

**HEALTH HAZARDS OF  
AERIAL SPRAYING OF ENDOSULPHAN IN  
KASARAGOD DISTRICT, KERALA**

**Report of the Expert Committee,  
Government of Kerala  
August 2003**

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## COMMITTEE ON ENDOSULPHAN HEALTH HAZARDS

### **MEMBERS**

Dr.P.K.Sivaraman Chairman	Additional Director of Health Services (PH), Directorate of Health Services, Thiruvananthapuram-37
Dr.Valsala L.S	Head of State PEID Cell, Medical College Thiruvananthapuram-37
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Mr.K.K. Gangadharan	Additional Director of Agriculture Directorate of Agriculture Thiruvananthapuram.
Dr.Kalavathy M.C	Lecturer in Cancer Epidemiology Regional Cancer Centre Thiruvananthapuram-11
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## **Executive Summary:**

Aerial spraying of Endosulphan was taking place in the Cashew Plantations owned by Plantation Corporation of Kerala at Kasaragod for the last 24 years. Reports of its effect on health and environment started appearing in print and electronic media from 1997 onwards. This became a burning issue in the State and attracted the attention of public and government during the last few years.

Many Government and private agencies studied the issue in detail. Some of them are an Expert Committee from Kerala Agricultural University, under the Chairmanship of Dr. Abdul Salam, a Government Committee under the Chairmanship of Dr. Achuthan, Expert team from National Institute of Occupational Health, ICMR Ahmedabad and Thanal-Non Governmental Organization. Since these committees did not address the health issues in detail, Government of Kerala appointed a Committee with Dr. P.K. Sivaraman, Additional Director of Health Services (Public Health) as Chairman and members from various related departments to study the health related issues of Endosulphan affected area.

The Committee conducted field visit in the affected areas, visited the houses of affected persons and PHCs in the area. Committee met stakeholders, doctors in the Government and Private Institutions and officers of Plantation Corporation of Kerala and conducted discussions for details. Available registers and records in this matter were studied.

The Committee noticed many people with various health problems in the banks of stream 'Swarga'. Among the school children of Vani Nagar, more children with congenital anomalies were observed. Private doctors reported more cases of Cancers and abortions in the affected area. The committee observed that Plantation Corporation of Kerala was not following the guidelines for the use of aerial spraying of Endosulphan in the Plantations.

A health survey was conducted in the affected area and in a non-affected area of Kasaragod district. Diseases like congenital anomalies, Mental retardation, Cancer and Infertility were found to be more in the affected area. Specialist Medical camps organized at Vani Nagar also showed more number of people with Central Nervous System anomalies and Skeletal problems. Laboratory investigations done by National Institute of Occupational Health also showed high levels of Endosulphan in the Serum of people, water, soil and vegetations.

WHO points out in its literature on Endosulphan about the chances of occurrence of health hazards due to short term and long term exposure to Endosulphan among human beings. Since the Committee could not find any other reason that could explain the health hazards seen in the Endosulphan sprayed area, this may be attributed to the aerial spraying of Endosulphan.

# REPORT OF THE EXPERT COMMITTEE TO STUDY THE ISSUE OF SUSPECTED HEALTH HAZARDS DUE TO THE USE OF ENDOSULPHAN in KASARAGOD DT, KERALA.

## **Background**

Environmental effects of aerial spraying of Endosulphan at the Cashew plantations of Kasaragod District is a burning issue during the past few years and now also in Kerala. Endosulphan aerial spraying was done in Kasaragod District by Plantation Corporation during the last 24 years. More and more health problems, were reported from the areas surrounding the plantations of Cheemeni, Periya, Rajapuram, Panathadi, Muliayar and Perla. Some school children of the area reported to have congenital anomalies, mental retardation and other Central Nervous System related problems. All these were alleged to be due to the aerial spraying of Endosulphan. This was projected by the media and it attracted the attention of the public and authorities from 1997 onwards.

From 2000 onwards committees of various departments, Non Governmental Organizations, Indian Council of Medical Research and other agencies conducted visits to the area and submitted reports to the Government regarding this issue. Some of them are

1. Committee appointed by Kerala Agricultural University with Dr. Abdul Salam as Chairman.
2. Committee appointed by Government of Kerala with Dr. Achuthan as Chairman.
3. Committee from National Institute of Occupational Health, ICMR, Ahemedabad.

Health related problems turned out to be the main issue and their causal association with aerial spraying of Endosulphan was debated, a multidisciplinary committee consisting of experts from the field of Public Health, Agriculture, Pollution Control Board and RCC was appointed by Government of Kerala to study the issue in detail.

## **Endosulphan Short-term toxicity**

There is concern over the acute toxicity of endosulphan. The world Health Organization (WHO) classifies endosulphan in Category 2 (moderately hazardous). The U.S. Environmental Protection Agency (US EPA) classifies it as Category 3 (highly hazardous) pesticide. It is readily absorbed by the stomach, by the lungs, and through the skin, meaning that all routes of exposure can pose a hazard.

Numerous cases of both suicidal and occupational poisoning have been reported. Proper protective clothing (safety goggles, gloves, long sleeves, long pants, respirator) is needed to prevent poisoning when handling endosulphan. (IPCS, 1988).

Before it was banned in the Philippines in the early 1990s, endosulphan had become the number one cause of pesticide poisonings. (NPCIC, 1991) Another concern, especially in developing countries, is that people with diets low in protein may be more sensitive to the effects of this pesticide. (ATSDR, 1993).

### **Long-term toxicity**

Although the short-term toxicity of endosulphan is of immediate concern, there are also long-term effects to consider. There is some indication that endosulphan can have adverse effects on the immune system at low levels of exposure. (ATSDR, 1993). There is mounting evidence that organochlorine compounds can act as hormones. These compounds, including DDT, PCBs, and endosulphan, may also be part of the cause for the disease in the quality of semen, an increase in testicular and prostate cancer, an increase in defects in male sex organs, and increases incidence of breast cancer which has been observed in the last fifty years. (Hileman, 1994; Soto, 1993). Endosulphan has also been found to cause mutations (ATSDR, 1993).

