REPORT
ON
MONITORING OF ENDOSULFAN RESIDUES IN THE 11 PANCHAYATHS OF KASARAGOD DISTRICT, KERALA

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Kerala State Council for Science, Technology and Environment
Sasthra Bhavan, Thiruvananthapuram

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1.0 Introduction

The Government of Kerala has directed the Kerala State Council for Science Technology and Environment (KSCSTE) for monitoring endosulfan persistence in soil, water and blood samples in the selected areas of Kasaragod District and its impacts on human health and environment vide G.O. (MS) No. 1550/20/10/HFW, dated: 09.04.2010 (Annexure I). Besides the members of the duly constituted technical cell, the District Medical Officer of Kanhangad Dr. D'cruz and his office extended their support for the completion of the assignment. A technical cell was constituted by KSCSTE vide Council (M) order No 104/2010/KSCSTE, dated 29/06/2010 with specific terms of references (Annexure II).

The study was necessitated as there was notable environmental and health related issues in these areas after 1970s when aerial spraying of endosulfan, a persistent neurotoxin and endocrine disruptive pesticide, to contain the tea mosquitoes of Cashew plantation was initiated in these areas. It is reported that this has brought in inexplicable human sufferings, loss of life, virtually wiping out biodiversity and, seriously damaging the ecology of the area.

The technical cell in the KSCSTE was constituted with following terms of reference:

a. Prepare a report on the current status of the environment in the area where Endosulfan was sprayed earlier, including an assessment of the residues in soil, water, human blood and the state of biodiversity.
b. Establish protocols for periodic monitoring of changes in endosulfan residues in soil, water and blood and undertake necessary analysis to provide information on the changes at regular intervals.
c. Undertake any other related tasks that may be required in assessing the economic, social and environmental impacts stemming from the past use of endosulfan.

2.0 Location

The study was conducted in the 11 Gramapanchayaths of Kasaragod District (Fig. 1) which are listed below:

1. Badiyaduka
2. Bellur
3. Enmakaje
4. Karaduka
5. Muliyur
6. Kumbadaje

7. Ajanur
8. Kallar
9. Panathady
10. Kayyur – Cheemeni
11. Pullur – Periya

Fig 1: Location Map of the study area

3.0 Methodology

The technical cell discussed in detail about various issues relating to monitoring endosulfan residue and analysing the water, sediment and soil samples of the area. Different study groups were formed to collect soil/sediment/water and blood samples from selected sampling locations and to conduct endosulfan residue analysis in the laboratories of the Centre for Water Resources Development and Management (CWRDM), Kozhikode and the Salim Ali Centre for Ornithology and Natural History (SACON), Anakatty. Assessment of likely changes in biodiversity and socio-economic issues were also taken up by a third group. An overview of the status of endosulfan problems in the area is also attempted (Annexure III). Dr. Jayakrishnan from Kozhikode Medical College has collected human blood samples from the affected persons in the locality to find out persistence of endosulfan. Dr. Jayakrishnan has prepared a report for separately submitting to Govt. of Kerala.

3.1 Sampling and analysis:

a) The soil, sediment and water samples were collected from specific sampling points of the affected Panchayaths. The sampling points were fixed by taking into account of the drainage morphometry, topography and hydrological parameters (Fig. 2).

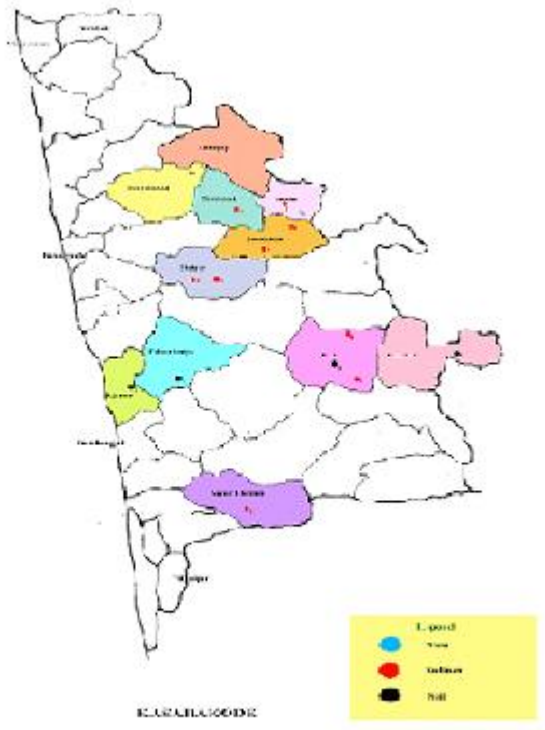

Fig 2: Sampling location map for Endosulfan Analysis in Kasaragod District

Sampling locations/ points were identified and fixed with the help of representatives of NGO's, Panchayath officials and health workers. Standard procedures were adopted in collecting the samples and analyses were done based on a standard protocol developed (Annexure IV). Repeated samplings of water/ soil/ sediments in the area were done to ensure consistency and accuracy in certain cases. Split sample analysis was done in the laboratories of CWRDM and SACON which helped to minimise probable errors.

