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**Evaluation of the Safe Use of Malathion  
in the Pakistan Malaria Control II Project**

**August 13 - September 4, 1989**

**by**

**Jack Hayes, Ph.D**

**AR-119-4**

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## Acronyms and Abbreviations

<b>ACD</b>	Active Case Detection
<b>A.I.D.</b>	Agency for International Development
<b>API</b>	Annual Parasite Incidence
<b>ARD</b>	Agricultural and Rural Development (Division, A.I.D./Pakistan)
<b>CD</b>	Communicable Disease
<b>CICP</b>	Consortium for International Crop Protection
<b>DOMC</b>	Directorate of Malaria Control
<b>EA</b>	Environmental Assessment
<b>EC</b>	Emulsifiable Concentrate
<b>EE</b>	Energy and Environmental (Division, A.I.D./Pakistan)
<b>EPA</b>	Environmental Protection Agency
<b>GOP</b>	Government of Pakistan
<b>HPN</b>	Health, Population and Nutrition (Division, A.I.D./Pakistan)
<b>IEE</b>	Initial Environmental Examination
<b>IPM</b>	Integrated Pest Management
<b>MCP</b>	Malaria Control Program
<b>MT</b>	Metric Ton
<b>NIMRT</b>	National Institute of Malaria Research and Training
<b>NMCP</b>	National Malaria Control Program
<b>NWFP</b>	North West Frontier Province
<b>OP</b>	Organophosphate
<b>PACD</b>	Project Assistance Completion Date
<b>PCD</b>	Passive Case Detection
<b>PID</b>	Project Identification Document
<b>PP</b>	Project Paper
<b>RHC</b>	Rural Health Center
<b>TVA</b>	Tennessee Valley Authority
<b>ULV</b>	Ultra Low Volume
<b>UNHCR</b>	United Nations High Commission for Refugees
<b>UNICEF</b>	United Nations International Children's Emergency Fund
<b>USAID</b>	United States Agency for International Development
<b>VBC</b>	Vector Biology and Control Project
<b>WHO</b>	World Health Organization
<b>WDP</b>	Water Disposal Powder
<b>WP</b>	Wettable Powder

(From Drs. Hobbs & Larew)

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## I. Executive Summary

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The project paper for The Malaria Control II Project extension, which was authorized by USAID/Islamabad and the BOP, contains specific conditions regarding pesticide use and storage. Project Covenants (page 119 of the project paper) requires that the grantee provide annual assurances to A.I.D. that the spray operation is safe. The goal of this site visit was to ascertain, as well as possible, to what degree the insecticide spray program operated in a safe manner.

A review of the safe use and storage of insecticide was conducted during the last three weeks of August 1989 to follow up the Environmental assessment (EA) of 1988. The visit began with a review of the EA and its major recommendations about the safe use of malathion. Field examination to ascertain the actual conditions of storage, transport and application of malathion was limited to the Punjab, North West Frontier Province (NWFP) and the city of Karachi. It was determined there was not enough time to visit Balochistan because this consultancy occurred during the end of the active spray season. The political situation in the Sindh prevented inspection of that area.

This report contains the results of visits to administrative subunits of MCP and some of their respective districts and villages. It enumerates the degree of cholinesterase test results, describes infractions of safe practices and provides recommendations.

The key recommendations are, in summary, to: continue routine unannounced visits to active spray teams and districts where malathion is stored; develop a contingency plan for major accidents in transportation or storage; and most important, to improve training at the spray team level.

### List of Recommendations:

1. Conduct adequate training for spray teams for both efficacious and safe use of pesticides.
2. Conduct routine "early in the season" visits by supervisors to ensure that safe practices are followed.
3. Develop and use a checklist system to ensure the presence of safety equipment, atropine and sterile syringes.
4. Develop a contingency plan for accidental spills of the chemical concentrate while in transit and/or at storage sites. Consideration also should be given to contingencies for fire or flooding of storage facilities.

5. Collect tintometric data for **all** spray men preceded by appropriate preseason baseline testing. Examinations should be conducted at the midpoint of the spray season (after three to four weeks) and end of season examination to ensure that any observed depression is within acceptable levels and that remedial action is taken if depression is below acceptable levels.

## 2. Introduction

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An Environmental Assessment (EA) was prepared by Drs. Jesse Hobbs and Hiram Larew during a 21-day visit to Pakistan (July 31-August 20, 1988). The rationale for this activity is completely covered in the VBC document "Environmental assessment of the Pakistan Malaria Control II Project extension, No. 391-0472" (AR-099).

My visit to assess the practices employed during the spray season was a follow-up to the EA. This visit was unavoidably delayed due to changes in scheduling. Many of the target sites had been sprayed before my arrival. Mission personnel believed that I should not travel to the Sind because of civil unrest in that state. Considering the time constraints, I confined my visits to Punjab, Northwest Frontier Province (NWFP) and the city of Lahore.