## Review of Related Studies.

A series of studies and investigations were carried out by a number of agencies in the affected area in this regard. There were severe allegations of diseases such as mental disorders, congenital anomalies and neurological defects etc. occurring in the area sprayed with Endosulphan and were attributed to the spraying of Endosulphan.

In 1999, a team of researchers from **Thanal**, a Trivandrum based Non Governmental Organization visited the area and conducted a house to house health survey. They observed cases of anemia, generalized weakness, Cancer, Congenital anomalies, menstrual abnormalities and miscarriages among women, and infertility among men.

**Dr. Mohana Kumar. Y.S.**, a physician practicing in the area since 1982, has published an article on Endosulphan related health problem of Kasaragod in "Down to Earth "Magazine (28th February 2001).

**Centre for Science and Environment, New Delhi** analysed biological and environmental samples for Endosulphan residue in February 2001, (about one month after the last aerial spray of Endosulphan which was carried out on 26th December 2000) . Very high levels of Endosulphan were found in human blood, human milk, vegetables , spices, cow's milk, animal tissues, cashew leaves and cashew.

**Fredrick Institute of Plant Protection and Toxicology (FIPPAT)** at the request of Plantation Corporation of Kerala conducted endosulphan residue estimation in some samples from Padre village in February 2001. But their survey did not show any elevated endosulphan level in the samples of blood, cow's milk and water. But FIPPAT didn't perform any confirmative test for endosulphan.

**National Institute of Occupational Health** carried out a field study from 24th September 2001 to 7th October 2001. The study was done among school children. Sexual Maturity Rating was done by Pediatricians and the blood samples were collected for analyzing endosulphan residues, hormonal analysis and cytogenetic studies. The survey showed congenital malformations and low sexual maturity rate in the affected children. The endosulphan residue levels were found to be above the permitted levels in all the blood samples studied.

As per Order DO No. 70/2001 dated 13/2/01 of the Director of Research, Kerala Agriculture University, an expert committee with Dr. M. Abdul Salam as convener conducted an investigation of the environmental effects of spraying, of endosulphan in Perla division of PCK in Kasaragod. They reported that even though CNS related problems are present in some families, there were no evidence to confirm the involvement of endosulphan. They also suggested a detailed study by a multidisciplinary expert group and to stop aerial spraying.

Endosulphan spray protest action committee (ESPAC) produced a white paper against the report of Kerala Agricultural University and contradicted the findings mentioned in their report.

In order to study the effect of Endosulphan in the health of people and the environment of Kasaragod, Government of Kerala appointed a committee in early 2001, which was chaired by Dr: Achuthan. The committee consisted of an Environmentalist, Agriculture Director and Pathology Professor of Medical Education Department. The committee collected evidence from Government Officers, experts, documents, local residents and submitted a detailed report to Government. It put forward the following recommendations:

1. To ban aerial spraying of pesticides in all cashew plantations in Kasaragod.
2. Rotation of various pesticides when used 3. Special medical care to the victims

As the above mentioned Committees had not gone in depth to the health hazards of Endosulphan in the area of PCK, a Committee with experts from related departments and Department of Health for the purpose by Government of Kerala as per the G.O.(Rt) No. 2090/2002/H&FWD. Dt. 04-09-02. Later the Committee was reconstituted with Public Health experts, experts of Agricultural Department and Pollution Control Board to study the issue in detail.

## GOVERNMENT OF KERALA

### Abstract

Suspected Health Hazard due to the use of Endosulphan in Kasaragod district -  
Constitution of Expert Committee to study the issue -  
Revised- Orders issued.

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HEALTH & FAMILY WELFARE (G) DEPARTMENT

G,O, (Rt) No. 58/2003/H&FWD.

Dated

Thiruvananthapuram. 06/01/2003

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Read:- 1. G.O. (Rt) N 2090/2002/H&FWD dated 4/9/02.

2. Letter No. PH2/5654/2001/DHS dated 01.10.2002 from the  
Additional Director of Health Services, Thiruvananthapuram.



## ORDER

In supersession of the orders issued in the Government Order read above Government are pleased to constitute the expert committee to study the adverse effect of Endosulfan in human being with the following members:

- |    |   |              |
|----|---|--------------|
| 1. | Dr. P.K. Sivaraman<br>Additional Director of Health Services (PH)   | Chairman     |
| 2. | Dr. Aysha Beegom. A<br>Epidemiologist, State Rapid Response Team,<br>Directorate of Health Services,<br>Thiruvananthapuram. | Co-ordinator |
| 3. | Dr. Valsala. L.S<br>Professor of Community Medicine,<br>Head of State PEID Cell, Medical College,<br>Thiruvananthapuram.    | Member       |
| 4. | Dr. Kalavathy. M.C<br>Lecturer in Cancer Epidemiology,<br>Regional Cancer Centre,<br>Thiruvananthapuram                     | Member       |
| 5. | Shri. K.V. Indulal,<br>Member Secretary,<br>Kerala State Pollution Control Board.   | Member       |
| 6. | Mr. K.K. Gangadharan,<br>Additional Director of Agriculture,<br>Directorate of Agriculture.                                 | Member       |

The Committee will study the issue, especially the following specific issues.

- a. Whether the use of Endosulphan is a health hazard to the human beings
- b. Whether the health related problems found in the areas are directly attributable to the use of Endosulphan
- c. What all corrective measures should be taken by the Health & Family Welfare Department to contain the health hazards if it is found that this pesticide is the cause of such health hazards.
- d. Other suggestions/ recommendations of the Committee relating to this subject. The committee will submit its recommendations within three months.