b) The team constituted for assessing the biodiversity changes has conducted a rapid survey in the area to assess the overall status of plants, fishes, amphibians, honeybees, butterflies, and birds population following standard methods. The study was done in both the areas where endosulfan was sprayed and those areas where no spraying was done. Further, discussions with knowledgeable persons, who have been living in the area for a long time, helped to provide a picture of the biodiversity status prior to the spraying of endosulfan. These were corroborated with the data collected from the areas. Meencha Panchayath, located far away from the area subjected to endosulfan spraying was also covered under the study. An attempt was also made to assess the loss of forest in the district to provide an indirect idea about the ecological changes in the area.. The report on the assessment of biodiversity is given as Annexure V.

c) The socio economic survey of the area was conducted through interviews and discussions with people from diverse backgrounds, including older people (75 persons), President and members of Grama Panchayath (18 persons), political activists (30persons), social and cultural activists (25 persons), officials at Panchayath institutions (10 persons), District Panchayath officials and Kasargod District Panchayath President, District collector and media. The team has also undertaken (i) a socio-economic survey in 181 houses of Kallar Panchayath, (ii) survey among honeybee farmers (50 people) and (iii) survey for evaluating academic performance of schools (2 schools). The report prepared by the group is also given (Annexure VI).

4.0 Results and Discussion

4.1. Water/ Soil and Sediment analysis

A total of 33 water samples were analyzed and the results of the analysis are indicated in Table-1.

Table 1a: Results of Endosulfan Analysis of Water Samples (CWRDM)

Sl. No.	Sample Code	Panchayat	Source of sample	Site Description	Co -ordinates	Total Endo Sulphan CWRDM, (µg/L)
1.	KUM 2	KUMBADAJE	Open well	Inside plantation, Chiparambu	N 12°36.844' E 075° 09.173'	BDL
2.	KUM 3	''	Surangam	Surangam near PCK land	N12^0 34. 989 E075^0 09.160	BDL
3.	KUM 4	''	Stream	Near Mukkur Anganwadi, ephemeral stream end	N 12° 34.744' E 075° 06.958'	BDL
4.	KUM 5	''	Paddy field	Paddy field, Puthrakala	N 12°34.989' E 075°09.160'	BDL
5.	BEL 1	BELLUR	Pond	Pond near the plantation, Adukkaramajalu	N 12°35.535' E 075°11.216'	BDL
6.	BEL 2	''	Pond	Pond outside the plantation valley	N 12°35.532' E 075°10.897'	BDL
7.	BEL 3	''	Pond	Pond in private land	N 12°35.289' E 075°10.396'	BDL
8.	MUL1	MULIYAR	Open well	Well inside Muthalappara Colony	N 12°29' 984'' E 075°05'373''	BDL
9.	MUL 2	MULIYAR	Open well	Well inside Lakshamveedu Colony, Mooladakam	N 12°29.956' E 075°04.918'	BDL
10.	MUL 3	''	Open well	Well inside Alanadaka plantation	N 12°29.338' E 075°05.210'	BDL
11.	MUL 4	''	Quarry	Abandoned quarry near Plantation, Thazhe Alur	N 12° 29.101' E 075°05.568'	BDL
12.	MUL 5	''	Bored well	Near abandoned Quarry	N12^0 29.101 E075^0 05.568	BDL
13.	MUL 6	''	Pond	Jaurykulam (pond) near PCK land	N12^0 29.101 E075^0 05.568	BDL
14.	BAD 1	BADIYADUKA	Stream	Ukkinaduka, kangilla	N 12°37.327' E 075°06.279'	BDL
15.	ENM 1	ENMAKAJE	Surangam	Water and	N12^0 37.23'	BDL

				Sediments from Surangam near Periyal	E075^0 07.596’	
16.	ENM 2	‘’	Stream	Kodengirithodu	N 12° 37.351’ E 075°08.172’	BDL
17.	ENM 4	‘’	Pond	Household drinking water source	N 12°37.921’ E 075°06.911’	BDL
18	ENM 5	‘’	Pond	Pond at Sarpamala Near Galigopuram	N 12°37.923’ E 075°06.709’	BDL
19	KAR 1	KARADUKKA	Pond	Near Minchipadavu Plantation	N12^0 34 717 E075^0 11 420	BDL
20	KAR 2	‘’	Open well	Well in Plantation office perimerter	N 12°34.638’ E 075°12.128’	BDL
21	KAR 3	‘’	Stream	Stream near Minchipadavu plantation	N12^0 34 571 E075^0 12.031	BDL
22	PAN 1	PANATHADI	Stream	Stream near Panathadi PCK	N12° 28’34.4’’ E 075°22’48.3’’	BDL
23	PAN 2	‘’	Plantation tank	Plantation area near Helipad	N 12°27’53.8’’ E 075°23’49.2’’	BDL
24	PER 1	PULLUR PERIYA	Open well	Well inside Plantation	N 12°23’33.9’’ E 075°05’26.7’’	BDL
25	PER 3	‘’	Stream	Stream near PCK land	N12° 23’32.3’’ E 075° 06’03.5’’	BDL
26	PER 4	‘’	Open well	Well near plantation	N12° 23’26.2’’ E 075° 06’02.7’’	BDL
27	KAL 1	KALLAR	Open well	Well near plantation quarters painikkara	N 12°25’44.5’’ E 075°14’51.8’’	BDL
28	KAL 2	‘’	Open well	Well near plantation land	N12° 25’17.7’’ E 075°13’57.0’’	BDL
29	KAL 4		Open well	Well near	N12°	BDL