A chronology of my trip and a list of the persons and places visited in chronological order is attached (Appendices 1 and 2). The scope of work was as follows:

1. Review EA and major recommendations concerning safe use of malathion;
2. Examine actual conditions of field storage, transport and application of the malathion to determine whether the recommendations of the EA are being followed;
3. Determine whether conditions of the EA regarding use of protective clothing and training have been followed by DOMC;
4. Evaluate current training practices of the DOMC and municipal authorities used to instruct workers handling malathion;
5. Assist DOMC in preparing schedules for monitoring and evaluation of safe use procedures, analysis of exposure and treatment of pesticide intoxication;
6. Prepare a report describing the status of DOMC compliance with the recommendations of the EA.
7. Leave draft report with USAID/Islamabad and discuss findings with USAID staff.

My initial briefing in country was conducted by Dr. Rifaq. The following day we were joined by the head of MCP Directorate, Mr. Choudhary



Mujahid. Travel arrangements and support in-country were handled by USAID/Pakistan. When we visited the first spray team, I was immediately concerned that no one wore protective footwear and only the mixer had rubber gloves. Men had two uniforms, not four as detailed in the safety protocol (8.2.1) of the Project Paper. My hosts, the malaria supervisors, explained that it had proven "intolerable" for the spraymen to endure the heat and sweaty hands produced when they attempted to wear gloves. Since only the mixer came in close contact with the chemical concentrate, the MCP staff thought it was not necessary for spraymen to wear gloves. The same held for rubber or other water-proof footwear. The MCP staff pointed out that if a man spilled the mix in the boot, he would be in contact with it all day. When spraymen do not wear boots, spills can be rinsed off quickly.

These findings led to my immediate request to see tintometric test data and have a squad tested early during my visit. Those data are presented in Annex 3. The rationale for having only two uniforms was that two were sufficient for only a four- to six-week season. Procedures enumerated for householders in the Malaria Control extension document (8.2.1.2) generally were being followed, but house cards were not being posted to record MCP visits, inspections and spray visits. I was told that when the householders were given the cards, they usually lost them.

Annex 3 also provides the limited tintometric data for the two regions I visited. It should be noted that MCP does not establish a mean value (preseason) for spraymen. Due to a shortage in travel support to visit field sites, one area in the NWFP had no data on some teams. In a few cases, values obtained in the initial blood sample were lower than those obtained at subsequent intervals (two to four weeks later). No cases of intoxication were observed. Upon questioning, I learned that if an individual shows signs of insecticide intoxication, he is released, but I was told that this rarely happens. The only cases of such sensitivity that any of the supervisors could recall had occurred when spraymen had not changed their clothes and had slept in contaminated clothing. In Punjab, they could remember this happening about five times in five years. The MCP believes that malathion is so safe (non-toxic to man) that there is nothing to worry about. This indicates a lack of training on the toxicological effects of pesticides.

### 3. Findings

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I observed the following infractions or instances when practices or procedures were counter to established safe practice. In all instances, malaria supervisors took immediate steps to correct the situation or give appropriate advice to the leader of the spray squad. These omissions were usually single occurrences unless otherwise noted:

1. Absence of gloves or presence of only one glove (four times).
2. No funnel available - sprayman holding cloth to filter liquid material, which contaminated his hands and resulted in a loss of chemical that was spilled on the ground. The cumulative effect at the end of the day is considerable. Many of these sites were mosques, which are often the most available source of water, where people might walk through the contaminated area for many days to come (three times).
3. Over-pressurizing spray tank, which may result in a "blow out" and loss of most of the contents, contaminating a large area.
4. Absence of spare parts (rare).
5. Absence of atropine or syringes: one team had a glass syringe that was not sterile and syringes were lacking on two occasions.
6. Syringes (disposable) with broken packaging resulting in possible microbial contamination (many occurrences). Even though there had been no atropine injections given during the past year or the spray season, broken packaging is a serious potential threat for infectious disease.
7. Failure to remove bedding and intentional spraying of beds and bedding. The latter occurred only once when the villagers wanted their beds and bedding sprayed to control bed bugs.
8. Disposal of rinsate: The best procedure observed was when a hole was dug and a flat rock placed in the bottom to support the spray tank, so that any spills or rinsed off chemical were confined to the hole and easily buried. Most usually, rinsed cans and buckets of rinsate were thrown into a field so "sunlight could inactivate the chemical."

9. Storage was discussed previously, but it needs to be noted specifically that the bags of larvicide were not stored properly. Many were punctured and the granules spilled. This material is more toxic than malathion.
10. Bleeding for tintometric testing was done using a disposable 26-gauge needle REPEATEDLY. The risk of hepatitis B infection is great. A disposable lancet should be used and discarded after use.

