

Government of Kerala

**REPORT OF
THE COMMITTEE TO STUDY AND ANALYSE THE
EFFECTS OF AERIAL SPRAY OF LINDOSULFAN
IN THE CASHEW PLANTATIONS OF PCK LTD.
IN KASARAGOD DISTRICT**

November 2001

SUMMARY

The Plantation Corporation of Kerala Ltd. (PCK) has been resorting to aerial spraying of the pesticide endosulfan for about 2 decades, 2 to 3 times an year, in 4696 ha. of cashew plantation owned by it in Kasaragod district of Kerala for the control of tea-mosquito bug. From 1979, there have been press reports on health abnormalities in the region adjoining the plantation. From 1998, there were isolated protests against the spraying of endosulfan. Protests gathered momentum after the latest spraying in Dec. 2000 and the media began highlighting the problem. The Government of Kerala received several representations regarding the pollution caused by the spraying of endosulfan in the cashew plantations of PCK Ltd. in Kasaragod District. Consequently, the government appointed a Committee to undertake a 'detailed study and scientific analysis on the effects of endosulfan on human population and environmental pollution'.

The Committee visited the plantations, took evidence from Government officers, experts, institutions, organizations and individuals who are concerned with the problem. The Committee analyzed all the available data.

The Committee came to the following conclusions:

1. The undulating nature of the land and the presence of large number of water bodies and human habitation in and near the plantations make the area unsuitable for aerial spraying of pesticides.
2. The protocol for aerial spraying of pesticides was not strictly followed by the PCK.
3. The same pesticide was repeatedly used for about 2 decades against the recommended practice of rotating different pesticides.
4. There was no arrangement to see whether the protocol was followed and to monitor the effects of spraying.
5. There is widespread complaint among the local people about the aerial spraying of endosulfan.

The Committee recommends the following measures to be adopted.

1. Ban aerial spraying of pesticides in all the cashew plantations of PCK Ltd. in Kasaragod District.

2. Since continuous use of any pesticide is not recommended by research organizations, use of endosulfan, which has been applied continuously for about 2 decades, should be frozen for 5 years in the cashew plantations of PCK Ltd in Kasaragod district.
3. Enforce a pesticide holiday for 5 years in the Peria Division of the PCK plantations (783.14 ha.). These plantations should be left to nature. The degree of tea-mosquito bug infestation and the productivity should be strictly monitored during these years.
4. The question of resorting to need-based manual or ground level power-operated spraying of pesticide in the other plantations of PCK should be decided in consultation with the cashew research organizations like the Kerala Agricultural University and the National Research Center for Cashew, Puttur.
5. The plant protection and pesticide management of the PCK Ltd. are unscientific and unsatisfactory. These are to be rationalized on sound scientific basis, on the advice of research organizations.
6. Research efforts to evolve integrated pest-management should be augmented.
7. Breeding programs to develop cashew varieties resistant to tea-mosquito bug infestation should be undertaken.
8. Since the factors leading to the high morbidity rate in Padre village of Enmakaje Panchayath and other areas adjoining the cashew plantations of PCK Ltd. in Kasaragod District, could not be established through this short study, a detailed investigation involving scientists from different disciplines and organizations should be conducted.
9. Since most of the people in the area near the plantations, who complain about health problem, are from the poor sections of the society, the Government should make arrangements to provide special medical care to them.
10. Since cashew is an important export commodity item earning revenue to the State, undue publicity to the problem will be detrimental to the interests of the state. There should be transparency in the pest-control measures adopted by PCK Ltd. and other agencies managing cashew plantations. There should be strict technical supervision for all pest control measures besides the monitoring of their effects on the environment.
11. The apprehensions of the local people should be cleared by making them aware of all aspects of the problem.

CONTENTS

	Page
SUMMARY	3
1. BACKGROUND	5
2. ENDOSULFAN	8
3. CASHEW PLANTATIONS OF PCK	22
4. INVESTIGATIONS BY THE COMMITTEE	25
5. CRITICAL ANALYSIS OF THE DATA	26
6. ANALYSIS OF THE WRITTEN & ORAL DEPOSITIONS	32
7. CONCLUSION & RECOMMENDATIONS	47
ANNEXURES	51

ACKNOWLEDGMENT

The Committee acknowledges the unstinted cooperation that has been received from the Government Departments, Research Organisations, the Kasaragod Dist. Panchayath, the Gram Panchayaths in the area, N.G.Os, experts and the general public in conducting the study and places on record its sincere thanks to all of them.

LIST OF ANNEXURES

1. Copy of press cutting "Handicapped Calves : Curse or Insecticide?" from Sudha, Kannada Weekly, dt. 30 Sep. 1979.
2. Copy of press cutting from Udayavani "Aerial Spray of Pesticide : Why this Negligence" Kannada daily, dt. 24 Nov. 1981.
3. Copy of press cutting from the "Evidence Weekly", Dec. 25, 1981.
4. Copy of "Correspondence for communication" from Dr. Mohankumar Y.S, published in Kerala Med. Journal, Feb. 1997.
5. Letter dt. Jan. 16, 2001 from Sri. Y. Aravindan to the Director of Agriculture.
6. Letter dt. 21 Jan. 2001 from the Secretary, Enmakaje Panchayath, Addressed to the Agr. Secretary, Govt. of Kerala.
7. Copy of letter dt. 07 Feb. 2001 from Director, Directorate of Cashew nut and Cocoa Development, Cochin addressed to the Director of Agriculture.
8. Copy of G.O. (Rt) No. 353/2001/AD dt. 23-02-2001.
9. Copy of letter No. F.P.A/(Aerial Spray - PCK) 2001 dated 8 March 2001, addressed to Directorate of Cocoa and Cashew Development.
10. Copy of letter No. F.P.A (Aerial Spray - PCK)/2001/08 March 2001, addressed to Directorate of all Cashew Research Stations.
11. Copy of G.O. (Rt) No. 1322/2001/AD/25-08-2001.
12. Copy of Proceedings of the Dist. Collector, Kasaragod, dt. 17-02-2001.
13. Copy of letter No. F.P.A. (Tech. Adv.) 97 dt. 26-12-2977 from Director, NRCC to PCK
14. Copy of notice issued by PCK.
15. List of organisations and others who deposed before the Committee.
16. Copy of letter dt. 11-09-2001 from Director, Centre for Science and Environment, New Delhi.
17. Copy of letter dt. 11-10-2001 from Director, NIOH, Ahmedabad.

1. BACKGROUND

The Plantation Corporation Kerala Ltd. (PCK) has been resorting to aerial spraying of the pesticide endosulfan 2 to 3 times a year for about 2 decades in its cashew plantations spread over 20 villages in the Kasaragod district of Kerala State. Several health problems are reported from the areas adjoining the plantations, especially from the Padre village of Enmakaje Panchayath. The reported health problems include headache, dizziness, nausea, skin lesions, birth abnormalities, epilepsy, cerebral palsy, mental retardation, infertility and several endocrine disorders. Reports of alleged endosulfan poisoning have begun to appear in newspapers from 1979 (Annexures 1, 2 and 3). A reference on the abnormal health problems in Padre village appeared in Kerala Medical Journal in Feb. 97 (Annexure 4). In Dec. 2000, there were agitations by the local people against the aerial spraying in Muliyar Panchayath. In February 2001, an extensive report appeared in the journal "Down to Earth", published by the Society for Environmental Communication (SEC) from New Delhi (Sopan Joshi : Children of Endosulfan - Down to Earth, New Delhi. Feb. 28, 2001, Vol. No. 19), alleging endosulfan to be the cause for the abnormal health problems in the area. The Government of Kerala received several complaints on the matter (Annexures 5, 6). The Government also received a communication dated 07-02-2001 from the Directorate of Cashew nut & Cocoa Development drawing the attention of the Director of Agriculture to the letter F. PA 9 TECH ADV. 2001 dt. 25-01-2001 of the Director of National Research Centre for Cashew (NRCC), which contained a request to stop aerial spraying till conclusive evidence on the safety of endosulfan is confirmed (Annexure 07). The Hon. Minister for Agriculture announced in the Kerala Legislative Assembly that a committee is being appointed to study the problem and suggest remedial measures.

The Committee was constituted through G.O. (Rt.) No. 353/2001/AD dt. 23-02-2001 (Annexure 8) with the following members.

1. Dr. A. Achyuthan, Environmentalist, Bilathikulam,
Calicut - 673 006. (Chairman)
2. Sri. L. Sundaresan, Director of Agriculture (Convener)

2. Dr. K.P. Aravindan
Associate Professor,
Dept. of Pathology
Govt. Medical College,
Calicut - 673 008
Member
3. Dr. M. Abdul Salam
Associate Professor & Head,
Cashew Research Station,
Kerala Agricultural University
Madakkathra, Thrissur
Member
4. Dr. Samuel Mathew
Associate Professor,
A.M.P.R.S.,
Kerala Agricultural University,
Odakkali, Ernakulam Dist.
Member

The Committee had its first meeting on 27-04-2001. The details of the meetings of the Committee are given in Table 01.

TABLE 01 - MEETINGS OF THE COMMITTEE

No	Date	Place	Business transacted
1	27.4.01	Madakkathra, (Cashew Research Station, KAU)	Preparation of the draft of terms of reference.
2	20.8.01	Kasaragode, CPCRI Guest House)	Finalised the schedule of action. Visited the plantations. Discussions with Dr. Y. Mohankumar, Dr. Sreepathy, Sri. Sreepadre. Visited the H.S. School at Vaninagar.
3	5.9.01	Kasaragod (District Panchayath Hall)	Hearing-Government officers, Functionaries of District Panchayath and Gram Panchayaths and PCK Ltd.