		‘’		plantation perimeter	25’44.5’’ E 075°14’51.8’’	
30	KAL 7	‘’	Open well	Well near plantaion area	N12° 25’44’’ E 075°15’27.4’’	BDL
31	AJN 1	AJANUR	Stream	Thannothidil Stream	N 12°23’02.1’’ E 075°05’08.8’’	BDL
32	CHE 1	KAYYUR CHEMENI	Pond	Pond in plantation area	N 12°14’05.5’’ E 075°16’40.8’’	BDL
33	CHE 2	‘’	Open well	Well near Velichamthodu, Cheeemeni	N12° 14’07.5 E 075°16.404	BDL

*Note: **BDL** – Below Detection Limit*
Detection Limit: 1 ppb
Concentrations less than 1 ppb have been considered as BDL

Table 1b: Results of Endosulfan Analysis of Water Samples (SACON)

Sl. No.	Sample Code	Panchayat	Source of sample	Site Description	Co -ordinates	Total Endo Sulphan SACON (µg/L)
1.	KUM 2	KUMBADAJE	Open well	Inside plantation, Chiparambu	N 12°36.844’ E 075° 09.173’	BDL
2.	KUM 3	‘’	Surangam	Surangam near PCK land	$N12^0$ 34. 989 $E075^0$ 09.160	BDL
3.	KUM 4	‘’	Stream	Near Mukkur Anganwadi, ephemeral stream end	N 12° 34.744’ E 075° 06.958’	BDL
4.	KUM 5	‘’	Paddy field	Paddy field, Puthrakala	N 12°34.989’ E 075°09.160’	BDL
5.	BEL 1	BELLUR	Pond	Pond near the plantation, Adukkaramajalu	N 12°35.535’ E 075°11.216’	BDL
6.	BEL 2	‘’	Pond	Pond outside the plantation valley	N 12°35.532’ E 075°10.897’	BDL
7.	BEL 3	‘’	Pond	Pond in private land	N 12°35.289’ E 075°10.396’	BDL
8.	MUL1	MULIYAR	Open well	Well inside Muthalappara	N 12°29’ 984’’	BDL

				Colony	E 075°05’373’’	
9.	MUL 2	MULIYAR	Open well	Well inside Lakshamveedu Colony, Mooladakam	N 12°29.956’ E 075°04.918’	BDL
10.	MUL 3	‘’	Open well	Well inside Alanadaka plantation	N 12°29.338’ E 075°05.210’	BDL
11.	MUL 4	‘’	Quarry	Abandoned quarry near Plantation, Thazhe Alur	N 12° 29.101’ E 075°05.568’	BDL
12.	MUL 5	‘’	Bored well	Near abandoned Quarry	$N12^0$ 29.101 $E075^0$ 05.568	BDL
13.	MUL 6	‘’	Pond	Jaurykulam (pond) near PCK land	$N12^0$ 29.101 $E075^0$ 05.568	BDL
14.	BAD 1	BADIYADUKA	Stream	Ukkinaduka, kangilla	N 12°37.327’ E 075°06.279’	BDL
15.	ENM 1	ENMAKAJE	Surangam	Water and Sediments from Surangam near Periyal	$N12^0$ 37.23’ $E075^0$ 07.596’	BDL
16.	ENM 2	‘’	Stream	Kodengirithodu	N 12° 37.351’ E 075°08.172’	BDL
17.	ENM 4	‘’	Pond	Household drinking water source	N 12°37.921’ E 075°06.911’	BDL
18	ENM 5	‘’	Pond	Pond at Sarpamala Near Galigopuram	N 12°37.923’ E 075°06.709’	BDL
19	KAR 1	KARADUKKA	Pond	Near Minchipadavu Plantation	$N12^0$ 34 717 $E075^0$ 11 420	BDL
20	KAR 2	‘’	Open well	Well in Plantation office perimerter	N 12°34.638’ E 075°12.128’	BDL
21	KAR 3	‘’	Stream	Stream near Minchipadavu plantation	$N12^0$ 34 571 $E075^0$ 12.031	BDL
22	PAN 1	PANATHADI	Stream	Stream near Panathadi PCK	N12° 28’34.4’’ E 075°22’48.3’’	BDL
23	PAN 2	‘’	Plantation tank	Plantation area near Helipad	N 12°27’53.8’’	BDL