(BY ORDER OF THE GOVERNOR)

**G. Geetha**

Under Secretary

## REPORT OF VISIT OF THE COMMITTEE

The committee visited the affected areas of Kasaragod during 20th to 23rd of November 2002 and assessed the health implications. The following areas were visited and held discussions with the Key persons and stakeholders. The details are given below:

1. Dr. Harikrishnan DMOH, Kasaragod
2. M. Sunil Dath Technical Assistant, Kasaragod
3. Dr. Sumathi Ganesh and Field Workers PHC Muliyar
4. Dr. Mohammed & Field Workers PHC Mulleria
5. Dr. Sajeesh and Dr. Savithri Private Hospital, Mulleria Krishna Nursing Home, Mulleria
6. Mr. Santhosh (Manager) B. Ahamad, Supervisor Plantation Corporation Office, Mudalappara, Bhavikkara
7. Mr. Gopalakrishnan, K Mulleriya Panchayat Panchayat President
8. Dr. Ramanan & Dr. Kala Ramanan Private Hospital, Mulleria Krishna Maternity Home
9. Kunjiraman Moniyani Perla division of PCK  
19 workers and 2 Supervisors.
10. Dr. Vasanthi & Field Staff Vani Nagar, PHC
11. Field visit to Ward 6 & 7 with JPHN Smt. Jaya & Smt. Jayasree Vani Nagar, PHC
12. Head master & Staff of Govt. L.P. School (165 Students) Vani Nagar, PHC
13. High School section of Govt. High School (780 Students) Vani Nagar, PHC
14. Kusumam (Anganwadi teacher) & Anganwadi students Vani Nagar, PHC
15. House visits W 6 & W 7 - Vani Nagar.
16. Dr. Mohan Kumar, Kumars Clinic Private Hospital, Vani Nagar

- |  |                              |
|--|------------------------------|
| 17. Mr. Sarada. Y<br>Panchayat President | Enmakaje Panchayat           |
| 18. Dr. Iswar Naik,<br>Chattamchal PHC   | Medical Officer, Chattomchal |

Under the leadership of Dr. P.K. Sivaraman, the Chairman of the expert committee, four medical camps were conducted in the disputed area to assess the alleged health hazards due to 'Endosulphan. The Committee analysed the reports of the medical camps and hospital records from near by Primary Health Centres. All the scientific studies done in the area so far were reviewed in detail.

**Observations based on the discussions and visits**

Plantation Corporation of Kerala has 4696 hectares of Cashew Plantations in Kasaragod district. It is distributed in 3 sectors spread over 20 villages.

I. Kasaragod Plantations	
a. Muliyar division	367.86 hectares
b. Perla Division	783.14 hectares
c. Adhur division	749.00 hectares
d. Periya division	<u>290.00 hectares</u>
	<u>2190.00 hectares</u>
(II). Rajapuram Plantations	1526.00 hectares
(III). Cheemeni Plantations	980.00 hectares

Plantation Corporation had taken over this estate in 1999. Trial spraying was started in 1977-78. From 1981 PCK started regular spraying of Endosulphan two to three times a year.

## Details of Health Survey

### **1. Environmental and other related factors:**

Habitations were seen in and around the plantations. The plantation areas mostly situate on the hills and the people are living in the valleys and slopes. Many of the habitations are almost surrounded by the plantations except on one side. Water sources are seen in plenty in the plantation areas as well as border areas. One of the streams "Swarga" had its origin in the plantation hills itself. The Endosulphan contaminated water from the hills of the plantations were draining to the stream and nearby wells which are catering water to all the houses in the valley.

#### **Data received from PCK**

Division	Land	No. of houses		No. of wells	
		Inside	Outside	Inside	Outside
Kasaragod	2190	210	1593	174	1333
Rajapuram	1526	36	225	3	18
Cheemeni	980	46	208	46	208

#### **Details of the workers of PCK**

There are 160 workers in Kasaragod. 93 in Cheemeni and 158 in Rajapuram. Some of them stay in and around the plantations. Many of them were involved in the preparation and mixing of pesticides, without taking precautions. Some workers had skin problems, Lymphnode enlargement, Chronic asthma and history of Cancer deaths in their houses. There was no Medical Officer in the hospitals attached to PCK and they were not given the benefits of ESI Scheme. According to the workers there were no facilities for medical care whenever necessary or late permission for seeking medical care was also not permitted. Both the health centres attached to the PCK plantations remain closed. The workers never had any health precautions or regular medical check ups.

The committee could not find any technically qualified or skilled persons in the plantation staff. The workers were involved in mixing the insecticide, without the know-how to handle and prepare the solution. No masks or body protective devices were provided to the staff, who used to work even while spraying operations were taking place. The spraying operations were done continuously, not in the prescribed timings suitable for spraying. The helicopters were flying very high because of the other tall trees in the plantations, so that the pesticide sprayed reached

in far areas also. According to the Manager, only 2000 coconut leaves were used to cover the entire water sources of the area., which is quite insufficient.

Plantation Corporation of Kerala informed that mike announcements and pasting of notices were done in some of the Govt. offices two days prior to the spraying. But the people were not aware of the precautions and the importance of getting themselves protected. The information in the notices pasted were found to be unsatisfactory regarding the pre-, cautionary measures. Same pesticide Endosulphan was continuously used twice or thrice a year without any rotation continuously with other pesticides from 1981 to 2000.

## **2. PHC doctors and Private doctors**

Government doctors now working in the PHCs of areas were new recruits with limited experience in the Endosulphan issue. Field staff revealed that asthma, skin problems, mentally retarded children, repeated abortions and cancer cases were more in the affected area compared to the places where they had worked previously in other districts. Field staff working in Ward 6 and 7 of Vani Nagar said that there were clustering of cases of mental retardation , low IQ children, sterility, abortions and psychiatric illness in their area especially on the banks of the stream" Swarga" originating from the hills of PCK.