4	6.9.01	Kasaragod (PWD Rest house)	Hearing - Pesticide Manufacturers & Formulators Asso. (PMFA). The other hearings scheduled for that day were postponed because of hartal in Kasaragod Taluk.
5	21.9.01	Kasaragod	Field visits of the Plantations
6	22.9.01	Kasaragod (District Panchayath Hall)	Hearing - Research Organisations, NGO's, public, workers of PCK.
7	13.10.01	Calicut (Directorate of Arecanut & Spices Development)	Discussion of the draft report
8	18.11.01	KAU, CRS, Madakkathara	Discussion of the draft report
9	22.11.01	KAU, CRS, Madakkathara	Finalisation of the report

In the meantime, the National Research Centre for Cashew (NRCC) decided to withdraw the recommendation of endosulfan for use in cashew cultivation (Annexure 09). The Director, NRCC requested all cashew research stations to "kindly refrain from recommending endosulfan spray for the control of pests in cashew forthwith" (Annexure 10). In Aug. 2001. The Government of Kerala ordered that "the use of the insecticide endosulfan in crops/plantations in Kerala is suspended until further orders" (Annexure 11). The National Human Rights Commission (NHRC) has asked the Director of Indian Council of Medical Research (ICMR) to study the effects of endosulfan on human population in Padre village. This study is being done systematically by the National Institute of Occupational Health, Ahmedabad (Annexure 17). Studies have also been conducted by the Kerala Agricultural University (KAU) and the State Committee on Science, Technology & Environment (STEC).

This Committee has taken into consideration all available data from the above studies before finalizing this report. The members of the Committee visited the plantations, held discussions with local people, received oral and written depositions from government officers, representatives of PCK and PMFA, research organizations, functionaries of the Dist. Panchayath and Gram Panchayath, NGO's and the general public. All the available data were analyzed and discussed and based on these, the report was finalized.

2 . ENDOSULFAN

History

The use of synthetic chemicals for pest control in agriculture has been projected as safe and as one without serious adverse impacts on the environment. The immediate economic benefits often prompted the users to ignore the warning signals. But of late, the hazardous nature of several synthetic chemicals has been discussed at length. In May this year, the UNEP has taken the lead to get a protocol banning 12 persistent organic pollutants (POP) signed by more than 120 nations. Endosulfan is not included in the list of banned POPs.

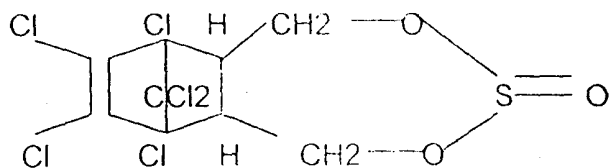
Endosulfan was made available in most of the countries from 1950.

Chemical Properties

Endosulfan formulations are marketed in several trade names like Thiodan, Endocel Acmaron, Endotex, Agrosulfan etc. It is an organochloride insecticide and acaricide. It acts as a contact poison in a wide variety of insects and mites. The reported chemical properties are given below :

Chemical name : 6,7,8,9,10,10 - hexachloro - 1,5,5a,6,9,9a hexahydro - 6,9 - methano - 2,4,3 - benzodioxathiepin - 3 - oxide

Structural formula : $C_9H_6Cl_6O_3S$



Colour	:	Cream to brown
Smell	:	Like that of turpentine
Alpha to beta isomer ratio	:	70 to 30
Solubility	:	Virtually insoluble in water

Mode of action	:	Through contact, digestive system and respiratory system
Half life	:	7 to 50 days
LD 50 for rats	:	Oral 110mg/kg body weight Dermal 74-130mg/kg body weight

The Commercial endosulfan contains two isomers alpha and beta in the ratio of 70 to 30. The alpha-isomer is more toxic, the while beta-isomer is more stable and persistent. In the presence of oxygen, endosulfan will be oxidised forming endosulfan sulfate. Photo degeneration is fast (in 4 weeks). This break-down product, endosulfan sulfate, is more persistent than the parent compound and accounts for around 90% residue in 11 weeks. Sulfate formation increases as temperature increases (EXTOXNET, Endosulfan Data Sheet, Extoxnet, Ithaca, NY, U.S.A, Oct. 1992). The half life in water and in many fruits and vegetables is 3 to 7 days (Ghadiri H, et al - "Controlled Env. Study of the Degradation of E.S in Soils" in Challenging the Future - Proc. of World Cotton Res. Conf. Brisbane, 1994 & 95). In strong alkaline conditions, it degrades very fast (half life - 1 day). In contact with acids, endosulfan gets hydrolysed forming endosulfan diol and sulphur dioxide.

General Characteristics and Toxicity

Endosulfan was originally classified under cyclodienes. The other pesticides of this group namely aldrin, dieldrin, chlordane, heptachlor and endrin are banned in India due to high toxicity and long persistence. Many countries are phasing out these chemicals in accordance with UNEP convention resolution passed in May 2000. However, endosulfan is chemically unique by the presence of a sulphurous acid bridge attached to the hexachloro aromatic ring. The presence of this sulfurous acid bridge makes the molecule vulnerable to chemical and enzymatic degradation. All the degradation products of endosulfan are formed as a result of cleavage at this point. Because of this peculiar chemical nature of endosulfan, in the latest classification by the IUPAC and the WHO, it is classified as sulfurous acid ester of chlorinated cyclic diol.

Endosulfan is chemically close to dieldrin. The other well-known chemicals in cyclodiene sub-group are aldrin, endrin, dieldrin, heptachol and chlordane. All these except endosulfan are banned in India and are being phased out by many countries in step with UNEP convention resolution passed in May 2000.

Endosulfan is reported to be highly toxic to animals exposed to it. Alpha endosulfan residues have been detected in liver and brain tissues in rabbits, which died due to active exposure (Quijano R.P: "Applying the Precautionary Principles in the Risk Assessment of Pesticides", E.S. case study, Int. Jour. of Occupational Eng. Health, Vol. 06, No. 4, Oct. - Dec. 2000). Rueber has shown that endosulfan was carcinogenic in male and female rats (PNAP - E.S data sheet - Pesticide Action Network Asia & Pacific, Penang, June 1996).

Short-Term Toxicity

The W.H.O. has classified endosulfan in category II (moderately hazardous based mainly on the LD 50 value taken from the manufacturer - generated acute toxicity data (ATSDR - E.S. data sheet - Agency for Toxic substances & Disease Registry, P.H. Service, U.S Dept. of Health & Human Science, U.S.A, Sep. 1995). But the U.S. Env. Protection Agency (EPA) classifieds it as category 1 b (highly hazardous) (PNAP, June 1996). Short-term toxicity has been reported to be high and influenced by the solvents and emulsifiers used to dissolve it. Endosulfan is absorbed from the stomach, through the lungs and through the skin which means that all the 3 routes of exposure can cause hazard. Proper protective clothing including long sleeve shirts long pants, gloves, safety goggles and respirator are recommended while handling the chemical. Acute toxicity stimulation of the CNS is said to be main characteristic of endosulfan poisoning. Effects of acute exposure include hyperactivity, tremors, decreased respiration, salivation, anaemia and lack of coordination (Endosulfan Data sheet, Exttoxnet, Ithaca, NY, Oct. 1992). Other signs are vomiting, diarrhoea, convulsions. People with low protein diets are more sensitive to the effects.

Chronic Effects

Very few studies have been reported on the long-term toxicity of endosulfan. Studies on animals have indicated that endosulfan may cause adverse effects on the immune system even at low levels of exposure (ATSDR - 1995). Endosulfan has been reported to cause mutations in animals (PNAP 1996). Endosulfan can cause chronic health problems and genotoxicity at least in animals. Acceptable daily intake of endosulfan for human being is 0.006mg/kg of body weight.

Limited information is available regarding the effects of endosulfan on the human immune system. However, specially designed studies using rats indicate that both humoral and cellular immune responses are depressed by ingested endosulfan at doses that do not induce any overt signs of toxicity (Banerjee BD, Hussain QZ. 1986. Arch Toxicol 59:279-284). In vitro studies support the possibility that endosulfan affects immune system function (Das N et al Curr Sci 57:524-526). These results demonstrate that immunotoxicity may be a more sensitive end point of endosulfan-induced toxicity than other end points, and humans may be at risk for adverse immune effects following exposure to endosulfan.

Reproductive Toxicity

No information is available on humans to indicate that endosulfan affects reproductive function. Studies have reported that oral endosulfan had no effect on reproductive performance in rats (Dikshith et al. Ind Health 22:295-304). At higher doses than those used in these studies, adverse effects on the testes were observed in male rats that ingested endosulfan, but no assessment of reproductive performance was made (Gupta and Gupta. Toxicology 7:283-288). More recent studies that looked at possible effects of endosulfan on spermatogenesis found reduced sperm counts and sperm abnormalities in rats and mice in intermediate-duration studies (Khan and Sinha 1996 Mutagenesis 11(1):33-36). Testicular atrophy was observed in rats treated with relatively high doses of endosulfan in the diet for up to 82 weeks (NCI 1978 Technical Report Series No. 62).

Genotoxicity

No reliable data on humans exist to indicate whether endosulfan may act by a genotoxic mechanism. The results from available in vivo animal studies and in vitro studies are mixed, but generally provide evidence that this compound is mutagenic, clastogenic, and induces effects on cell cycle kinetics in two different mammalian species (Dikshith et al. 1978 Indian J Exp Biol 16:1000-1002; Dorough et al. 1978 Pesticide Biochemistry Physiology 8:241-252; Dubois et al. 1996 Environmental Toxicology and Pharmacology 1(4):249-256; Dzwonkowska and Hubner 1986 Arch Toxicol 58:152-156; Usha Rani and Reddy 1986 IRCS J Med Sci 14:1125-1126; Velazquez et al. 1984 Mutat Res 136:115-118). Recently Chaudhuri et al showed genotoxic effects of endosulfan in bacterial systems. (Mutat Res 1999;439(1):63-7). Popov et al reported that endosulfan caused

embryonic death, teratogenesis, and inhibited embryonic growth in rats. (Ontogenez 1998;29(2):104-12).

Carcinogenicity

No studies are available regarding cancer in humans after oral exposure to endosulfan.

Carcinogenicity in rats was first assayed in Osborne-Mendel rats by NCI (1978 Technical Report Series No. 62). The assay was flawed because the female rats were given endosulfan for less than their entire lifetime (78 out of 110 weeks); high early mortality in the males caused the high- and low-dose males to be terminated at 74 and 82 weeks, respectively, while half of the control males continued on study until 110 weeks; and the doses were changed several times during the study. The poor survival in the male rats precluded drawing a conclusion regarding the carcinogenicity of endosulfan in males because insufficient numbers of animals were alive to demonstrate a risk from late-developing tumors. However, the authors concluded that under the conditions of the assay, endosulfan was not carcinogenic in female rats.