					E 075°23’49.2’’	
24	PER 1	PULLUR PERIYA	Open well	Well inside Plantation	N 12°23’33.9’’ E 075°05’26.7’’	BDL
25	PER 3	‘’	Stream	Stream near PCK land	N12° 23’32.3’’ E 075° 06’03.5’’	BDL
26	PER 4	‘’	Open well	Well near plantation	N12° 23’26.2’’ E 075° 06’02.7’’	BDL
27	KAL 1	KALLAR	Open well	Well near plantation quarters painikkara	N 12°25’44.5’’ E 075°14’51.8’’	BDL
28	KAL 2	‘’	Open well	Well near plantation land	N12° 25’17.7’’ E 075°13’57.0’’	BDL
29	KAL 4	‘’	Open well	Well near plantation perimeter	N12° 25’44.5’’ E 075°14’51.8’’	BDL
30	KAL 7	‘’	Open well	Well near plantaion area	N12° 25’44’’ E 075°15’27.4’’	BDL
31	AJN 1	AJANUR	Stream	Thannothidil Stream	N 12°23’02.1’’ E 075°05’08.8’’	BDL
32	CHE 1	KAYYUR CHEMENI	Pond	Pond in plantation area	N 12°14’05.5’’ E 075°16’40.8’’	BDL
33	CHE 2	‘’	Open well	Well near Velichamthodu, Cheeemeni	N12° 14’07.5 E 075°16.404	BDL

*Note: **BDL** – Below Detection Limit*
Detection Limit: 1 ppb
Concentrations less than 1 ppb have been considered as BDL

A total of 20 sediment samples and 10 soil samples were analyzed and the results of the analysis are given in Table-2 and Table-3 respectively.

Table 2a: Results of Endosulfan Analysis of Sediment Samples (CWRDM)

Sl. No.	Sample Code	Panchayat	Source of sample	Site Description	Co -ordinates	Total Endosulfan CWRDM µg/Kg
1.	KUM 1 (Depth 25cm)	KUMBADAJE	Open well	Sediment from abandoned dry well, Inside plantation, Chiparambu	N 12°36.844' E 075° 09.173'	BDL
2.	KUM1 (Surface)	"	Open well	Sediment from abandoned dry well, Inside plantation, Chiparambu	N 12°36.844' E 075° 09.173'	BDL
3.	KUM 3 (Surface)	"	Surangam	Surangam Near Plantation	N 12° 34.744' E 075° 06.958'	1.39
4.	KUM 3 (Depth)	"	Surangam	Surangam Near Plantation	N 12° 34.744' E 075° 06.958'	2.48
5.	KUM 4	"	Stream	Sediment, near Mukkur Anganwadi, ephemeral stream end	N 12°34.989' E 075°09.160'	BDL
6.	KUM 5	"	Paddy field	Paddy field,Puthrakala	N 12° 34.989' E 075°09.160'	BDL
7.	BEL2	BELLUR	Pond	Valley near Pallappady	N 12° 35.532' E 075°10'897"	1.33
8.	MUL4	MULIYAR	Quarry	Abandoned quarry near Plantation, Thazhe Alur	N 12° 29.101' E 075°05.568'	1.81
9	MUL 6	"	Pond	Jaaurykulam inside PCK area	$N12^0$ 29.101 $E075^0$ 05.568	3.39
10	PER 2	PULLUR PERIYA	Paddy field	PCK Valley slope	N12° 23'54.9'' E 075°05'53.3''	BDL
11	PER 3	"	Stream	Stream near PCK	N12° 23'32.3'' E 075°06'03.5''	BDL

12	ENM 1	ENMAKAJE	Surangam	Surangam near Periyal	N12^0 37.23' E075^0 07.596'	BDL
13	ENM 2	"	Stream	Stream near Kodengirithodu	N 12° 37.351' E 075°08.172'	BDL
14	CHE 1	KAYYUR CHEMENI	Pond	Water& Sediments	N12° 14'05.5'' E 075°16'40.8''	BDL
15	CHE 3	"	Plantation Area	Sediment from Plantation Area	N12° 40'09.1 E 075°30'44.6	1.34
16	KAL 3	KALLAR	Pond	Pond near Kanhirathody	N12° 25'10.0'' E 075°14'0.9''	5.37
17	KAL 6	"	Valley	Sediment from valley slope	N12° 25'85.1'' E 075°14'60.4''	6.22
18	KAR 1	KARADUKKA	Pond	Pond near Plantation area	N12^0 34 717 E075^0 11 420	1.37
19	KAR 3	"	Stream	Near Minchipadavu Plantation	N12^0 34 571 E075^0 12.031	1.29
20	KAR 4	"	Pond	Sediment from Kaveri Temple pond	N12^0 34 918 E075^0 12 121	1.48

*Note: **BDL** – Below Detection Limit*
Detection Limit: 1 ppb
Concentrations less than 1 ppb have been considered as BDL

Table 2b: Results of Endosulfan Analysis of Sediment Samples (SACON)