## **3. Field Visits**

During the field visit, human habitations were noticed in the valleys and down hill areas. Almost all water sources were connected to the stream or situated very close to it. We could see many artificially made earth excavated tanks, which were collecting water called from `Surangas' which is very peculiar to the area. The `Surangas' in many places were draining water from the plantations .

The committee visited the houses on the banks of the stream arising from `Swarga'. In all the houses visited, more than one affected member with mental retardation, epilepsy, stunted growth, "physical deformities, history of repeated abortions, psychiatric illness, sterility etc. were noticed. Such problems had resulted in many divorces due to social stigma in the affected area. Number of children were also found to be less in the families which was unusual to an area of such a social status. In their houses no elderly persons were noticed with similar diseases.

Paediatrician of a private hospital in Muliya, which was functioning since 12 years reported that he had seen more cases with blood cancer in children to the extent of one case per month. He used to refer these cases to higher centers in Karnataka and the follow-up was less since the patients didn't report back to him. So exact data on this could not be collected.

Dr. Mohan Kumar, who is a native of the area , practicing there for the past 20 years had practically visited the entire area. According to him, a total change in the pattern of diseases in the area now different from those he saw in early nineties. He reported that unlike his previous years of practice, more and more cases of epilepsies, mental retardation, stunted growth, birth defects, repeated abortions, infertility, cancer, congenital anomalies, chronic asthma, skin infections were more reported.

#### **4. School visits**

Among the 165 School children of Vani Nagar Lower Primary School, 6 children were with mental retardation , 2 with congenital anomalies, 7 children with poor study performance and more children with short stature. In the High School only two mentally retarded children were noted among 800 students. All the Anganwadi children examined were found to be normal.

#### **5. Interview with local people and workers**

People complained that while spraying many used to develop giddiness, head ache, respiratory problems, skin irritation etc. Fish, frogs, hens and chicken were found dead and while taking bath, workers noticed that dead fish in the ponds at the time of spraying.

#### **6. Other observations:**

Consumption of alcohol in the area was more and was noticed in the morning hours also. The team could see the sale of illicit liquor during the time of house visits. Arecanut was the main source of income. Chewing was extensively seen in all age groups. The committee could not see any vegetable shops in the affected area. People were using the locally grown vegetables and fruits. The existence of consanguinity was not noticed as a relevant factor.

#### **7. Review of Hospital records and Medical Camps**

Hospital records, and reports of medical camps were reviewed and no relevant information was obtained since the spraying was stopped 2 years back.

With all the above informations the committee reached in the following Conclusions.

1. There was clustering of cases of mental retardation, epilepsy, infertility and cancer cases in the banks of the stream "Swarga".
2. Affected cases were more reported in the families of Plantation workers .
3. All the above health problems were seen irrespective of the socio economic status.
4. The children of Lower Primary School were found to be more affected than the high school students.

5. Drinking water sources were wide and exposed, with more chance of contamination during spraying.

Since there was no definite data to show the high prevalence of above mentioned diseases and anomalies in the disputed area of Kasaragod, the committee suggested to conduct

(a) A household survey in the Endosulphan sprayed areas as well as in a control area to study the prevalence of listed diseases.

(b) Medical camps with specialists in the affected areas to o diagnose and treat and document the diseases.

## MEDICAL CAMPS

As per the recommendations of the expert committee Medical camps were conducted in the sprayed area of Kasaragod. A team of doctors of various specialities from Calicut Medical College, RCC Trivandrurn and Health department About 2000 people e were examined in the camps and treatment was prescribed.

## HEALTH SURVEY

The Committee felt the need for a detailed survey in the Endosulphan sprayed areas and in non sprayed areas to study the disputed health hazards. The survey was organized by District Medical Officer (Health), Kasaragod. Study and control areas were selected according to the criteria to the criteria mentioned and conducted the survey during January - February 2003. With the help of trained health staff , who were familiar with the area, and the Medical Officers of PHCs conducted the Survey within the time limit. Identified cases were confirmed by the Medical Officers of PHCs. Data was compiled and studied in detail. Congenital anomalies, Mental retardation, Cancers, Cases of Infertility, repeated abortions and growth retardation etc. were found to be more in the Endosulphan sprayed areas compared to non-sprayed areas.

### Details of Survey

House visits were conducted by trained health staff. Illness details of 80,275 persons were collected from the sprayed area and 80,281 persons from the non-sprayed area. The data is given below:-

SI No.	Disease	Sprayed area	Nonsprayed area
1.	Congenital Anomalies	95	70
2.	Mental Retardation	971	83
3.	Cancers	58	34
4.	Infertility	104	75
5.	Repeated abortions	22	72
6.	Growth retardation	25	11
7.	Movement disability	67	84
8.	Epilepsy	37	37
9.	Psychiatric problems	46	33
10.	Other problems	54	0



## **SPECIALIST MEDICAL CAMP**

After the Health Survey, a Specialist Medical Camp was conducted at the Government Higher Secondary School at Vani Nagar of Enrnakaje Panchayat on 15/03/03 for the opinion of Specialist doctor s. Patients were mobilized to the camps and 248 patients attended the camp.

### **Details of Specialist Medical Camp**

The specialists of the following Departments participated in the camp.

1. General Medicine
2. Neurology
3. Ophthalmology
4. Dermatology
5. Gynecology
6. E.N.T
7. Physical Medicine

### **Details of cases diagnosed in the camp are given below:**

1. Brain problems (Congenital & others)	27
2. Infectious diseases (TB & Respiratory infection)	10
3. Asthma & COPD	17
4. Paralysis & AFP	3
5. Skeletal problems	14
6. Eye problems	30
7. Skin problems	15
8. Anemia	10
9. Hypertension	6
10. Goitre	2
11. Infertility	4
12. Oral cancer	2
13. Heart disease	3
14. Diabetes	1
15. Gynaec problems	3
16. Other minor illness	59

Sitting of Medical Board was organized along with the Medical Camp and Medical Certificates were issued to the 42 disabled persons 66 persons with severe abnormalities were informed about the facilities in. the Rehabilitation Centres and advised to stay in these centers. DMO was entrusted to talke necessary action for same.