Histological sections from this study were reevaluated by Reuber (Sci Total Environ 1981;20:23-47) who concluded that endosulfan was carcinogenic. By grouping tumors, Reuber identified statistically significant increases in the total number of malignant tumors in both high-dose females (TWA dose, 22.3 mg/kg/day) and low-dose females (TWA dose, 11.1 mg/kg/day), as well as in the total number of carcinomas and sarcomas in high-dose females and lymphosarcomas in high-dose males (TWA dose, 47.6 mg/kg/day) and high-dose females. No increases in tumor incidence were identified in any specific tissue, and Reuber's conclusions were not independently confirmed by other scientists.

The carcinogenicity of technical endosulfan was reevaluated in Sprague-Dawley rats using lower doses of endosulfan (Hoechst study). Endosulfan was administered in the diet for 2 years, and no effect on survival was observed in either sex at any dose. Under the conditions of this assay, dietary consumption of doses as high as 3.8 mg/kg/day by females or 2.9 mg/kg/day by males did not result in an increase in the incidence of any neoplastic lesions in these animals. The results from the Hoechst bioassay were subsequently published in the open literature (Hack et al. 1995 Food Chem Toxicol 33(11):941-50).

Endocrine Disruption

Endocrine disruptors are synthetic chemicals and natural plant compounds that may affect the endocrine system. Many of these substances have been associated with developmental, reproductive and other health problems in wildlife and laboratory animals. Some experts suggest these compounds may affect humans in similar ways.

Endocrine disruptors alter hormonal functions by several means. Some substances can mimic or partly mimic the sex steroid hormones estrogens and androgens (the male sex hormone) by binding to hormone receptors or influencing cell signaling pathways. Those that act like estrogen are called environmental estrogens.

Environmental estrogens are the most studied of all the endocrine disruptors. Natural compounds capable of producing estrogenic responses, such as the phytoestrogens, occur in a variety of plants and fungi. Many synthetic chemicals that also mimic estrogen are commercially manufactured for a specific purpose or produced as a byproduct.

Exposure to these substances occurs throughout our lives from food, air, water, soil, household products and probably through breast milk and during development in our mother's womb. The human health risks that may be associated with these low-level yet constant exposures are still largely unknown and highly controversial.

Endosulfan has been shown to have hormone disrupting action on diverse animals ranging from newts (Park et al. *Environ Health Perspect* 2001;109(7):669-73) to zebra fish (Willey & Krone *Aquat Toxicol* 2001;54(1-2):113-23) and rats (Sinha et al 2001;10(1-2):29-32; Chitra et al. *Asian J Androl* 1999;1(4):203-6; Dalsenter et al. *Hum Exp Toxicol* 1999 Sep;18(9):583-9).

There are disturbing reports suggesting the endocrine effect of pesticides including endosulfan on humans. Zaidi et al describe impaired thyroid function in pesticide formulators exposed to endosulfan and other pesticides. (*Hum Exp Toxicol* 2000;19(9):497-501). Estrogenic effects of organochlorine pesticides on human uterine leiomyoma cells in vitro has been demonstrated by Hodges et al (*Toxicol Sci* 2000;54(2):355-64).

In southeastern Spain, along the Mediterranean coast, extensive areas alongside residential zones are devoted to intensive farming in plastic greenhouses, with the use of large amounts of pesticides. Human tissue samples have been investigated for pesticide residues. Samples of fat from children living in farm areas contained a total of 14 pesticides, including endosulfan among others.

Scientists in the University of Granada, Spain studied the relationship between level of pesticide use and cryptorchidism (undescended testis - which may occur as a consequence of hormone disruption) in these areas by looking at orchiopexy rates (ie. surgery for cryptorchidism). Regression models showed that the strength of association between orchidopexy and level of pesticide use tended to increase with higher levels of use. (Garcia-Rodriguez et al. Environ Health Perspect 1996;104(10):1090-5; Olea et al. Toxicol Ind Health 1999;15(1-2):151-8)

The ATSDR (Agency for Toxic Substances and Disease Registry) review Sept. 2000 is the most comprehensive peer-reviewed summary that is available regarding the toxicity of Endosulfan till date. As is clear from the quotes below there is still much that is unknown about the chronic ill effects of Endosulfan on human health. However, it is abundantly clear that such effects on human population are not ruled out in scientific literature contrary to claims made by Pesticide manufacturers.

We do not know whether endosulfan has ever affected the ability of people to fight disease or has ever caused cancer in people. The Department of Health and Human Services (DHHS) (National Toxicology Program), the International Agency for Research on Cancer (IARC), and EPA have not classified endosulfan as to its ability to cause cancer.

One animal study suggested that after somewhat longer exposures, there is a possibility that the body's ability to fight infection may be impaired; however, this was not directly demonstrated.

The kidneys, testes, and possibly the liver are the only organs in laboratory animals affected by longer term exposure to low levels of endosulfan. The seriousness of these effects is increased when animals are exposed to higher concentrations of endosulfan. Because these effects occurred in animals, they might also occur in humans.

Limited studies in animals show no evidence that endosulfan causes cancer in animals.

Some studies in animals have shown that endosulfan causes damage to the genetic material within cells.

It is not known if children's intake of endosulfan per kilogram of body weight is different than that of adults. It is also not known whether children differ from adults in their

susceptibility to health effects from endosulfan exposure. Whether endosulfan affects the ability of people to have children or whether it causes birth defects in children is also not clear.

Some studies show that large amounts of endosulfan damage the testes, but it is unknown whether such large amounts affect the ability of animals to reproduce. Pregnant animals given endosulfan by mouth had some offspring with low birth weight and length, and some with skeletal variations. Often, these effects were seen at doses where the pregnant animals themselves showed signs of poisoning by the endosulfan. Because these effects occurred in animals, they might also occur in humans.

It is not known for certain whether endosulfan or its breakdown products can cross the placenta, but it is likely that they can do so. Endosulfan has been found in human breast milk, but results of studies in animals that ate endosulfan while nursing their young suggest that only very small amounts of endosulfan can find their way into breast milk.

The above review indicates that the effects of endosulfan is totally dose- dependant and species- dependant. Specific evidence showing deleterious effects (short term and long term) of endosulfan on human beings at recommended doses of agricultural use is not available.

Environmental Effects

Safe levels of endosulfan in water are measured in ppt (parts per trillion). For example, the maximum level in water acceptable to the European Union is 0.001mg/lit. Endosulfan can cause fish kills even at recommended application levels. Because of this, endosulfan is not to be used over marshes and water bodies. Endosulfan is persistent in soil according to ATSDR report 1993(PNAP, 1996). Fish kills from endosulfan poisoning have been reported in Sudan (1988), Indonesia (1990-93), Philippines (1990).

Regulatory Status of Endosulfan

In Philippines, there was a long battle between the Government and the manufacturers (Hoecht) regarding the banning of endosulfan. In 1990, use of endosulfan 35% was banned, but endosulfan 5% was allowed to be used under controlled conditions. The manufactures 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.

Table 02- REGULATORY STATUS OF ENDOSULFAN

Continent	Banned in	Severely restricted in
Asia	Tonga Syria	Indonesia (banned in rice fields) Korea (do) Bangladesh (do) Thailand (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	Venezuela
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 consumption of endosulfan formulations is of the order of 50 million litres. 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 behavioral 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.
2. Short term toxicity (mice, rats)
3. Long term studies of toxicity and carcinogenicity (mice, rats, dogs).
4. Genotoxicity (mice).
5. Multi generation reproductive toxicity (rats).
6. Development toxicity (rats, rabbits).
7. Enzyme induction (mice).
8. Promotion (rats).
9. Immune toxicity (rats).
10. Neurobehavioral effects and neuro toxicity.

11. Effects on sperm.
12. Endocrine effects

The effects depended primarily on the dosage and on the test organism. The group recommended the following levels that cause no toxic effect.

Table 03. ENDOSULFAN LEVEL WITH NO TOXIC EFFECT

Organism	Level that causes no toxic effect	Study on which recommendation is based
Mouse	3.9 ppm (0.58 mg/kg body weight/day)	Females in 78- week study of toxicity
Rat	15 ppm (0.60 mg/ kg body weight/ day)	2 year dietary study of toxicity
	75 ppm (6.0 mg/ kg body weight/ day)	Reproduction toxicity
	0.66 mg/ kg body weight/ day	
	2.0 mg/ kg body weight/ day	Maternal toxicity in a study of developmental toxicity Foeto-toxicity in a study of developmental toxicity
Rabbit	0.7 mg/ kg body weight/ day	Maternal toxicity in a study of developmental toxicity
Dog	10 ppm (0.57 mg/ kg body weight/ day)	1 year study of toxicity

After applying necessary safety factor, the FAO panel recommended the Acceptable Daily Intake (ADI) of 0-0.006 mg/ kg body weight for man.

Review of Regulations in India

The Ministry of Agriculture, Department of Agriculture and Co-operation, Government of India constituted a high power committee under the chairmanship of Dr. S.N. Banerji, Ex-Plant Protection Adviser to Government of India in 1991, for reviewing the use of endosulfan in India. All the available scientific data on chemistry, bioefficacy, carcinogenicity, mutagenicity, teratogenicity, neuro toxicity, epidemiological studies, foreign reports from WHO/ FAO, environmental impact, persistence in soil, water, crops, toxicity to birds, fish and honey bees, status of registration abroad and restrictions were studied. The committee recommended the continued use of endosulfan in the country, but specified that endosulfan should not be used near water-bodies and that this should be put

as a condition while issuing certificate of registration. R.B.Singh Committee appointed in 1999 also insisted that labelling should be made mandatory in bold letters to avoid use of endosulfan near water-bodies.

The All India Co-ordinated Research Project on Pesticide Residues, being conducted in 17 research centers in the country, has generated residue data on endosulfan by carrying out multi-locational supervised trials under "Good Agricultural Practice " on cereal crops, pulses, oil seeds, cash crops, vegetables and other food crops (Annual Report of All India Coordinated Research Project on Pesticide Residues, 1999 ICAR, New Delhi). The waiting period (between spraying and harvesting) of endosulfan on vegetables is between 3 and 7 days and no detectable residues were found in the pulses, cereals and oil seeds at harvesting. The project also generated data on monitoring endosulfan residues in soil, water, fish, honey, vegetables, fruits, milk and milk products. In most of the samples, no detectable residues of endosulfan were reported and in samples where it was detected, the levels were below the maximum allowed limits. Of course these study did not include residues on cashew.

Use of Endosulfan in Kerala

PCK Ltd. has been spraying endosulfan over its cashew plantations from 1981. It is being used in the following crops in Kerala.