Sl. No.	Sample Code	Panchayat	Source of sample	Site Description	Co -ordinates	Total Endosulfan SACON µg/Kg
1.	KUM 1 (Depth 25cm)	KUMBADAJE	Open well	Sediment from abandoned dry well, Inside plantation, Chiparambu	N 12°36.844' E 075° 09.173'	BDL
2.	KUM1 (Surface)	"	Open well	Sediment from abandoned dry well, Inside plantation, Chiparambu	N 12°36.844' E 075° 09.173'	BDL

3.	KUM 3 (Surface)	”	Surangam	Surangam Near Plantation	N 12° 34.744’ E 075° 06.958’	BDL
4.	KUM 3 (Depth)	”	Surangam	Surangam Near Plantation	N 12° 34.744’ E 075° 06.958’	BDL
5.	KUM 4	”	Stream	Sediment, near Mukkur Anganwadi, ephemeral stream end	N 12°34.989’ E 075°09.160’	BDL
6.	KUM 5	”	Paddy field	Paddy field,Puthrakala	N 12° 34.989’ E 075°09.160’	BDL
7.	BEL2	BELLUR	Pond	Valley near Pallappady	N 12° 35.532’ E 075°10’897”	BDL
8.	MUL4	MULIYAR	Quarry	Abandoned quarry near Plantation, Thazhe Alur	N 12° 29.101’ E 075°05.568’	BDL
9	MUL 6	”	Pond	Jaaurykulam inside PCK area	$N12^0$ 29.101 $E075^0$ 05.568	19.69
10	PER 2	PULLUR PERIYA	Paddy field	PCK Valley slope	N12° 23’54.9’’ E 075°05’53.3’’	BDL
11	PER 3	”	Stream	Stream near PCK	N12° 23’32.3’’ E 075°06’03.5’’	BDL
12	ENM 1	ENMAKAJE	Surangam	Surangam near Periyal	$N12^0$ 37.23’ $E075^0$ 07.596’	2.32
13	ENM 2	”	Stream	Stream near Kodengirithodu	N 12° 37.351’ E 075°08.172’	BDL
14	CHE 1	KAYYUR CHEMENI	Pond	Water& Sediments	N12° 14’05.5’’ E 075°16’40.8’’	BDL
15	CHE 3	”	Plantation Area	Sediment from Plantation Area	N12° 40’09.1 E 075°30’44.6	
16	KAL 3	KALLAR	Pond	Pond near Kanhirathody	N12° 25’10.0’’ E 075°14’0.9’’	BDL
17	KAL 6	”	Valley	Sediment from valley slope	N12° 25’85.1’’ E 075°14’60.4’’	4.52
18	KAR 1	KARADUKKA	Pond	Pond near Plantation area	$N12^0$ 34 717 $E075^0$ 11 420	BDL

19	KAR 3	”	Stream	Near Minchipadavu Plantation	N12^0 34 571 E075^0 12.031	3.27
20	KAR 4	”	Pond	Sediment from Kaveri Temple pond	N12^0 34 918 E075^0 12 121	BDL

*Note: **BDL** – Below Detection Limit*
Detection Limit: 1 ppb
Concentrations less than 1 ppb have been considered as BDL

Table 3a: Results of Endosulfan Analysis of Soil Samples (CWRDM)

Sl. No.	Sample Code	Panchayat	Source of sample	Site Description	Co -ordinates	Total Endosulfan CWRDM, µg/Kg
1.	BAD 2	BADIYADUKA	Plantation Area	Soil from a private land near plantation	N 12°37.327’ E 075° 06.279’	BDL
2	BAD 3	BADIYADUKA	Church Compound	PCK Valley slope from	N12^0 37.536 E075^0 05.670’	1.96
3	BEL 4 (Depth 25cm)	BELLUR	Plantation Area	Plantation Area near Hosanamana	N 12° 39.84’ E075° 12.45’	3.61
4	BEL 4 (Surface)	BELLUR	Plantation Area	Plantation Area near Hosanamana	N 12° 39.84’ E075° 12.45’	BDL
5	ENM 3	ENMAKAJE	Plantation Area	Inside Periyal Plantation	N 12° 37.265’ E 075° 7.962’	BDL
6	PER 5	PULLUR PERIYA	Plantation Area	Soil from plantation area	N12°23’39.7’’ E075°05’41.9’	BDL
7	PER 6	PULLUR PERIYA	Plantation Area	Soil from plantation area	N12°23’38.3’’ E075°05’41.4’	16.91
8	KAL 5	KALLAR	Plantation Compound	Soil from Plantation Compound	N12°25’0.796’ E 075°14.794’	1.64
9	PAN 2	PANATHADI	Plantation	Soil and water	N12°27’53.8’’	14.85

			Area	from plantation Tank	E075°23'49.2'	
10	AJN 2	AJANUR	Plantation	Soil from plantation perimeter	N12°23'19.4'' E075°05'27.3'	5.51

*Note: **BDL** – Below Detection Limit*
Detection Limit: 1 ppb, Concentrations less than 1 ppb have been considered as BDL

Table 3b: Results of Endosulfan Analysis of Soil Samples (SACON)