A team from Regional Cancer Centre, Thiruvananthapuram also attended the camp and examined the patients. The programme was organized jointly by the Panchayat and Health Department.

## CONCLUSION AND RECOMMENDATIONS

High levels of Endosulphan residue in the examined blood samples of school children of the dispute area shows the long term exposure of them to the pesticide. Ecological studies also showed high content of Endosulphan in soil, water and vegetations. It was evident that protective precautions were not followed for the workers, public in the surrounding areas and water sources by the Plantation Corporation of Kerala during spraying. So this might be the reason for more concentration of the Pesticide seen in the samples of blood, water, soil and vegetation examined in the laboratories by ICMR.

Vani Nagar area is situated in the valley surrounded by plantation hills, where the Plantation corporation of Kerala was undertaking continuous spraying operations. It is from the plantation hills sprayed with Endosulphan rain water gets drained into the water sources of Vani Nagar area. The people of the area are entirely dependent in this water sources and hence there is more chance for exposure to Endosulphan. This could be the reason for clustering of cases in the valleys surrounding the plantations.

Since the committee could not find out any other reason that could explain the health hazards in the area, this may be attributed to Aerial spraying of Endosulphan. Circumstances and finding of other relevant studies of various agencies also point to this casual relationship. The Govt. had issued orders to stop the aerial spraying of Endosulphan by PCK temporarily and declared pesticide holiday.

In view of the above findings and possibilities the committee put forward the following recommendations:

1. Permanent ban of Endosulphan aerial spraying
2. Enhancement and strengthening of Medical facilities in Government sector is required, especially in the affected area of Kasaragod. Mobile teams may be posted for medical camps in the affected area on regular basis periodically.
3. Suitable Rehabilitation measures for the handicapped may be initiated by LSG/ Government or jointly. Registration of handicapped at Panchayat level is recommended for providing social assistance.
4. Monitoring of the people for similar anomalies/fresh cases in the affected area by Health workers and timely reporting to District Medical Officer of Health is also required.
5. To make it mandatory by any pesticide user agency for establishing a system of periodic monitoring of
  - a. Health Status of Workers and Public.
  - b. Environmental Monitoring.
  - c. Monitoring for similar anomalies in future in the affected area.

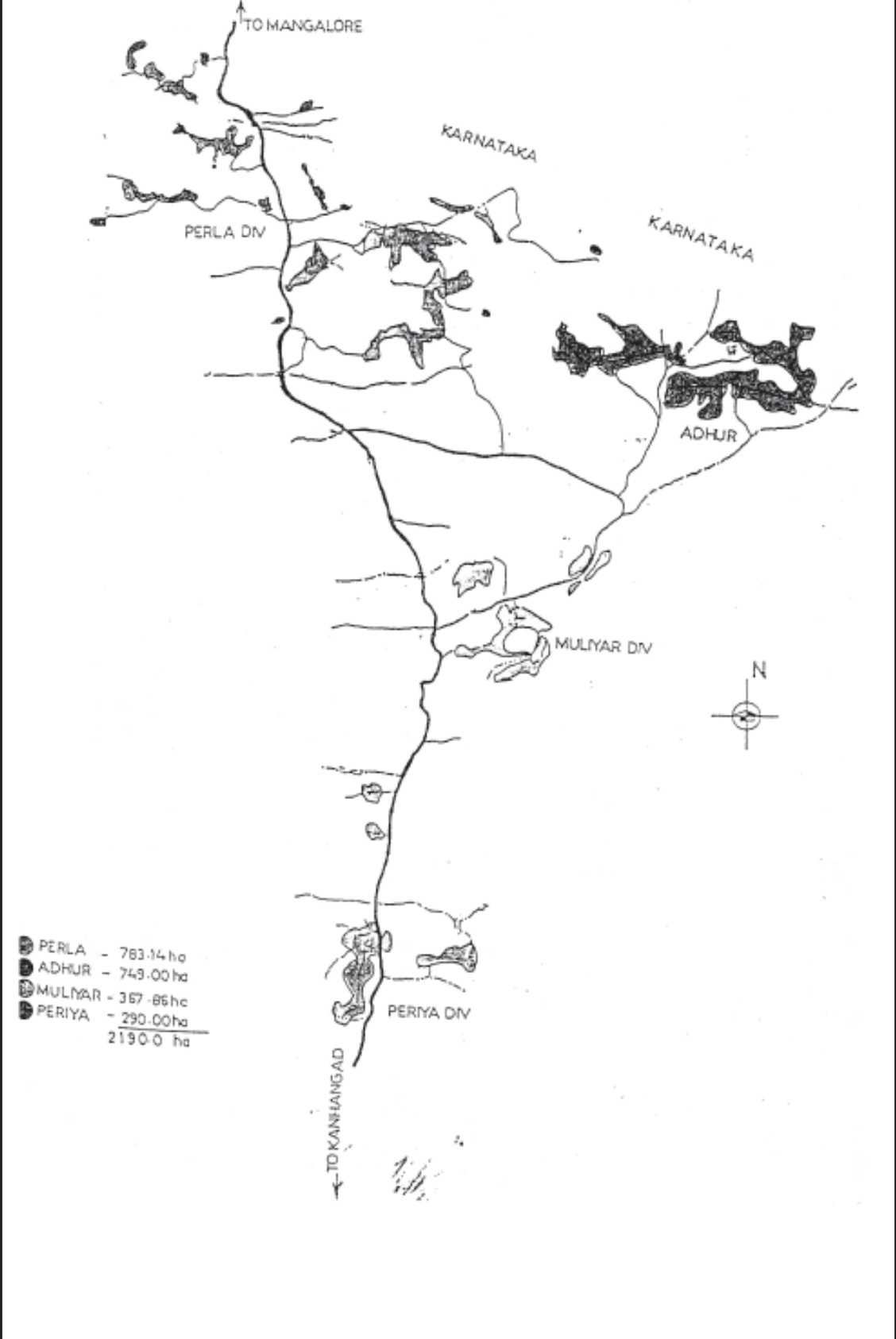
6. Integrated Pest Management Methods (IPMM) using botanical pesticides must be popularized. This can reduce the use of chemical pesticides.