TABLE 04. CROPS FOR WHICH ENDOSULFAN IS USED

Crop	Strength %	Crop	Strength %
Cashew	0.05	-----	0.20
Cotton	0.07	Cocoa	0.05
Coconut	0.05	Tobacco	0.05
Oil Palm	0.20	Coffee	1.7ml/lit.
Cardamon	0.10	Tea	
Pepper	0.05	Rice	
		Colocasia	

Endosulfan 35% EC is one of the several pesticides approved by the Directorate of Plant Protection, Govt. of India for aerial spraying on crops either by fixed wing aeroplanes or by helicopter.

A spraying protocol has been prescribed as per Insecticides Act 1968 and Insecticides Rule 1971 of the Government of India. The Central Insecticides Board is the Central Government Agency that regulates the use of pesticides in India. The designated licensing officers in the States issue licences for sale, stocking and use of the pesticides. The State Agricultural Department is the licensing authority in the State.

The District Collector, Kasaragod, issues permission to PCK Ltd. for use of endosulfan as aerial spray subject to the conditions of the Act and Regulations. Copy of the proceedings of the Dist. Collector dt. 22-11-2000 is appended (Annexure 12).

The rule 43 of the Insecticides Rules stipulate the following conditions for aerial spraying.

1. Marking of the area shall be the responsibility of the operator.
2. The operator shall use only approved insecticides and their formulations at approved concentrations.
3. Washing, decontamination and first aid facilities shall be provided by the operator.
4. All aerial spraying should be notified to the public not less than 24 hours in advance through competent authorities.
5. Animals and persons not connected with the operation shall be prevented from entering the areas for specified periods.
6. The pilots shall undergo specialized training including clinical effects of insecticides.

The District Collector gives license on the following conditions.

1. Notice should be given to the public by the Corporation sufficiently in advance of the date of spraying. Notice should be displayed in all the village offices, Panchayath offices and ration shops in the area where spraying is done.
2. All the precautionary measures should be taken by the Corporation to prevent water pollution or health hazards to inhabitants in and around the Plantation and neighboring area as per rules and prevailing directions.
3. The Corporation should arrange to cover all wells, drinking water sources in and around the locality before spraying.

-
4. In the event of any death of cattle occurring in the locality due to aerial spraying, the corporation should arrange to get post-mortum examination conducted at its own cost and pay any compensation in case the death is found to be due to poisoning as result of aerial spraying.
 5. This should also be brought to the knowledge of the local public by wide publicity so that the local public can report such death of cattle and avail the compensation in all eligible cases.
 6. Mike announcement should be made in the area on the day previous to the date of spraying instructing people to take precautionary measures at the time of spraying.
 7. The Corporation should by all means ensure that the spraying does not cause any environmental problems.

The Director, NRCC has also specified identical conditions for aerial spray. (Letter dt. 26-12-1997 from Director) (Annexure 13). The Director NRCC has in his letter dt. 08-03-2001 stated that endosulfan has been continuously in use for more than 25 years in spite of other equally effective chemicals and that long-term exposure of a single pesticide is an unjustifiable practice (Annexure 9).

3 . THE CASHEW PLANTATIONS OF PCK

The PCK has 4696 ha. of cashew plantation in Kasaragod district, distributed in 3 sectors (as shown below) in 20 villages, as several fragmented plots :

1.	Kasaragod Plantation		
	a) Muliar Division	367.86 ha.	
	b) Perla Division	783.14 ha.	
	c) Adhur Division	749.00 ha.	
	d) Periya Division	290.00 ha.	
	Total	2190.00 ha.	: 2190.00 ha.
2.	Rajapuram Plantations		1526.00 ha.
3.	Cheemeni Plantations		980.00 ha.
	Total		4696.00 ha.

The plantations were under the Dept. of Agriculture until they were taken over by PCK in 1979. Endrine, Ekalux etc. were used till 1981 for pest control. Trial sprayings of endosulfan were done during 1977-1978 in the Kasaragod plantation. From 1981, aerial spraying of endosulfan alone is carried out 2 to 3 times a year. The cashew trees are mostly old ones, aged 35 to 38 years. There are no grafted trees except in the scion banks.

The land where the plantations are located is undulating. The soil is lateritic to a large depth. The cashew plantations are mostly on the hills while the valleys are inhabited by the local people. Several of the inhabited areas outside the plantations are surrounded by the plantation areas on 2 or 3 sides (vide location map). There are several houses inside the plantations of PCK and a large number of houses in the adjoining areas. Similarly, there are a good number of wells inside the plantation and also in the marginal areas. A table showing the number of house and wells is given in table 05.

THE PLANTATION CORPORATION OF KERALA - LTD. KASARAKODE ESTATE.

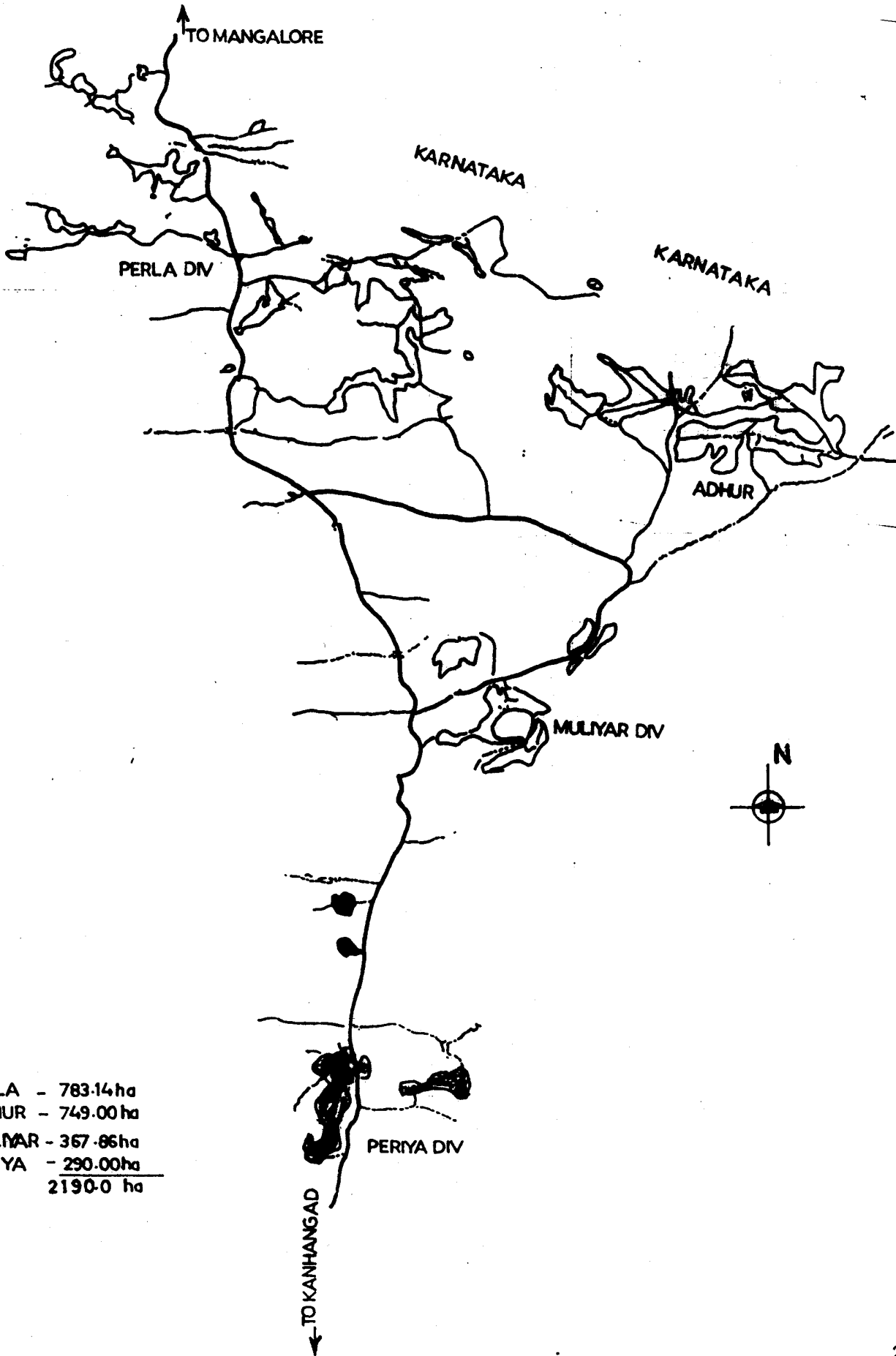


Table 05. HOUSES AND WELLS INSIDE AND JUST OUTSIDE THE PLANTATIONS *

No.	Division	Land area ha.	No. of houses		No. of wells	
			inside	just outside	inside	just outside
1	Kasaragod	2190	210	1593	174	1333
2	Rajapuram	1526	36	225	3	18
3	Cheemeni	980	46	208	46	208
* Data supplied by PCK.						

There are several schools inside the plantation areas. The water from the hills, forming the plantations, can reach the streams, some of which feed Chandragiri river, which provides drinking water supply to Kasaragod town and several pançhayaths.

There are 160 workers in Kasaragod estate, 93 in Cheemeni and 158 in Rajapuram. Some of the labourers are staying inside the plantations. The workers are not covered by E.S.I. scheme. There are two health centres owned by the PCK, one attached to Muliar estate and the other to Periya estate. But there are no doctors in both. The workers go to other hospitals for medical treatments. Therefore, there is no record to verify the morbidity levels of the workers.

The aerial spraying of endosulfan is entrusted to outside agencies based on competitive bids. The PCK has no technically qualified staff to guide or supervise the spraying and to monitor the effects. The PCK issues routine notices before the spraying. A copy of the notice issued in one estate is attached (Annexure 14). The PCK gets permission for each spraying from the Dist. Collector.

The rights to collect the cashew nuts are auctioned every year. The production is not assessed and the actual crop is not quantified. The productivity is based only on the auction amounts. There is no means to verify the annual variations in the yield of the crop.

The spraying of the same chemical (endosulfan) 2 or 3 times a year went on year after year till Dec. 2000. No spraying has been done after Dec. 2000. There is no integrated pest management. The major pests are tea-mosquito bug and stem borer.