Sl. No.	Sample Code	Panchayat	Source of sample	Site Description	Co -ordinates	Total Endosulfan SACON(µg/Kg)
1.	BAD 2	BADIYADUKA	Plantation Area	Soil from a private land near plantation	N 12°37.327' E 075° 06.279'	1.52
2	BAD 3	BADIYADUKA	Church Compound	PCK Valley slope from	$N12^0$ 37.536 $E075^0$ 05.670'	BDL
3	BEL 4 (Depth 25cm)	BELLUR	Plantation Area	Plantation Area near Hosanamana	N 12° 39.84' E075° 12.45'	BDL
4	BEL 4 (Surface)	BELLUR	Plantation Area	Plantation Area near Hosanamana	N 12° 39.84' E075° 12.45'	25.96
5	ENM 3	ENMAKAJE	Plantation Area	Inside Periyal Plantation	N 12° 37.265' E 075° 7.962'	BDL
6	PER 5	PULLUR PERIYA	Plantation Area	Soil from plantation area	N12°23'39.7'' E075°05'41.9'	BDL
7	PER 6	PULLUR PERIYA	Plantation Area	Soil from plantation area	N12°23'38.3'' E075°05'41.4'	4.23
8	KAL 5	KALLAR	Plantation Compound	Soil from Plantation Compound	N12°25'0.796' E 075°14.794'	20.83
9	PAN 2	PANATHADI	Plantation Area	Soil and water from plantation Tank	N12°27'53.8'' E075°23'49.2'	3.56

10	AJN 2	AJANUR	Plantation	Soil from plantation perimeter	N12°23'19.4'' E075°05'27.3'	BDL

*Note: **BDL** – Below Detection Limit*
Detection Limit: 1 ppb, Concentrations less than 1 ppb have been considered as BDL
The permissible limit for endosulfan in drinking water as per WHO standard is 20 μg/litre (WHO, 2003). EPA's acute reference dose for dietary exposure to endosulfan is 0.015 mg/kg for adults and 0.0015 mg/kg for children. For chronic dietary exposure, the EPA reference doses are 0.006 mg/(kg·day) and 0.0006 mg/(kg·day) for adults and children respectively (US EPA,2002)

The level of endosulfan residues in the water samples is found to be within the permissible limits as per WHO.

Table 4a: Analysis of samples (water/ sediment/ soil) for Endosulfan by CWRDM

Sl. No.	Panchayats	Water samples		Soil samples		Sediment samples		Total samples detected for Endosulfan
		Total no. analyzed	Total no. detected	Total no. analyzed	Total no. detected	Total no. analyzed	Total no. detected	
1	Kumbadaje	4	Nil	Nil	Nil	6	2	2 out of 10
2	Bellur	3	Nil	2	1	1	1	2 out of 6
3	Muliyar	6	Nil	Nil	Nil	2	2	2 out of 8
4	Badiyadukka	1	Nil	2	1	Nil	Nil	1 out of 3
5	Enmakaje	4	Nil	1	Nil	2	Nil	nil out of 7
6	Karadukka	3	Nil	Nil	Nil	3	3	3 out of 6
7	Kayoor Cheemeni	2	Nil	Nil	Nil	2	1	1 out of 4
8	Kallar	4	Nil	1	1	2	2	3 out of 7
9	Panathadi	2	Nil	1	1	Nil	Nil	1out of 3
10	Ajanur	1	Nil	1	1	Nil	Nil	1 out of 2
11	Pullurperiya	3	Nil	2	1	2	Nil	1 out of 7

Table 4b: Analysis of samples (water/ sediment/ soil) for Endosulfan by SACON

Sl. No.	Panchayats	Water samples		Soil samples		Sediment samples		Total samples detected for Endosulfan
		Total no. analyzed	Total no. detected	Total no. analyzed	Total no. detected	Total no. analyzed	Total no. detected	
1	Kumbadaje	4	Nil	Nil	Nil	6	Nil	nil out of 10
2	Bellur	3	Nil	2	1	1	Nil	1 out of 6
3	Muliyar	6	Nil	Nil	Nil	2	1	1 out of 8
4	Badiyadukka	1	Nil	2	1	Nil	Nil	1 out of 3
5	Enmakaje	4	Nil	1	Nil	2	1	1 out of 7
6	Karadukka	3	Nil	Nil	Nil	3	1	1 out of 6
7	Kayoor Cheemeni	2	Nil	Nil	Nil	2	Nil	nil out of 4
8	Kallar	4	Nil	1	1	2	1	2 out of 7
9	Panathadi	2	Nil	1	1	Nil	Nil	1out of 3
10	Ajanur	1	Nil	1	Nil	Nil	Nil	nil out of 2
11	Pullurperiya	3	Nil	2	1	2	Nil	1 out of 7

Details of samples for Endosulfan analysis from the selected panchayaths is given in Table 4.