7. Technical supervision must be strengthened whenever chemicals are used.

### **References**

1. Report submitted by the Committee constituted by Government of Kerala under the Chairmanship of Dr. A. Achuthan in 2001.
2. Report submitted by NIOH, (ICMR) Ahemadabad in 2002.
3. Report submitted by Kerala Agricultural University, under the Chairmanship of Dr. Abdul Salam.

THE PLANTATION CORPORATION OF KERALA LTD. KASARAKODE ESTATE.



**Consolidated figures of Health problems Identified in the endosulphan, Kasaragod**

Sl. No.	Name of Institution	Name of Panchayat	Population Covered	Congenital Anomalies	Mental Retardation	Cancer Site	Infertility	Repeated abortion	Growth Retardation	Movement Disability	Epilepsy	Psychiatric cases	Other Problems	Remarks
1.	PHC Perala	Enmakaje	5696	23	15	8	19	16	2	7	16	13	52	Nil
2.	PHC Mulleria	Karadka	12338	24	16	0	8	2	2	1	2	2	Nil	Nil
3.	PHC Muliya	Muliya	21100	4	12	2	4	1	3	5	4	6	2	
4.	PHC Periya	Pulloor, Periyar	9338	2										
5.	PHC Anandasram	Ajanur	9414	13	16	4	5	1		9	3	6		
6.	PHC Panathady	Kallar	8080	14	15	30	41	1	7	20	4	8		
7.	PHC Panathur	Panathady, Kayyur	3418	8	10	8	7		3	18	3	8		
8.	PHC Kayyur	Cheemeni	10891	7	13	6	20	1	8	7	5	3		
	<b>TOTAL</b>	<b>80275</b>	<b>95</b>	<b>97</b>	<b>58</b>	<b>104</b>	<b>22</b>	<b>25</b>	<b>67</b>	<b>37</b>	<b>46</b>	<b>54</b>		

Workers in endosulphan aerial sprayed area in the ...

Sl. No.	Name of Institution	Name of Panchayat	Population Covered	Congenital Anomalies	Mental Retardation	Cancer Site	Infertility	Repeated abortion	Growth Retardation	Movement Disability	Epilepsy	Psychiatric cases	Other Problems
1.	CHC Badiadha	Badiadka	6000	0	6	2	8		1	2		1	
2.	PHC Chengala	Chengala	12906	13	11	2	12		2	1,4	4	2	
3.	PHC Chattamchal	Chemnad	22204	19	12	8	8		3	1,6	4	9	12
4.	PHC Anandasram	Ajanur	11533	17	4	4	27			2,3	10	7	
5.	PHC Ajanur	Ajanur	6638	11	11	3	2		4	2	7		
6.	PHC Cheruvathur	Cheruvathur	10000	2	12	11	14	2		1,6	1	5	
7.	PHC Padna	Pillicode	11000	8	13	4	4		3	9	16	2	6
		<b>TOTAL</b>	<b>80281</b>	<b>70</b>	<b>83</b>	<b>34</b>	<b>75</b>	<b>2</b>	<b>11</b>	<b>8,4</b>	<b>37</b>	<b>33</b>	<b>18</b>

## REGULATORY STATUS OF ENDOSULPHAN

Philippines, there was a long battle between the Government and the manufacturers (Hoecht) regarding the banning of Endosulfan. In 1990, the use of Endosulfan 35% was banned, but endosulfan 5% was allowed to be used under controlled conditions. The manufacturers started legal action against this and got the order quashed. In 1993, the ban was again implemented. Though legal action was initiated, the ban was confirmed in 1994, but exemption was given for pineapple farms. The other countries where partial or complete ban is in force are Denmark, Germany, Netherlands, Sweden, Belize, Singapore, Brazilian State of Rondonia. Its use in rice fields is not allowed in Bangladesh, Indonesia, Korea and Thailand. Its use is severely restricted in Canada, Finland, U.K., Kuwait, Philippines, Thailand.

Continent	Banned in in	Severely restricted in
Asia	Tonga  Syria	Indonesia (banned in rice fields) Korea (do) Bangladesh (do) Philippines (allowed only for pine apple) UK Japan Khaskistan Kuwait Lithuania Sri Lanka Thaiwan
Europe	Germany  Sweden	Denmark Ugoslavia Netherlands Norway Finland Russia
South America	Brazilian State of Rondonia	Kenezuela
North America	US	Canada

But Endosulfan is still in use in about 60 countries including USA, Australia, Japan, France, Israel and Korea. It is reported that the global insumption of Endosulphan

formulations is of the order of 50 million acres The consumption in India is about 10 million litres.

### **FAO/WHO REGULATIONS**

Endosulfan was registered in India in 1965 along with several other pesticides based on the data on toxicological and environmental effects generated world over and as approved by the Codex Alimentarius commission of the FAO / WHO. Toxicological and environmental behavioural data generated subsequently on the pesticide was reviewed by the Joint Meeting of the FAO Panel of Experts on Pesticide residues in food and the Environment and the WHO Core Assessment Group in 1989 and later in 1998.

In the 1998 meeting the joint committee examined the effects of the pesticide under the following heads.