The PCK owns 340 ha. of cashew plantations at Mannarghat in Palakkad district. Aerial spraying of endosulfan is done here. The PCK has a smaller plantation at Perambra in Kozhikode district. No aerial spraying is done there.

4 . Investigation by the Committee

The members of the Committee visited the plantations to get a first-hand knowledge regarding the nature of the terrain, density of houses, schools, wells, water-courses etc. in and around the plantations. Since the Committee started its work only in August 2001, 7 months after the last spraying, there was no use in collecting samples of water, blood and soil for examining the residues endosulfan or its derivatives in them. Hence the Committee critically examined the data collected by other agencies. In addition to this, the Committee received written and oral depositions from Government officers, research agencies, experts, office-bearers of the District Panchayath and Gram Panchayaths, organisations and individuals. The list of persons who deposed before the Committee is given as Annexure 15.

The Committee went through the following reports of the Kerala Agricultural University.

1. Report on the visit of the expert team constituted for investigating the environmental effects of aerial spraying of endosulfan - Study Report 1 (Feb. 2001)
2. do - Study Report 2 (Aug. 2001)
3. Report of the Brain - storming Session on the use of Endosulfan for the control of tea mosquito in cashew held on 16-08-2001.

The Committee also examined the reports entitled "Children of Endosulfan" and "Toxic Tales from God's Own Country" that were published in the journal Down to Earth on Feb. 18, 2001 and Aug. 15, 2001 respectively. The Chairman wrote to the editor of the journal and Dr. Padma S. Vankar, who did the investigation, requesting to send information on the method used in the collection and analysis of samples. The reply received from the publishers of the journal is given as Annexure 16.

The Pesticide Manufacturers and Formulators Association of India forwarded to the Committee the report on the "Evaluation of Residues of Endosulfan" prepared by the Dept. of Pesticide Chemistry, Frederick Institute of Plant Protection & Toxicology (FIPPAT), Padappai, Tamilnadu for the PCK Ltd.

The Chairman contacted the Director of National Inst. of Occupational Health, Ahmedabad to know the status of their investigations. The reply received is given as Annexure 17.

The data were critically examined by the Committee. The critical assessment of the data is given in the next section.

5 . CRITICAL ANALYSIS OF THE DATA

Since the last spraying was done in Dec. 2000 and the endosulfan residues dissipate fast, the Committee felt that collection and analysis of human and environmental samples by the Committee may not provide proper information in the effects of endosulfan residues. The Committee, therefore, critically examined the data generated by the following organisations :

1. Society for Environmental Communication (SEC) - Data and report published in the journal "Down to Earth" dated 28 Feb. 2001 and Aug. 15, 2001.
2. Frederic Inst. of Plant Protection & Toxicology (FIPPAT) published on 04 June 2001.
3. Kerala Agricultural University Study Reports prepared in Feb. 2001. and Aug. 2001.

1. SEC Report

The report published in Down to Earth created considerable stir as the residues of endosulfan reported to be found in water, human blood, soil, milk, leaves etc. were very high as given in table 06:

TABLE 06. ANALYSIS OF RESIDUE (DOWN TO EARTH Vol. 9, No. 19)

Sample	Detected value of endosulfan ¹	Maximum residue limit (MRL) ²	Number of times value exceeds MRL	Site/source of sample
Water	1.18	0.18*	7	Small stream in Kumbdaje village near Padre
Water Padre	6.87	0.18*	38	Tank near the cashew plantation, Kajampady,
Water	9.19	0.18*	51	The Kodenkiri stream near Vaninagar, Padre
Butter	14.00	NA#	NA	From the milk of a cow of Saletadka, Padre
Cow's skin/ fat tissue	49.99	0.1	500	From the abdominal region of a cow from Padre
Cow's Milk	31.80	0.5	64	From a cow that grazes around Kajampady, Padre
Cow's Milk	57.20	0.5	114	From a stall-fed cow in Kumbdaje village
Coconut oil	17.00	NA	NA	Extracted from produce of trees in Vaninagar, Padre
Cashew	54.11	NA	NA	From a tree in the plantation near Kumbdaje village

Vegetable	31.24	0.4-2.0	78-16	Basale; leafy, spinach-like vegetable, from Kajampad
Human Milk	22.40	NA	NA	Lalitha, 35, resident of Kumbdaje village
Human Blood	108.90	NA	NA	Vishnu Kulkarni, 16, has epilepsy & mental retardation
Human Blood	114.13	NA	NA	Prabhawati Shastri, 35, has asthma & skin allergies
Human Blood	115.19	NA	NA	Mohana Kumar, 40, has chronic throat infection
Human Blood	109.50	NA	NA	Kittanna Shetty, 21, has cerebral palsy
Human Blood	196.47	NA	NA	Muthakka Shetty, 50, Kittanna Shetty's mother
Human Blood	176.90	NA	NA	Lalitha, 35, resident of Kumbdaje village
Live Frog	10.35	NA	NA	From a small stream in Kumbdaje village
Cashew	3.74	NA	NA	From the plantation near Kajampady, Padre
Spices	212.28	NA	NA	Pepper bunch from Kajampady, Padre
Fish	28.24	NA	NA	From a tank in Kajampady, Padre
Soil	35.16	0.09*	391	From Lalitha's house in Kumbdaje village
Soil	3.17	0.09*	35	From a few metres inside the plantation at Kajampady
soil Padre	6.40	0.09*	71	From plantation area on a hilltop in Periyal, Padre
Cashew leaves	6.52	NA	NA	From the heart of the plantation at Periyal, Padre

Note: All figures in parts per million (ppm)

- 1 : Values are the sum of a -endosulfan and b - endosulfan residues. Levels of endosulfan sulphate were not measured. Had this been done, the figures would have been higher.
- 2 : The MRLs are for the sum total of a - endosulfan, b - endosulfan and endosulfan sulphate residues. Calculated from documents of the US Environmental Protection Agency.
- * : The MRLs for water and soil are the sum total of a - endosulfan and b - endosulfan residues, and do not include the MRL for endosulfan sulphate.
- # : MRLs not available (NA)

The validity of the data has been questioned on technical grounds. Dr. H.K. Handa, a renowned pesticide residue chemist has remarked that the procedure adopted by the SEC team appears to be faulty (Agriculture Today - June 2001). He says that "the residues of

endosulfan and consequently the results reported by SEC should be verified by an independent residue expert. The study is contradictory in itself and the results obtained are highly questionable". In its communication dated Sep. 11, 2001, (Annexure 16) the SEC has explained the test procedure. The SEC has not tested for endosulfan sulphate. The tests were done in Centre for Science & Environment's Pollution Monitoring Lab under the supervision of Dr. P.S. Vankar, Head, Facility for Ecological Analytical Testing Lab, IIT, Kanpur. Dr. Vankar did not respond to the queries of the Chairman. The SEC reply has not been able to satisfactorily rebut the objections raised about their data.

Dr. E.V.V. Bhaskara Rao, Director, NRCC also has questioned the findings of SEC (Annexure 18). He has stated that "the procedure adopted certainly looks biased". He cites a research finding according to which the endosulfan residues are lost within 2-7 days in fruits and vegetable.

The values of endosulfan residues reported by SEC in the experimental samples collected from Padre are unbelievably high. The procedure is erroneous and validation of the data by alternate method (GC – MS) is not done. As such, data cannot be depended upon. The comments on the SEC report furnished by the Project Co-ordinator (Pesticide Residue), AICRP on Pesticide Residues, IARI, New Delhi (Annexure 22) also confirm this.

2. FIPPAT Studies

The PCK sponsored a study by FIPPAT. The investigators, were collecting environmental samples from the problem area. Therefore, they collected samples from other areas, which are subjected to aerial spraying. The major findings of this study are given below :

TABLE 07. RESIDUE LEVELS IN BIOLOGICAL & ENVIRONMENTAL SAMPLES (FIPPAT)

Sample	Number	Residue
Water	36	Nil
Fish	1	Nil
Milk	1	Nil
H - Blood	106	Nil
H - Blood (C)	6	Nil
Soil	29	0.001 - 0.012 ppm
Cashew leaves	28	0.04 - 2.863 ppm

(Detection limit : 0.001 ppm)

The samples were collected on 17 and 18 March, 2001. The studies did not indicate the presence of endosulfan in samples of water, human blood, fish and milk. Small amounts of residues were noted on samples of cashew leaves and soil.

Since the samples were collected on 17 and 18 of March 2001, about 21/2 months after the last spraying, high level of endosulfan residues cannot be anticipated, as endosulfan is degraded fast in animal tissues. High levels are not likely to be found in water as it is virtually insoluble in water.

3. KAU Studies

Three study reports of KAU were made available to the Committee.

- 1 Report of the visit of the expert team (Feb. 2001).
- 2 Report on the visit (6 to 8 Aug. 2001).
- 3 Report on Brain Storming Session on Use of Endosulfan held on 16 Aug. 2001.

The study team visited Perla and 4 other villages and interviewed members of 10 families. The team collected samples on Feb. 19, 2001, about 50 days after the last spraying for residue analysis. The samples were analysed separately in two different laboratories of the KAU (AMPRS at Odakkali and College of Agriculture, Vellayani).

Table 08. RESULTSS OF KAU STUDY

Matric	No. of samples	Total Endossulfan ppm
Water	5	Nil
Pepper berries	1	Nil
Betal leaf	1	Nil
Soil	5	0.05 - 3.80
Cashew leaves	3	0.50 - 0.80

The results given in Report I are shown in Annexure 19. No residue was detected in water. The residue levels are very low (0.055 to 0.315 ppm) in soils from adjoining areas, while they were comparatively high (up to 3.815 ppm) inside the plantation. On the cashew leaves also, the levels were high. These samples were collected on 19th Feb. 2001. In FIPPAT samples collected one month later also, residues were found only in soil and leaves, of course at a lower level. Qualitatively, these two studies agree.

The team recommended the stoppage of aerial spraying in the area with immediate effect. They suggested that the current practice of scheduled spraying should be replaced by need based application following insecticide rotation.

In the second report also, the stoppage of aerial spraying was recommended. The summary of the other observations and recommendations of second report are given below :

1. There exists some unusual human health problem in the Padre village, but the cause-effect relationship is yet to be established.
2. A multidisciplinary team may take up this investigation. A project with a financial outlay of Rs. 4.5 lakhs has been proposed for such an investigation.

The third report was based on a brainstorming session held on August 16, 2001. Thirty-one scientists from different disciplines participated in this. Consensuses on eleven items were arrived at this session.