The pH values determined for selected soil, sediment and water samples are given in Table-5, Table-6 and Table-7 respectively.s

Table 5: pH values for Soil Samples

Sl. No.	Sample Code	Panchayat	Source of sample	pH
1	PER 6	PULLUR PERIYA	Plantation Area	4.68
2	BAD 3	BADIYADUKA	Church Compound	4.88
3	PER 5	PULLUR PERIYA	Plantation Area	4.81
4	AJN 2	AJANUR	Plantation	5.16
5	BAD 2	BADIYADUKA	Plantation Area	5.41

Table 6: pH values for Sediment Samples

Sl. No.	Sample Code	Panchayat	Source of sample	pH
1	CHE 1	KAYYURCHEMENI	Pond	4.42
2	CHE 3	KAYYURCHEMENI	Plantation Area	4.86
3	PER 3	PULLUR PERIYA	Stream	4.86
4	PER 2	PULLUR PERIYA	Paddy field	4.96
5	KAR 1	KARADUKKA	Pond	4.98

Table 7: pH values for Water Samples

Sl. No.	Sample Code	Panchayat	Source of sample	pH
1	MUL 6	MULIYAR	Pond	5.97
2	ENM 1	ENMAKAJE	Surangam	5.82
3	KUM 2	KUMBADAJE	Open well	5.92
4	BEL 3	BELLUR	Pond	5.76
5	ENM 2	ENMAKAJE	Stream	6.00

All the analysed samples reported pH value less than 7(acidic)

4.1.1 Salient observations on Water/ Soil/ Sediment analysis:

A total of 33 water samples were analysed. The detected values of Endosulfan in water samples were below 1ppb and reported as Below Detection Level.

A total of 20 sediment samples were collected from 11 Panchayats. Depth samples were also collected in a few cases. The maximum concentration of Endosulfan detected was in the sample KAL 6 collected from Kallar Panchayat (6.22 µg/Kg). The source of sediment was a valley slope where the runoff water from the nearby plantation area got clogged and settled down.

A total number of 10 soil samples were collected from 11 Panchayaths using an auger at a depth varying from 0-30cm. Out of 10 samples endosulfan was detected in 7 samples. The maximum value for endosulphan in soil was detected by SACON in sample No BEL 4 from BELLUR followed by KAL 5 from Kallar. The values are 25.96 µg/Kg and 20.85 µg/Kg respectively.

CWRDM has reported the maximum value in soil sample PER-6 collected from the Pullur Periya Panchayath, having 16.91 µg/Kg (Endosulfan-alpha =7.38 µg/Kg, Endosulfan-beta=9.53 µg/Kg). The soil was collected from a site inside the Periya plantation area near the

helipad. The site was primarily used for cleaning as well as filling pesticide into the sprayers in the helicopter. This may be the reason for the presence of a comparatively high concentration of Endosulfan in the area. Also beta isomer was found to be present in higher concentration than the alpha isomer.This result showed that degradation of beta Endosulfan was significantly slower than that of the alpha isomer. The presence of high water content and temperature of this area might be the reasons for this anomaly (Ghadiri H, Rose CW, 2001).

From the analysis of the 63 water/ sediment/ soil samples, majority of the samples reported the presence of the alpha-isomer only. This may be because of the chemical conversion of beta- Endosulfan into alpha-endosulfan over a period of time (Hapeman et al.1997; Rice et al. 1997).

The concentration of Endosulfan detected in water samples was comparatively lower than in sediment or soil samples and lie within the permissible limit of 20 μg/L prescribed by WHO. In water, Endosulfan decays at a faster rate with increase in the factors such as temperature and pH (Kaur and Mathur, 1998). Endosulfan is also fairly immobile in soil and is highly persistent (Romeo F. Quijano, MD, 2000; NIOH 2000).

Sorption is considered to be the major route of disappearance from a water body, with volatilization, hydrolysis and biodegradation are minor routes by comparison. The two isomers of Endosulfan express different degradation times in a soil system. The differences in the values of half life of each isomer under different laboratory conditions have been reported by a number of studies. For example, it is reported that under neutral pH conditions (pH7) the alpha isomer has half-life of 88 days, and for the beta isomer it is 40 days. (Miles and Moy, 1979) Under more acidic conditions, these two isomers will persist longer. Endosulfan sulfate, a metabolite of Endosulfan, will also be associated with colloids or particulates, leaving very little freely dissolved in the water. Because Endosulfan and its metabolite are hydrophobic, they will partition to adipose (fatty) tissues of organisms. Subsequently, Endosulfan will bioaccumulate and is transported in the environment by the organism itself and through the food chain from organism to organism.

In the present study all the 63 samples were also analyzed for the Endosulfan sulphate, a degradation product of Endosulfan. The presence of Endosulfan sulphate was not detected in the 33 water samples analyzed and the results of the analysis of 10 soil samples and 20 sediment samples are given in Tables 8 and 9.

