however will be subject to import licencing as it is currently done on barter basis.
- 2) On the composition of pesticide requirement, he indicated the present need for Diazinon granules @ 200 Tpa (for rice stem borer) and 50 Tpa of fungicide (Tekonil WF) for use in potato, tomato and groundnut. The future requirement of Diazinon granules and Fungicide is placed 500 and 100 Tpa respectively. He appreciated that for such small quantities of solid (dry) formulations, setting up a plant may not be justified.

3) Formulations prepared by the Pesticide Project using a mixture of superior Kerosene and xylene as solvents have been tested and found satisfactory from the phytotoxicity and bioefficacy view points. Hence, such formulation will be accepted from the next year.

4) The pesticide law of Myanmar has been passed by the Government. The rules are being framed and the law is expected to be operational by the middle of 1992.

In this context -

i) A Pesticide Testing Lab has already been set up. It will check on pesticide quality, residues in crops and environmental contamination (soil and water) in the principal areas of pesticide use.

ii) Pesticide Registration Board is being constituted (yet to be gazetted) and may comprise of - MD of MAS (Chairman). D.G. Health Services, D.G. Veterinary Services, DG Fishries, DG Trade, DG Forests, MD of Myanmar Agricultural Produce Trade, Director Health Laboratory & GM Extension Division. The Head of Plant Protection will be the Secretary of the Board.

iii) Pesticide Project will need to seek Product Registration, Manufacturing Licence & Selling Licences when the law is implemented.

5. On the prevention of misuse of empty pesticide bottles, there is no control as yet. Mr. Johnson suggested that breaking such bottles & sending back to glass factory would be ideal. MGS suggested that the trade centers could undertake collection of empties against payment OR the return of bottles could be linked to subsidy disbursement.

6. A Farmer's Health Programme is prepared to be launched by the Health Dept. It will monitor pesticide exposure/toxicity to the farmers in the areas of intensive use of pesticides.

Another user Education Programme is planned with the help of FAO.

DISCUSSIONS WITH
MYANMAR PHARMACEUTICAL INDUSTRY ON
27.11.91

Present :

U Ban Yi, Director MPI
U Myo Lwin, National Coordinator of RENPAP
U Myint Swe, G.M. Pesticides Project
Mr. K Johnson, UNIDO Consultant on Environment
Dr. M.G. Srivastava, UNIDO Consultant on Safety.

This was our second meeting and held to brief the Director/s of the principal observations and recommendations (The first meeting was held on 18/11 at the beginning of the mission). U Ban Yi was informed that -

- i) Nearly $\frac{1}{2}$ of the recommendations of the "1st Safety Report" have been implemented. These will be listed & commented upon in the present report.
- ii) There was serious spillage & contamination problem on the bottling plant. The defect in the filling probes & jerking movement of the turn table were highlighted. The matter needs to be corrected with help of Sicplant. Alternatively, arrangement for washing and dry mopping the contaminated bottles must be made.
- iii) House keeping needed closer attention of the management on site.
- iv) Use of safety equipment and clothes by the workers & staff needed greater emphasis. The Director pointed out that the climatic & cultural inhibitions. However the need for worker education and persuasion was accepted.

- v) The upkeep of the site is tardy. The profuse weed growth (tall grass and bushes) present potential fire hazard and must be removed even if labour cost is involved. (Mr. U Banyi accepted this).
- vi) The use of plant floor area for warehousing finished product and the stacking of xylene drums 4-high in the solvent warehouse are unsafe practices. There is need to review the solvent & finished product storage capacity in an integrated manner in the light of space requirements over the next few years. (There is already a plan to build a new warehouse for xylene).
- vii) The Road between Hmawbi town & the project (approx 12 Km) is unsafe for transportation of toxic chemicals & solvents and a potential hazard for pollution from solvent, finished products and Tech. grade pesticides. This needs to be corrected without further delay.
- viii) The Medical treatment Room needs to be equipped for emergency treatment items (list of items provided).
- ix) Workers health monitoring & cholinestrase testing are inadequate & must be improved. Health Cards for individual worker as already recommended have not been introduced. These should be maintained & equipment for cholinestrase testing should be provided to the JC laboratory.
- x) The present system of collecting toxic effluents in evaporation tanks & toxic solid wastes in drums is acceptable only as an interim measure. Mr. Johnson has recommended establishment of effluent treatment & incineration facilities for toxic solids.
- xi) The monitoring of the vapour level in the work environment of the plants is desirable. Hand held equipment for vapour testing should be provided and a proper system for recording data introduced.