1. Even though, the scientists were very much concerned on the alleged health problems reported from Padre Village, there was no conclusive evidence to fix endosulfan as the whole cause of the problem.
2. In-depth studies are required in finding the cause of the alleged health hazards.
3. Studies on water pollution, heavy metal contamination and natural radioactivity of the area are also to be considered.
4. In the context of horrifying reports in the media, to be on a safer side, it is better to suspend the aerial spraying of endosulfan till conclusive results on the proposed investigations are made available.
5. Aerial spraying of all insecticides in the State has to be dispensed with since safety measures, though stipulated, cannot be followed strictly due to high population density and fragmented nature of plantations in the inhabited areas.
6. Only need-based manual or ground level power-operated spraying of the insecticide need be recommended.
7. Pest surveillance program has to be strengthened in order to make use of the application of insecticides need-based.

8. Endosulfan was in use in controlling the pests of agricultural crops during the last two decades and only on this account alone it is advisable to switch over to some other newer insecticide for the control of the tea-mosquito bug. Research programs are to be intensified in this line.
9. The possibility of using botanical insecticides for the control of the tea-mosquito bug requires immediate attention.
10. Cashew being an export oriented crop, too much publicity on the alleged reports without establishing the cause of the problem may be detrimental to the interest of the State.
11. Breeding programs to identify cashew lines resistant to tea-mosquito bug infestation require priority.

The Committee studied the above scientific reports available on the subject. Excepting the SEC report, none of the reports has found that endosulfan is the cause of health problems reported from Padre. No direct proof was available to book endosulfan as the causative factor.

6 . ANALYSIS OF THE WRITTEN & ORAL DEPOSITIONS

The depositions are classified into 8 broad divisions.

1. Government Officers
2. Functionaries of District Panchayath & Gram Panchayaths
3. Research Organisations
4. Officers of PCK Ltd.
5. Pesticide Manufacturers & Formulators' Association of India (PMFA)
6. Non-Government Organisations
7. Professionals
8. General Public
9. Workers of the PCK Plantations

1. Government Officers

The District Collector, Kasaragod, in his written deposition has stated that permission to use endosulfan 35% EC is granted to PCK Ltd. when requests are received for such permission. The permission order stipulates conditions for the aerial spray. But it is strange that the Dist. Collector has excluded the campus of Jawahar Navodaya Vidyalaya, the hospital premises of Kasaragod district, the Govt. Polytechnic campus, parallel college compounds and the LBS Engineering College campus, but not the high schools, L.P and U.P Schools and anganvadies. The Dist. Collector has stated that "the Corporation had conducted aerial spraying without taking proper precautionary measures and the spraying was conducted not within the stipulated period for which the permission was granted" (Annexure 20). He has stated that procedure to monitor the effects of spraying are being ascertained. This evidently means that there was no mechanism to monitor the effects at the Dist. Administration level. Based on the complaints against spraying in Enmakaje and Bellur Gram Panchayaths, the Dist. Collector has promulgated orders prohibiting aerial spraying from 21-08-2001.

The Deputy D.M.O in charge of D.M.O deposed that he has arranged a medical survey of 400 houses (population 3118) in Feb. 2001 as soon as he received a paper cutting regarding the health problems. The findings of the survey are as follows (Table 09).

TABLE 09. RESULTS OF HEALTH SURVEY BY D.M.O.

Total population covered : 3118		
Health problems	Affected cases	Rate per 10,000
Mental retardation	9	28.8
Sterility	15	48.0
Abortions in last one year	9	28.8
Chronic diseases	20	64
Cancer cases	3	9.6

The DDMO remarked that the rate of mental retardation case is above the State average. He said that a more detailed study in the affected areas and a control area is required to assess the morbidity rate. Fish kills in Cheemeni have been reported but have not been confirmed. He also stated that health cases have been highlighted in Padre, because some doctors took interest to study the problem. In other areas, such interest was not taken. He also stated that the DMO is not informed when the spraying is done and, therefore, no monitoring is done by the Health Department.

From the above depositions, it is clear that the spraying was done in a routine and casual manner and there was no Government machinery to supervise it or to monitor the effects.

2. District Panchayath & Gram Panchayaths

Sri. Moideen Kunhi Kalnad, Vice President of District Panchayath in charge of the President and Sri. V.V. Rajan, Chairman of the Standing Committee deposed on behalf of the Dist. Panchayath. No written complaints have been received by the Dist. Panchayath, but they are aware of the problems. They stated that the boundary of spraying area is not clearly marked and proper precautions are not taken before and during the spraying. The Vice President remarked that the aerial spraying should not be done, but ground level power spraying can be considered. He also wanted the Government to take steps to remove the fear among the local people regarding the health problems.

From the Gram Panchayaths in the affected area, the following functionaries deposed before the Committee.

1. Smt. Mariyamma, President, Muliya Panchayath.
2. Smt. Sarada. Y, President, Enmakaje Panchayath.
3. Sri. Kallage Chandrasekhara Rao, President, Bellur Panchayath.
4. Sri. M Kunhambu, Vice President, Pullur Periya Panchayath.

5. Sri. K.B. Mohammed Kunhi, Chairman, Stg. Comm., Muliyar Panchayath.
6. Sri. K. Sathyanarana, Member, Bellur Panchayath.
7. Smt. B. Usha, Member, Bellur Panchayath & President Enmakaje Mahilasamajam.
8. Sri. Purushothaman C.V., Chairman, Stg. Comm. Bellur Panchayath.
9. Sri. Balakrishnan M.K., Vice President, Enmakaje Panchayath
10. Sri. M. Jayakara, Chairman, Stg. Committee, Karadka Panchayath.

All the functionaries remarked that necessary precautions are not taken by PCK before or during the spraying. The Pullur-Periya Gram Panchayath had raised apprehensions about the aerial spraying in 1997 itself. In Muliyar Panchayath, there were demonstrations against the spraying. The PCK Ltd. sought police help in Dec. 2000 for spraying. Representations were sent to the Dist. Collector and DMO. The Enmakaje Panchayath has passed 3 resolutions against the use of pesticides. All the representatives spoke about health problems in their respective Panchayaths. They also stated there are several streams and large number of wells in and around the plantations. There were several schools even inside the plantations. The students used to have headache, giddiness and nausea after the spraying. All the functionaries, except those of Pullur - Periya Panchayath, wanted aerial spraying of any type of pesticide banned. The representatives of Pullur - Periya were not against ground-level spraying. They stated that if the spraying is strictly limited to the Plantation area and all protocols are observed, even limited aerial spraying can be considered. The representatives of Enmajake Panchayath wanted the Committee to recommend compensation to the victims of health hazard.

3. Research Organisations

Scientists of two research organisations gave evidence before the Committee.

Dr. P. Sivarama Bhat, Scientist, NRCC, Puthur stated that as early as 1977, the NRCC had advised PCK Ltd. to rotate the pesticide, but PCK was using only endosulfan. Since allegations have been levelled against endosulfan as causing health hazard, aerial spraying has been stopped in Karnataka and Orissa. He also stated that aerial spraying of any insecticide is not advisable in Kasaragod Dist. Carabaryl and quinalphos are equally dangerous as endosulfan when applied as aerial spray. The NRCC advises need-based ground spraying. With regard to biological control, Dr. Bhat said that attempts to culture parasitoids in-situ have not been successful. The experiments with neem products also have not been successful. Dr. Bhat stated inter-cropping is not possible in old plantations. To the specific question whether endosulfan is the cause for the reported health problems,

Dr. Bhat said that he does not think so. There are no health problems reported from Karnataka State in areas under aerial spray.

In short Dr. Bhat does not recommend blanket spraying, but suggests need-based ground spraying rotating the chemicals.

Dr. E.V.V Bhaskara Rao, Director of NRCC forwarded his letter (Annexure 8) to Director, Cashew & Cocoa Development, Kochi and all other cashew research stations in which he has recommended the withdrawal of endosulfan in cashew plantations. He specifically mentions that long term use of a single chemical is an unjustifiable practice. In his e-mail communication dated 03-09-2001 posted to research groups, Dr. Bhaskara Rao has reiterated his earlier statement regarding "the safety of environment and health being more important than simple economics while adopting plant protection practices".

Dr. K.M. Sreekumar, Asst. Professor of Entomology, College of Agriculture, Padnekkad also deposed before the Committee. Dr. Sreekumar was in the study team deputed by the KAU. He is staying in a place which is only 1.5 km. from the Cheemeni estate. He is aware of the problem from 1998, when Asst. Agricultural Officer Smt. Leelakumari Amma filed a suit in the local court against aerial spraying of endosulfan. He has information that PCK Ltd. has started covering of wells only from 1986. It is not possible to cover tanks and streams in the area. In Cheemeny, there were local protests from 1990. Dr. Sreekumar was associated with a health survey conducted in 1998-99 by the KSSP. In the survey conducted by KSSP in Padre and Cheemeni, serious health problems have been seen in Padre, but in Cheemeny, the problems are of smaller dimension. During the spraying, those who are inside the houses do not have problems of headache and giddiness, but those who are exposed have problems. The plantation labourers also have similar problems. He stated that the PCK Ltd. advises the local people not to stir out of their houses for 10-12 days after the spray but this condition is impossible to be observed. The local people have to go out for work and the children have to attend the schools. Dr. Sreekumar stated that the height restriction regarding the spraying is not observed by the helicopters. To the question whether a pesticide holiday is warranted, Dr. Sreekumar stated that a holiday can be recommended only after studying the environmental parameters. He was of opinion that polyculture will help pest control. He also stated that if tea-mosquito bug is not controlled, fungal infection also will increase, as fungi will penetrate through the holes formed by tea-mosquito bug. To the question about the alternatives to endosulfan, Dr. Sreekumar said that he is not sure about it. This requires detailed study.

4. Officers of the PCK Ltd.

The PCK Ltd. was represented by Sri. Devapalan, Senior Manager, Calicut and Sri. Santhosh, Regional Officer.

To queries from the members of the Committee, the following answers were given.