## 4. Recommendations

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- \*1. There is an obvious need for continued training and supervision. It is abundantly evident that there is an admirable level of knowledge and experience among the upper echelon of the MCP and that it decreases as you go down to the spray man. The spray teams need forceful, experienced leadership. This also would ensure better cooperation with the village people and result in appropriate removal of household effects before spraying. Training is essential for success. This should begin at the district level and be carried down to the squads.
- \*2. A check list system should be initiated to ensure the presence of:
  - a. Spare parts - including gaskets.
  - b. Extra gloves.
  - c. Funnels and clean cloth filters.
  - d. Proper stirring paddles (wide), preferably finished board (not sticks).
  - e. Atropine and sealed syringes in a pouch, box or bag. Movement in pants pockets destroys the protective packaging. This is the responsibility of the spray team leader. Assistant malaria supervisors should check squad leaders.
- \*3. Reinforce the policy of not spraying bedding. Directives must come from district chiefs and be checked by assistant malaria supervisors.
- \*4. Squad leaders should ensure routine washing of hands and feet, especially after spills in the mixing area. Vigilance at the end of the day is important. The men should start the day with clean uniforms. This is also the squad leader's responsibility.
- \*5. Choosing mixing sites that minimize the exposure of village people is another responsibility of the squad leaders. Ideally, a hole should be dug to confine spillage. A rock should be placed at the bottom to prevent the spray tank from getting soiled. Assistant malaria supervisors should provide a shovel if ground is rocky.
- \*6. Post-spraying tintometric testing to evaluate whether safety procedures are being followed. If minimal depression is quantified, it "scientifically" substantiates that safeguards are adequate. The NWFP assistant entomologist said that transport was not available to do the necessary testing in distant areas.

\* indicates major importance

- \*6. (cont.) Tintometric testing should be done by the assistant entomologist in cooperation with the assistant malaria supervisor following WHO guidelines. Spraymen should be tested at the end of each spray cycle and the results should be reported to both DMOC and USAID/Islamabad.
- \*7. The available uniforms are not a source of pride. They are frequently ill-fitting and the quality of the material is inferior. The Directorate of MCP should upgrade the uniforms.
- \*8. Conduct unannounced, routine checks on the following program operations:
  - a. Transport and storage of insecticide.
  - b. Efficacy and safe spray procedure.
  - c. Availability of expendable supplies.
  - d. The presence of atropine, syringes and basic safety equipment. This should be done by the malaria advisor at the top level in conjunction with malaria supervisors to ensure reasonable checks at the district level.
9. Develop a commendation system. Reward people who are doing an outstanding job with written commendations, certificates or other appropriate means. Responsibility should begin at the top of the MCP and be passed down through the organization.
10. The level of pay for spraymen does not attract the best quality men needed for the job. Pay is reportedly one to four months late.
11. Cards should be permanently posted (nailed to doors) to document MCP activities.
- \*12. There is no clear policy for use of larvicides by municipal governments. They are not documenting control efforts to determine effectiveness and have no safety checks. The MCP should determine what responsibilities go along with receiving larvicide from government.
13. Locations of Anopheles breeding sites are usually unknown. In areas of heavy irrigation it is obvious, but some sites in non-irrigated areas should be designated to help determine the choice of control measures and pattern of use.
- \*14. Refugee malaria programs appear to be parallel systems. MCP does not include Afghan incidence data in its epidemiological assessments. No safety procedures for the use of insecticides were evident. (I must admit, however, that I was able to spend little time in this area.)

I want to conclude this section by saying that the overall effort to provide safe effective coverage using malathion was quite commendable. My recommendations are intended solely to help improve this situation.

The current use of malathion for only four to six weeks per cycle, as supported by the tintometric data, appear to indicate that MCP's handling of the insecticide is adequate. However, it should be noted that the tests found declining values in several spraymen. These men should be monitored to determine how long the depression continues.

It must be noted that should any change be made to a more toxic insecticide (e.g. fenitrothion), its use **must** be preceded by appropriate exposure testing and the adoption of safety procedures dictated by test results.