1. Acute toxicity

1. Short term toxicity (mice, rats)

2. Long term studies of toxicity and carcinogenicity (mice, rats, dogs)

3. Genotoxicity (mice)

4. Multi generation reproductive toxicity (rats)

5. Development toxicity (rats, rabbits)

6. Enzyme induction (mice)

7. Promotion (rats)

8. Immune toxicity (rats)

9. Neuro behavioural effects and neuro toxicity.

10. Effects on sperm

12. Endocrine effects.



## **Recommendations in the report submitted by Kerala Agricultural University, under the Chairmanship of Dr. Abdul Salam.**

1. From the short visit made and information gathered it is difficult to make any conclusion either in favour or against the argument that endosulphan causes health problems. In view of the above it is essential that a multi-disciplinary expert group (medical, agricultural, environmental scientists) investigates on the various aspects of the health and environment related problems of the area.
2. In view of the topographical disadvantages and high degree of inhabitation in the adjoining areas of cashew plantations, the Government may be requested to stop PCK from the aerial spraying in this area with immediate effect. The Director, NRCC Puthur has indicated this view as well.
3. The PCK should be advised to rationalize the plant protection operations in cashew on more scientific grounds. The current practice of scheduled spraying should be replaced with a need based application following insecticide rotation.
4. During the last year the country earned foreign exchange to the tune of Rs. 2500 Crores through the export of cashew kernels. If the present level of propoganda regarding the use of pesticide on an export crop like cashew is aired internationally, it may drastically damage the export prospects of cashew. This ultimately will affect the farmer himself.
5. Necessary technical and financial sanctions may kindly be accorded to the Heads of AMPRS, Odakkali and AICRP on Pesticide Residues Laboratory, College of Agriculture Vellayani to complete the analysis of environmental samples collected on a time bound basis.

**REPORT OF THE COMMITTEE TO STUDY AND ANALYSE THE EFFECT OF AERIAL SPRAYING OF ENDOSULPHAN IN THE CASHEW PLANTATION OF PLANTATION CORPORATION OF KERALA A LTD. IN KASARAGODE DISTRICT, GOVERNMENT OF KERALA, NOVEMBER 2001.**

**CONCLUSIONS & RECOMMENDATIONS**

After a detailed study of the data, and the oral and written statements and site visits, the Committee has arrived at the following conclusions.

1. The Cashew Plantations of PCK Ltd. in Kasaragode District are all located in undulating hilly areas. The plantations are spread in isolated patches and are intertwined with habitations. The typography of the area precludes the possibility of aerial spraying observing all the protocols.
2. There are a large number of wells inside and just outside the plantations area. Several streams originate there. The water from the plantations (situated on the hills) can run off into the valleys inhabited by local people. The rivulets Panathur and Karicheri, which are fed by streams originating from or passing through the area, are tributaries of Chandragiri river, which supplies drinking water to Kasaragode town and several Panchayats. The surangams, from which the local people draw water, are cut deep into the hills forming the plantations. They are prone to contamination by chemicals applied in the estates. Therefore, the hydrology and morphology of the area are unsuited for aerial spraying.
3. The human settlement pattern of the area also make the plantation area unsuitable for aerial spraying. The adjoining areas are thickly populated. There are large number of houses inside the plantations. There are pockets of human settlement surrounded on 3 sides by the plantations. There are large number of houses and wells inside and just outside the plantations. The local people allow their cattle to freely graze in the plantation area. There are several schools inside and just outside the plantation area.

Even the Pesticide Manufacturers and Formulators Association have agreed to the view that the area is not ideal for aerial spraying of pesticides.

4. The PCK has not been following the rules prescribed for aerial spraying. This has been reported by the District Collector, all the plantation owners of the Panchayats who deposed before the Committee, the experts and the great majority of general public. There was no effective supervision of spraying and no monitoring of the precautionary measures and the after-effects.

5. The same pesticide endosulfan was used continuously from 1981 onwards, in spite of the recommendations of Research organizations to rotate the chemicals. The reason given by the PCK is that endosulfan is the most economical pesticide available in the market. Even the possibility of the bugs acquiring immunity to endosulfan due to long exposure has not been considered by the PCK.

6. As in the cases of most other pesticides, endosulfan can cause acute toxicity in animals and human beings due to over exposure. That is why strict protocol is prescribed for its use. Though chronic toxicity due to long term exposure has not been convincingly established, it cannot be ruled out.

7. There are reports of health problems in three Panchayats adjacent to the plantations. There is no direct evidence to attribute these directly to endosulfan pollution, but there is no evidence to completely deny it. Other usual causes like pollution from automobiles and industries are absent here. The only activity that is not normal is the aerial spraying of endosulfan. The Pesticide is applied without observing the safety rules. The same chemical is used for 2 decades. Hence at this point of time, there is no evidence to implicate or exonerate endosulfan as the causative factor of the health problems. But, the proof of absence cannot be taken as the absence of proof. In all environmental pollution problems, the onus of responsibility to prove or disprove the cause-effect relationship should be that of the polluter and not of the general public who are the victims of pollution. Since cashew is an important export item earning revenue to the State and a large number of workers are involved in it, publicity to the pollution from endosulfan spray can prove detrimental to the industry.

On the basis of the investigations and the above conclusions, the Committee recommends the following measures to be adopted.

1. Ban aerial spraying of pesticides in all the cashew plantations of PCL Ltd. in Kasaragode District.
2. Use of Endosulfan in the PCK plantations of Kasaragode District should be frozen for 5 years.

In the Cashew plantations in the Perla Division (which includes Enmakaje Panchayat), a total pesticide holiday should be observed for years. This plantation should be left to the nature during these 5 years. Detailed studies on tea-mosquito bug menace and its relation to the crop productivity should be made during this period.

In the other plantations of PCK in Kasaragode district, need based ground spraying, (manual or power-operated) of pesticides other than endosulfan may be resorted to in consultation with research organisations.