1. Before 1983, spraying was done 3 times a year. After that, spraying is done twice a year. The spraying is done as per the directions of NRCC.
2. PCK Ltd. has 320 ha. in Mannarghat in Palghat Dist. There are no complaints about aerial spraying in that plantation. There is a small plot of 60 ha. in Alacode in Kozhikode Dist. where there are other crops in addition to cashew. No aerial spraying is done here.
3. Spraying of endosulfan started from 1980 in Kasaragod, 1983 in Rajapuram and 1984 in Cheemeni. Trial spraying was done from 1977-78 at Kasaragod.
4. The oldest plantation is in Periya - 1963-65.
5. There are no grafted plants. Grafted samplings are there only in scion banks.
6. There are 160 workers in Kasaragod estate, 158 in Rajapuram, 93 in Cheemeni and 37 in Mannarghat. None of them has abnormal health problems.
7. All necessary conditions regarding the spraying are met. PCK verifies the spraying. No complaint regarding the non-compliance of protocol has been received.
8. No study has been made by PCK on tea-mosquito bug.
9. PCK is not resorting to aerial spraying in Alakode estate in Kozhikode District, because there cashew is not a major crop.
10. There are no data regarding the actual annual production. The crop is not assessed before the auction. The yield increase due to spraying is 30% to 40%. This estimate is not based on assessment of yield.
11. Endosulfan is used continuously because it is the most economical pesticide.
12. The spraying is done by outside agencies.
13. Even though there are isolated tall trees other than cashew, the height restriction is observed.

14. PCK gives materials to cover the wells. Only small water bodies are covered. Streams are not covered.
15. The PCK has not tried ground level spraying. Moreover, it is not practically feasible.
16. In Aralam farm and in Karnataka and Goa, aerial spraying is done, even though there are habitations near these farms.
17. It is not possible to strictly monitor the height of helicopter. Only random check is done.
18. The cashew plantations of PCK are making profit.
19. The PCK has no experts for technical guidance. NRCC is approached for guidance, whenever necessary.
20. Other chemicals like carbaryl, monochrotophos etc. are not cost-effective.
21. There is a project for cashew apple processing, but it has not taken off.

To questions regarding specific complaints from local people in Vaninagar area, there was no reply. On the possibility of organic farming there was no specific reply. On the adverse effect of bad publicity arising out of continued aerial spraying of endosulfan on the international market of cashew, the officers evaded direct answer.

It was clear that the spraying was done in a casual matter. Without any technically qualified person under PCK's employment, the PCK's claim that supervision of spraying was done effectively does not stand to reason. All the functionaries of the Dist. Panchayath and Gram Panchayaths have testified that necessary rules for aerial spraying were not observed. No studies on tea-mosquito bug are made. The crop production is not assessed quantitatively. Still the PCK asserts that 30 - 40% reduction in crop will result if aerial spraying is not done. Rotation of chemical is not done because the other chemicals are costly. The officers do not know whether continuous use of the same chemical may lead to development of immunity by the bugs. The possibility of the bugs developing resistance is not considered but only the lower cost of the chemical is considered. The main reason for not resorting to aerial spraying in Alacode estate is given as the growth of different crops. The question whether the reason for this is that the biodiversity of the polycrops may have inhibited pest growth, there was no answer.

5. Pesticide Manufacturers & Formulators Association, Mumbai

The following persons represented the association :

Sri. Pradeep Dave, President

Dr. A.V. Dhuri

Sri. M. Raghavendra

Dr. A. Ramesh (FIPPAT)

Sri. Ganesan

Sri. Nair

The representatives agreed that the topography and fragmented nature as well as the large number of houses in and around the plantations makes it difficult to observe all rules regarding aerial spraying. They also agreed that the continuous use of the same chemical is not advisable. According to them, the issue is not the use of endosulfan but the use of pesticide in general. They said that all pesticides are specially formulated to harm the target insects most and to be safe to others. Endosulfan is the least harmful compared to others and most effective for use against tea-mosquito bug.

To the specific question whether the research on the effect of pesticides under controlled conditions are valid under uncontrolled field conditions, there was no specific reply. The representatives claimed that endosulfan cannot pass the placental barrier, but could not quote reference to any study to support that.

The representatives argued that by spraying from 7m height, the minimum risk level will not be exceeded. But as per rules, the spraying has to be done within 3m above the crop. They could not quote any study on the chronic effects on human beings. They did not give any satisfactory reply to the question on the effects of endosulfan on honey bees, especially during the foraging time.

Sri. Ganesan and Dr. Ramesh (FIPPAT) asserted that the Down to Earth data are not based on right procedure of testing. Since endosulfan is not water-soluble, the very high level of the chemical in water as given by the data cannot be trusted, according to them. Dr. Ramesh pointed out that data on sulfate residue are not given in the Down to Earth report. Dr. Ramesh suggested that the high residue level given in the Down to Earth article are due to diol formation. He said that it is likely that sulphuric acid was used is the treatment for the extraction of the samples causing diol formation. Unless diol formation is arrested, diol mediated error is likely to occur. He said that diol formation was arrested in the FIPPAT studies.

6. Non - Governmental Organisations

The following NGO's deposed before the Committee.

1. Kerala Sastra Sahitya Parishat (KSSP), Kasaragod Dist. Unit.
2. Thanal, Conservation Action & Information Network, Trivandrum.
3. Ban Endosulfan Dist. Co-ordination Committee, Kasaragod.
4. Endosulfan Spray Protect Action Committee (ESPAC), Periya - Padre
5. Kasaragod Jilla Parishithi Samithi.
6. Indian Youth Congress (I), Pullur - Periya
7. Kasaragod Taluk Azad Cultural Centre.
8. Sri Sakthi Friends Club, Yethadka.
9. Vivekananda Yuvakendra.
10. Punchiri Club, Muliya.
11. S.V. Brothers Club, Muliya.
12. Mahilasamajam, Endumooole.
13. Kasaragod People's Forum, Nillipady, Kasaragod.
14. Farm Information Exchange Club, Yethadka.

The KSSP conducted house hold survey in 7 Panchayaths surrounding the plantations (Annexure 21). The survey revealed that safety precautions were not strictly adhered to by PCK. A good percentage of people surveyed in Enmakaje have reported about considerable reduction in small animals like frogs and insects like bees and fish kills. According to them, disability ratio in the entire area is high compared to the average for Kerala. Similarly, chronic morbidity in Enmakaje was also more than that for the whole of Kerala. The KSSP advocated a ban on aerial spraying of endosulfan, but did not object to ground spraying of other chemicals.

Thanal sent a copy of a study on endosulfan by one of its activists. It sent a dossier on endosulfan pollution in Kasaragod (Prel. Report I). It also sent a copy of its Report II on the Preliminary findings of endosulfan spray. Dr. C. Jayakumar, Coordinator of the survey, met the Chairman to hand over the report. The study gives information on the details on endosulfan and its effects on the environment. It also gives details on regulations on endosulfan in different countries. The Prel. Report I is a dossier giving the background information on the impact of aerial spraying in Kasaragod. The Prel. Report II is a detailed study on the effects of human health. Several instances of abnormalities of gastro-intestinal reproductive and neural systems are cited in the report. 109 references are given

to prove the statements in the report. Thanal wanted the problem to be treated as one of human right violations.

ESPAC from Padre highlighted the health problems in Padre. The representatives drew the attention of the Committee to the observations made by the teachers of the Govt. H.S. School at Vaninagar on Jan. 03, 2000. before the media flare up of the problem started. They reported that most of the school children coming from the area exposed to endosulfan spray are physically and mentally ill. Later the NGO sent a white paper on the KAU Reports.

The group wanted a ban on endosulfan in the whole state, rehabilitation of the victims of aerial spraying and providing medical treatment to those who suffer from alleged endosulfan poisoning.

All the other NGOs were for stopping aerial spraying of endosulfan. They also mentioned about the growing resistance of the people to the endosulfan. They asserted that the health problem is not limited to Padre alone, but it is there in other areas like Pullur - Periya, Muliya and other places also,

7. Professionals

Two medical doctors practising in the Padre area testified before the Committee.

Dr. Mohan Kumar has reported abnormal health problem in 1997 to the Kerala Medical Journal (Annexure 4). He said that the problem has a history of several years. In 4 sq. km of Padre village with a population of 2000, there were 51 cancer deaths in the last 5 years. These are from 126 houses near Kodenkeri stream. He has detected 4 new cases. The cancer was mainly that affecting blood and liver. A survey by an organisation called Link - Trada of Mangalore also showed 11 cancer deaths in 52 families during the last 5 years in the same area. The other abnormalities detected by Dr. Mohankumar are given below :

Mental Retardation	38
Psychiatric cases	49
Epilepsy	33

Similar abnormalities are recorded from Kumbdaje village also. A random survey gave the following results.

Cancer deaths	-	7
Psychiatric cases	-	9
Epilepsy	-	6

M.R	-	2
Congenital abnormality	-	4
Others	-	7
Total	-	35

The doctor said that skin allergy and asthma were common complaints in the area. He also said that the children in the schools in the affected area have giddiness, nausea and skin trouble after the spraying.

The doctor stated that high rates of infertility and abortion are reported. Four new cases of epilepsy and 11 new cases of paralysis have been reported from Patrone village in Karnataka State, due to spraying of endosulfan.

The doctor said that private cashew planters are not using endosulfan spray. Still their crop is not bad.

The doctor wanted total ban on endosulfan or any other pesticide. He urged detailed medical check-up, compensation to victims and fixing up the responsibility for the malady.

Dr. Sreepathy Kanjanpady said he is practising at Perla. His house is in Padre. He has observed the deaths of honey bees and frogs, immediately after spraying operations. Reptiles move away from sprayed areas. He has also noticed tremors in cattle. Reports of deaths of cattle exposed to spray have been reported. The acute health problems faced by the human beings are head ache, vomiting, giddiness and cramps. Some plantation workers have approached his clinic for treatment after the spraying. With 10 to 15 days after a spray, an increase in cases of skin lesions, visual problems and general debility are seen. The doctor himself got cramps on Dec. 26, 2000 when the last spraying was done. The characteristic smell of endosulfan remains in the air for 10 days in some low areas near the plantations.

Dr. Sreepathy cited a few typical cases:

1. Mr. Nair : Has psychological problems. His wife is highly anaemic, had 3 abortions. The couple has only one child; she is sick, has symptoms of non-secretory endometrium.
2. Sri G. Bairi : Asthma. Daughter gets fever, cough, wheezing. Son (10 months old) has the development of his brain stopped, has convulsions.