xii) Non availability of Fire Engine & asuitable Water reservoir would be serious handicap in the event of a fire. Fire fighting facility on site is extremely essential & must be given specific attention. (U Ban Yi was not sure if the Fire Engine will be available).

DISCUSSIONS WITH UNDP YANGON
ON 27th NOV. '91.

Present :

- Mr. Rohinton Sethna : Sr. Deputy Resident Representative,
UNDP
- U Hla Min : Programme Officer
- U Myint Swe : General Manager, Pesticide Project
- Mr. Keith Johnson : UNIDO Consultant on Environment
- Dr. M.G. Srivastava : UNIDO Consultant on Safety.
-

The meeting was held to brief the UNDP personnel about the mission and principal findings. Mr. Sethna was specially briefed on the following points -

- a) That nearly half of the recommendations of my previous mission (Dec. '89) had already been implemented, which is considered satisfactory. As some of the pending items involve importation of equipment, these may be examined for suitable arrangements.
- b) Fire hazard due to unsatisfactory upkeep of site (tall grass & weeds) needs immediate attention.
- c) The plans to procure Fire Engine have not yet materialised. There is also no water reservoir for the fire engine to use. Both these are essential due to inflammable solvent & Finished product storage.
- d) Warehousing space for imported solvent and finished products is presently inadequate, Requires review and additional construction.

- e) Medical Treatment Room has not been fitted up with emergency treatment items. This is essential.
- f) The approach road is in a very bad condition & is a potential source of environmental pollution and fire hazard during transportation of solvents, tech. grade & formulated pesticides. This requires urgent attention.

Mr. Sethna informed that matter of road had been discussed at the tripartite meeting (UNIDO/JNDF/Myanmar Govt.) and was surprised that there has been no progress.

- g) The need for workers health and security measures at the plant were highlighted.

Mr. Johnson briefed on his findings on the quantity of effluent and solid waste requiring disposal. He outlined his recommendations on the treatment & incineration facility to be installed. Mr. Sethna enquired about the use of solid wastes for land filling and put Mr. Johnson in touch with Mr. Baccus (an expert on Town planning & hygiene) for exchange of views.

UNIDO Substantive Comments

The report gives in great detail all the aspects related to safety in the operation of the pesticide plant at Hmawbi. This report should be read along with the report submitted by Mr. Keith Johnson. While the Ministry of Agriculture is satisfied with the products supplied by the Hmawbi plant, the formulation plant itself needs a thorough safety overhaul and there seems to be a relaxed attitude on the part of the staff to pay serious attention to this.

UNIDO has already discussed the issues with senior Government officials regarding various actions to be taken so that funds and necessary staff are allotted to carry out the work.

The plant has a good scope for future expansion, but it is pointless to take up the expansion if the up-keep of the site is not satisfactory. A number of recommendations mentioned in the report(s) do not need external help or foreign exchange.

It is the responsibility and awareness that should be cultivated to maintain the plant at international standards. The plant is definitely a good investment for Myanmar and the quality of operation would bring outside companies for a possible joint venture in the distant future.

UNIDO is pleased that a top level officer attended the recent UNIDO meeting in Brussels on Safety Guidelines in Pesticide Formulation in Developing Countries. We hope that this would stimulate the government to take the necessary steps to clean the site and keep it in good order following the standard operation procedure and good manufacturing practice.