## **Annex 1**

### **Persons Visited in Islamabad**

Anne Aarnes, Chief, Office of Health, Population and Nutrition, USAID

Dr. Rifaq Ismail, Project Officer, MCP II

Choudhary Mujahid, Director, DOMC

## Annex 2

### Persons Visited and Localities Inspected in Punjab

#### Lahore:

Dr. Mazahir Hashmi, Director General Health, Punjab  
 Dr. I.A. Tirmizi, CDC Director  
 Mr. Azam Chaudhry, Directorate CDC Officer  
 Mr. Malik Javid, Entomologist  
 Mr. Mukhtar Shah, Parasitologist

#### Urban Control Program

Mr. Sardar A. Shaikh, Assistant Entomologist, DHO Office

#### District Visited:

A. Gujranwala: Regional Director, Mr. Nasir  
 District Office: Mr. Ashraf, CDC Officer  
 Mr. Rauf, CDC Officer

B. Gujrat: Dr. M. Rashid, DHO  
 Mr. Rafi, CDC Officer  
 Mr. Khalid Latif Butt, Entomologist

#### Villages inspected:

Parianwali, PCD Post  
 Lasoori UC 145-05  
 Ado-Sarwani UC 140-

C. Faisalabad: Dr. M. Bashir, Regional Director  
 Mr. M. Bashir, CDC Officer  
 Mr. Mushtaq, Assistant Entomologist

#### Villages inspected:

Village 104 (same as Union Council number)  
 Village 105  
 Village 111  
 Village 106 - Basic Health Unit to see storage facility.



### **Annex 3**

#### **Persons Visited and Localities Inspected in Peshawar**

##### **Regional Headquarters:**

Dr. Iqbal, Assistant Director of Malaria, NWFP  
Mr. Murtaza Khan, Malaria Superintendent  
Mr. Abdul Aziz, CDC Malaria Superintendent  
Mr. Pervez, Assistant Entomologist  
Mr. Fazle Raziq, Entomologist

##### **District Level:**

A. Dr. Irfan Mir, Health Officer  
Dr. Sher Bahaduz, CDC Officer  
Mr. Abdul Rehan  
Mr. Qibad Muhammad, Malaria Superintendent

##### **Villages inspected:**

Shakarpura SSb1-09  
Takhat Abad

##### **Mardan:**

Dr. Mohammad Shah, DHO  
Mr. Muhammad Anwar, Assistant Malaria Supervisor  
Mr. Naeem, Assistant Malaria Supervisor

##### **Malakand Agency - Headquarters Batkhela:**

Mr. Muhammad Jamil, Administrative Officer  
Mr. Fazle Rahim, Assistant Malaria Superintendent  
Mr. Sami-Ullah, Malaria Inspector

##### **Swat District - Capitol: Saidu Sharif**

Mr. Pikhawari Khan, Administrative Officer  
Mr. Shafiqur Rehman, Assistant Malaria Supervisor  
Mr. Sadequallah, Assistant Malaria Supervisor

**Villages inspected:**

Kabal Hospital for insecticide storage  
Kala Kahai  
Parrai  
Srashah

**Refugee Afghan Program - Administrative Headquarters - UNHCR:**

Deputy Director, Dr. Nasir (director not available)

Toured Kachagari Refugee Camp. We were not able to locate a spray team working without a supervisor, but did inspect malathion storage site (health post) in Kachagari.

## Annex 4

### Summary of Tintometric Testing Spray Season: July - Sept. 1989

#### A. Results from Gujrat for 1989 Season:

Test I (July 17)	Test II (July 23)	Number Tested
100%	100%	66 men
100%	87%	5 men
100%	75%	2 men

I requested that we test some squads and get a third (end-of-season value).

#### Test III

10 men had no change from 100%  
 4 men depressed to 87.5%  
 1 man depressed from 87.5% to 75%  
 1 man depressed from 100% to 75%

#### B. Results from Faisalabad:

Test I July 19	Test II July 29	
100%	100%	24 men
100%	87.5%	23 men
100%	75%	17 men
100%	62.5%	3 men
87.5%	62.5	1 man
87.5%	100%	1 man

**C. Summary from Headquarters:**

Year	Total Tested	100%	87.5%	75%	62.5%	50%	37%	<26%
1989	247	184	47	14	2	0	0	0
1988	2082	1175	569	260	67	6	3	2

These are initial test values supplied me by Mr. Azam.

Note: I made the request at the district level to have all squads possible tested upon the completion of the season and to forward the results to Islamabad.

**D. Tintometric Data from NWFP D.H.O. Office, Mardan**

Test I July 14	Test II August 19	Number Tested
100%	100%	11
100%	87.5%	10
87.5%	75%	1

I requested that we test a squad. Six men were tested and no change was recorded for these men (one man was 87.5% on 5/8/89, 22/8/89 and 26/8/89 and five men were 100% on 5/8/89, 22/8/89, 26/8/89). I did not witness the process but was given the data at the end of the day. I consider the other values presented with an indication of depression more realistic.

Additional records were requested and received from five other squads whose first and second bleeding ranged from 8, 15, 21, 22 and 37 days apart:

Twenty individuals showed no change (100% to 100% = 17 men, 87.5% to 87.5% = 3 men).

Seven men dropped from 100% to 87.5%; 2 men dropped from 87.5% to 75% and 1 man dropped from 100% to 75%.