The pesticide management and plant protection of PCK should be scientifically organized.

Research efforts to evolve integrated pest management (IPM) should be augmented.

Breeding programme to develop cashew strains resistant to tea mosquito bug should be undertaken.

Since the cause of the human health problem could not be deduced conclusively, a detailed investigation involving scientists from all related fields should be conducted to identify the risk factors for the high morbidity in the Padre village and other affected areas. A detailed health survey should be conducted in the Padre village and other areas from which cases of abnormal health problems are reported. The health survey should cover the plantation workers also.

Since most of the people who complain about health problems are from the poorer sections of the community, the Government should make arrangements to provide special medical care to these persons.

The Government should take all steps to implement these recommendations and dispel the fears regarding pesticide application.

The right to information on the use of pesticides should be respected.

The Grama Panchayats should be given all details, when requested. The apprehensions of the local people regarding the alleged pesticide problem could be cleared by awareness programmes conducted through PCK, Agricultural Department and Research institutions. In every division of the PCK, a committee consisting of the following members should be constituted for monitoring the proper application of pesticide.

1. President / Presidents of the concerned Grama Panchayat Panchayats
2. Agricultural Assistant
3. A representative of the Health Department
4. The Regional Officer of PCK.
5. A representatives of the workers of the concerned division of the PCK.

## **REPORT OF THE INVESTIGATION OF UNUSUAL ILLNESS ALLEGEDLY PRODUCED BY ENDOSULPHAN EXPOSURE IN PADRE VILLAGE OF ASARAGODE (NORTH KERALA) 1st REPORT, NATIONAL INSTITUTE OF OCCUPATIONAL HEALTH, ICMR, AHAMADABAD.**

### **CONCLUSIONS**

Presence of Endosulphan residues: Endosulphan residues have been detected in water samples as well as blood samples in the exposed area. Padre village. Alpha, Beta Endosulphan and Endosulphan Sulphate have different half-lives in different media. The detection of endosulphan the blood samples of children and water samples, 10 months after the last aerial spray of endosulphan, signifies a source of continuous exposure to endosulphan. Villagers living in Padre village use well water Surunga water as source of drinking water and use even the water from Kodenkiri stream for washing and other purposes as there is no piped water supply in the area. The cashew plantation as continuous source for endosulphan is further supported by the report of the RRSSC which has indicated that the villages are located in the micro-watershed that have steep slopes, nearly circular in shape, high runoff potential with predominantly cash crops. It was also concluded from the available data by RRSSC watershed characteristics are favorable for any, aerially sprayed toxicant to reach the soil-water-plant continuum in a very short span -off time and get accumulated.

### **MEDICAL FINDINGS**

Congenital malformations: Significantly higher prevalence of congenital malformations in the exposed group points to the exposure of this group to some genotoxic agent, which in the present study could be endosulfan. However, there is a need to confirm suspected cases of congenital heart diseases through further investigations such as echocardiography.

Neurological Problems:- School Children from the exposed area demonstrated a significantly higher prevalence of learning disabilities. Low IQ and scholastic backwardness further confirmed by higher rate of failures in this group. These functional abnormalities of the nervous system again signify exposure to some neurotoxic agent during developmental stages. Exposure to endosulfan in utero could be responsible for these abnormalities. The prevalence of other disorders such as epilepsy was not found to be different in the two groups. Severe neurological disorders such as cerebral palsy could not be detected in the school children. This may be due to the fact that such children would be able to attend school. Analysis and comparison of the family data would be a better indicator of crippling diseases.

Abnormalities of Re-productive System: - Though SMR could be carried out in limited number of exposed and control children, the findings are very striking and point to exposure to an Endocrine disruptor. The girls from exposed area attained menarche early, which was further confirmed by higher age related skin fold thickness in this group. Among boys on the other hand puberty was delayed in the exposed group as evidenced by lower SMR scores in this group as compared to the control group.

Since the exposed and control group of boys and girls are comparable in their nutritional status, these abnormalities signify exposure to estrogenic substances and endosulfan is experimentally shown to have estrogenic effects. Analysis of blood samples for reproductive hormones may provide further evidence and is under way.

Other diseases: No significant difference was observed in the prevalence of bronchial asthma, skin allergies or seizure disorders.

However, there was higher prevalence of goitre and past history of jaundice in the exposed group.

#### **Limitations of the Study:**

1. The study is limited to school children and all the children in Vani Nagar school may not come from the affected areas where Endosulfan spray has been carried out.

2. The study is limited to a defined age group. Some of the cases reported by Dr. Mohan Kumar, e.g. Cancers, Sterility among adults can not be detected in this age group. However, when the family proformas are analysed, these problems may be partly solved.

3. Children suffering from disabling diseases may not be able to attend school and therefore their ailments are not reflected in the present study.

#### **Future Plan of Work:**

1. The data of families of children from exposed and control areas will be analysed.

2. All environmental and biological samples will be analysed for endosulfan residues. The serum samples will be analysed for hormonal changes. The results of the above will be submitted after three months.

#### **Recommendations:**

1. All kinds of pesticide spray should be immediately stopped in the Cashew Plantation area of Kasaragod district. All methods of pest control other than chemical pesticides should be explored.

2. Extensive epidemiological studies in the areas where endosulphan has been sprayed should be carried out to investigate occurrence of illnesses similar to those reported in Padre village.

There is a need for investigating the effects of endosulphan spray on ecosystems in the exposed areas, especially the streams, rivulets all (ponds.

Endosulfan residues should be estimated in water, and agriculture produce of the area such as food grains, cashew nuts, arcca nuts, pepper, vegetables, fruits, fish, milk etc.

Epidemiological survey among cattle in the area should be made by animal husbandry department of the State Government.

There should be regular monitoring of the exposed population.

The affected persons should be provided relief.

Finally, we request the Commission to take note of the recommendations of Achuthan Committee appointed by Government of Kerala.