3. Sri. K.R. Rao : Leukoderma. Two daughters are childless. Son has brain tumour
Nephew was an M.R.

The Doctor said that there are several families like this where all the members are sick. He wanted a moratorium on "testing the pesticides" on human beings.

8. Educational Institutions

Representations were received from several educational institution urging a ban on aerial spraying.

In the representations from Govt. Higher Secondary School, Padre, signed by 537 students, it was alleged that many students have nausea, bronchitis, eye troubles and skin allergies during and immediately after the spray. Many students are said to be suffering from growth retardation, fits, asthma etc. They showed a table indicating on decline in SSLC results over the years. The students wanted a total ban on endosulfan and provision of medical aid and rehabilitation for the victims.

In the representation signed by the Head master, 9 members of staff and 213 students of SVAUP School, Swarna, Padre, it is alleged that endosulfan is the cause of health troubles experienced by them. They wanted total ban of all pesticides for cashew and treatment for those affected.

The President of PTA of Govt. H.S. Bellur also gave a similar representation. In the memorandum signed by 8 teachers of GUP School, Pothankandam and in another one signed by 109 students of the eco-club of the same school, similar requests were made.

In another memorandum signed by the Principal, 6 teachers and 78 students of Academy Periyé at Periya, it was alleged that endosulfan spray causes epilepsy, cancer, cerebral palsy. They wanted immediate stoppage of endosulfan spraying. The scout teacher and 2 student scouts brought a memorandum signed by HM of AUP school, Bovikkanam, which also contained similar requests.

It is clear from the above that the teachers and the student community are very much concerned about the alleged bad effects of endosulfan spray and this was personally felt by members of the Committee, when they visited the GHS School, Padre.

9. General Public

Several representations were received from the general public, some of them directly and some of them brought by others. Some deposed orally before the Committee.

Sri. Shree Padre, Journalist, Vaninagar, had noticed abnormalities in Padre village from 1977-78. He published features about them in 4 journals, including Kerala Kaumudi in Malayalam, between 1979 and 81. He has produced copies of press cuttings of 3 of them (Annexures 1, 2 and 3). Sri. Shree Padre deposed that there are abnormalities among animals and human beings. He said that similar incidents have been reported from a village near Dharmasthala, where the Karnataka Cashew Development Corporation has been spraying endosulfan aerially from 1985. He said that the workers wash the empty cans of endosulfan in streams. In Jan. 2001, 200 farmers had sent complaints to PCK and the District Collector. Sri. Padre wanted total ban of aerial spraying of all pesticides, medical care and rehabilitation of the affected persons and compensation of the victims. He also wanted the responsibility for the problem should be fixed through an enquiry.

Sri. Shree Padre took the Chairman and Dr. K.P. Aravindan to the surangam in his estate. Surangam gets water filtered through layers of laterite. A large number of people in the area depends on surangam for their water supply. It was stated that some of the surangams are cut into hills which are sprayed with endosulfan.

Sri. Ravindran K.K and 61 others from Pullur-Periya raised apprehensions about the effects on health due to the spraying and wanted the spraying to be stopped.

Fr. Vincent DSouza, Parish Priest, Ukkinadka and 5 others, in their signed affidavits, described the adverse effects of endosulfan on human health, bees, vegetables etc. and wanted a ban on the spraying of endosulfan. Sri. Harinarayan S. of Kumbadje deposed that he was not generally using insecticides. Once when he used endosulfan, he experienced urinary troubles. He also wanted a stop on spraying of chemicals.

Sri. M. Sasidharan gave a representation signed by himself and 106 others of Athooty - Kuppamun Harijan Colony near the Cheemeny plantation. They have stated that they suffer several ailments due to endosulfan. They urged that this pesticide should never be used. Sri. M. Jayakara, Chairman of Stg. Committee of Karadka Gram Panchayath presented a statement by himself and 8 others which urged that human life should not be destroyed by using pesticides.

Sri. Krishna Moorthi, a farmer from Vaninagar and Sri. Venkatram Bhat from Padre in written affidavits stated that bee population has declined considerably in and near the PCK plantations. Sri. Govinda Bhat, teacher, Bovikkanam A.U.P. School stated that he has not used any pesticide in his farms. But he suffers due to the bad effects of endosulfan used in the nearby plantations of PCK. He is not able to pursue his honeybee business due to decline in bee population.

The following farmers deposed in writing that they do not use endosulfan, still they do not find any decline in cashew crop in their plantations.

1. Smt. Seethamma K, Padre
2. Sri. Babu Poojary, Vaninagar
3. Sri. Madhava Bhat, Padre
4. Sri. Y.S. Krishna Sarma, Kasaragod
5. Sri. A.K. Gopolakrishna, Padre village, Baipadithaya
6. Sri. Srikrishna Kashyap, Padre
7. Sri. C.A. Basheer
8. Sri. Govinda Bhat, Bovikkanam

But the following farmers wanted that the ban on endosulfan to be lifted. They asserted that they have not felt any bad effects, but have found endosulfan necessary and useful to control the pests.

1. Sri. K. Krishnan Nair, Kundadukkam, Cherkala
2. Sri. A. Shiva Sankar Rao, Karnataka
3. Sri. Gyanadeva Shenoy, Peredal, Badiyadukka
4. Sri. Thirupathy Kumar, Peredal, Badiyadukka
5. Sri. B Moideen Kunhi, Badiyadukka
6. Sri. Aravind P, Badiyadukka
7. Sri. Abdul Basheer C.A, Kasaragod
8. Sri. Sasi, Kappimala, Kannur

The hand writing in the representations 3, 4, 5 and 6 was the same and all the four representations were brought in one bench.

The Pesticide Manufacturers and Formulators Association also brought some representations in which it was stated that endosulfan is not harmful and it is being used by the farmers.

The Committee received representations from the following persons for medical treatment/compensation. All the representations were forwarded to the Dist. Collector.

1. Sri. Hassan M.A, Kakkedettu
2. Sri. Muhammad, Bellur
3. Sri. Shyam Bhat B, Kirnivgar
4. Sri. Hukrappa Gowda, Bellur

It was noted that among those who deposed in writing and/or orally, a large number is from Padre, the village allegedly most affected by the spraying. A high degree of awareness was noted among them. From the depositions, it was clear that they are afraid that they are not safe from the reported health problems. It was stressed that the practice of spraying endosulfan started first in this area and, therefore, Padre area has been subjected to the longest period of exposure among the PCK areas.

From a detailed study of these depositions, the members of the Committee have found that the ordinary people are very much afraid about the alleged bad effects. They cannot find anything other than aerial spraying of endosulfan as an abnormal activity causing pollution in the area and, therefore, naturally connect this to their health problems. The lackadaisical approach of PCK to the spraying operations and the complaints has added to this.

10. Workers of PCK Plantations

The workers from PCK plantations deposed before the Committee.

1. Rajapuram Estate - Sri. P. Rajagopalan and 11 others
2. Perla Division - Sri. D. Mana Pattali and 24 others
3. Cheemeni Estate - Sri. K. Bhaskaran Nair and 4 others
4. Periya Division - Sri. Chavindiyar and 2 others
5. Adhur Estate - Sri. K. Narayan and 3 others
6. Muliya Division - Sri. Kunhiraman and 3 others

Several of these were working in these estates for more than 30 years. Most of them are staying within the estate area with the members of their family including small children. All of them stated that there are no abnormal health problems among them. They are not covered by E.S.I. There are hospitals in Periya and Muliya, but Doctors are not posted in them. The workers said that they are given masks, gloves etc. But to the question whether they use them, the reply was that they will cover their face with towels. Their experience is that the cashew flowers will wither away if pesticides are not applied. According to some of them, the reasons for the peoples' complaint are land disputes and right of passage through the plantations.

The workers reported that endosulfan has no bad effects and hence, they themselves do not care to cover their own wells during the spraying. But they had asserted that PCK arranges to cover all the wells in the affected area. When asked how can they be serious

about covering others' wells if they themselves do not care to cover their wells, there was no answer.

The depositions by all the groups of workers were more or less similar. Though they said they had no health problems, several of them appeared to be highly anaemic. One of the leaders had his hands shivering.

The general opinion of the public was against aerial spraying of pesticide. Some of them did not oppose ground level spraying.

Out of the 19 villages subjected to aerial spraying, abnormal health problems were reported mainly from Padre village, Enmakaje Panchayath. Health problems were also reported from Muliya and Pullur- Periya Panchayath to a lesser degree. But no cases from other sprayed areas were reported to the committee.

7 . 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 Kasaragod District are all located in the undulating hilly areas (Refer Plan - Annexure 21). The plantations are spread in isolated patches and are intertwined with habitations. The topography 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 Kasaragod town and several Panchayaths. 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 makes 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 has 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 functionaries of the Panchayaths 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 organisations 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 can not be ruled out.
7. There are reports of health problems in three Panchayath 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.

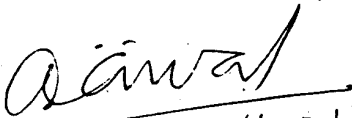
1. Ban aerial spraying of pesticides in all the cashew plantations of PCK Ltd. in Kasaragod District.
2. Use of endosulfan in the PCK plantations of Kasaragod District should be frozen for 5 years.

3. In the cashew plantations in the Perla Division (which includes Enmakaje Panchayath), a total pesticide holiday should be observed for 5 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.
4. In the other plantations of PCK in Kasaragod district, need based ground spraying, (manual or power-operated) of pesticides other than endosulfan may be resorted to, in consultation with research organisations.
5. The pesticide management and plant protection of PCK should be scientifically organised.
6. Research efforts to evolve integrated pest management (IPM) should be augmented.
7. Breeding programme to develop cashew strains resistant to tea-mosquito bug should be undertaken.
8. 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.
9. 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.
10. The Government should take all steps to implement these recommendations and dispel the fears regarding pesticide application.

11. The right to information on the use of pesticides should be respected. The Gram Panchayaths should be given all details, when requested. The apprehensions of the local people regarding the alleged pesticide problem should 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 Gram Panchayath / Panchayaths
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.

Dr. A. Achyuthan
(Chairman)



22-11-01

Sri. L. Sundaresan
(Convener)

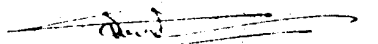
Dr. K.P. Aravindan
(Member)


22/11/01

Dr. M. Abdul Salam
(Member)


22/11/01

Dr. Samuel Mathew
(Member)


22/11/01

Dated 22-11-2001