Table 8: Results of Endosulfan Sulphate Analysis in Soil Samples

Sl. No.	Sample Code	Panchayat	Source of sample	Site Description	Co -ordinates	Endo Sulphan sulphate, µg/Kg
1.	BEL 4 (Depth 25cm)	BELLUR	Plantation Area	Plantation Area near Hosanamana	N 12° 39.84' E075° 12.45'	1.76

Total no. of samples analyzed: 10 *Detected: 01*

Table 9: Results of Endosulfan Sulphate Analysis in Sediment Samples

Sl. No.	Sample Code	Panchayat	Source of sample	Site Description	Co -ordinates	Endo Sulphan sulphate, µg/Kg
1	KAR 3	KARADUKKA	Stream	Steram near Minchipadavu plantation	$N12^0$ 34 571 $E075^0$ 12.031	1.29

Total no. of samples analyzed: 20 Detected: 01

The sampling location map for endosulfan sulphate in the study area is given in fig. 3

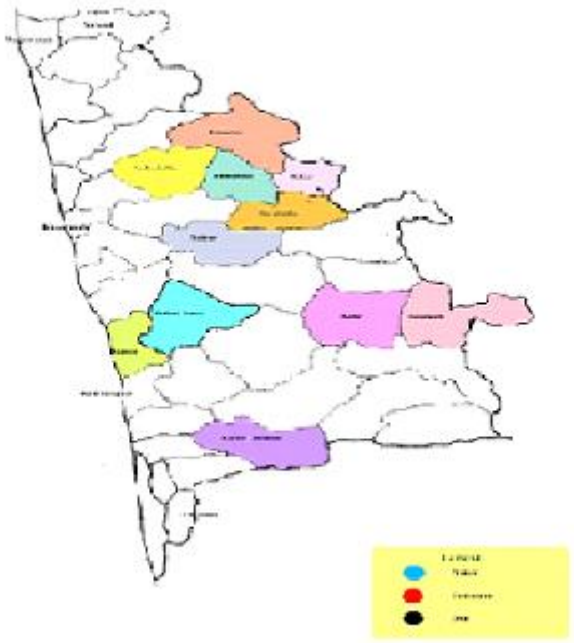

Fig 3: The sampling location map for endosulfan sulphate in the study area

Endosulfan sulphate was detected only in 2 samples (1 soil and 1sediment sample), out of 63 water/ soil/ sediment samples collected. It was detected in the soil sample, BEL-4, collected from Bellur Panchayat. The BEL-4 sample was taken from a site inside the Bellur plantation area. The sample collected from a depth of 25 cm reported a concentration of 1.76µg/Kg, while the surface sample did not detect any Endosulfan sulphate. The same sample had a concentration of 1.85µg/kg of Endosulfan. Endosulfan sulphate is a persistent degraded product of Endosulfan. (Linus Becker, Urs Schenker, Martin Scheringer, 2009)

The sediment sample which detected endosulfan sulphate is KAR-3 from the Karadukka Panchayat with an amount of 1.29µg/Kg It was collected from a stream which received inflow from Karadukka plantation area where the pesticide was reported to be used.

Endosulfan sulphate is of comparable toxicity as its parents and more persistent with half-life of 100-150 days, two or more times longer than its parents. Estimated half-lives for the combined toxic residues (alpha and beta endosulfan plus endosulfan sulphate) range from 9 months to 6 years (US EPA, 2002).

4.2 Biodiversity

The study on biodiversity in the area was done by Dr. V.S. Vijayan, Former Chairman, Kerala Biodiversity Board. His report is given in Annexure III and the salient findings are summarised below:

A. Flora

(1) The endosulfan sprayed area showed a decline in plant diversity between 40 to 70%, particularly of native species, compared to the natural habitat. Some of the conspicuously absent species in the sprayed area are: Hopea ponga, Cinnamomum malabatrum, Premna serratifolia, Ixora polyantha, Nothapodytes nimmoniana, Syzygium carryophyllatum, Desmos lawii, Embelia cheriyan-kottan.

B. Fauna

1) The study area which was rich in faunal diversity, had lost it during spraying of Endosulfan. Large number of wildlife, including, Nilgiri Langur, Tiger, Jackal, Wild Boar, Jungle Cat, Mouse Deer, Mongoose, Squirrels, Flying Fox, Black aped Hare, Sparrow, Parackeets, Crows, Frogs, Honey Bees, Snails were present in the area and they have completely disappeared when spraying commenced.
2) Abnormalities/deformities were recorded in cattle during the aerial spraying of endosulfan.
3) Honey bees which were abundant and a source of income for most farmers, became almost completely absent during the period of spray.
4) Fishes which are common in the streams of the region are fond to be in these areas where endosulfan was sprayed.
5) In the current study, 121 species of birds are recorded; 79 in plantations/homesteads and 94 in natural habitats. 42 species are found only in natural habitats, whereas 52 are common to both habitats and, 27 are recorded only in plantations.
6) Major species of birds missing in the plantations are flycatchers, babblers, and endemics such as Small Sunbird, Crimson throated Barbet, and White bellied Tree Pie. Common birds absent in the plantations are, Fairy Bluebird, Large Cuckoo Shrike, and Large Wood Shrike.

4.3 Socio-Economic Survey

The excerpts from the study conducted by the study group constituted for conducting socio-economic survey (Annexure – VI) are given below:

1. The impact of Endosulfan spraying is evident and measurable in all aspects of life of the people in the area. Adverse effects on environment are very pronounced. Impact of health related problems and the increase in expenditure for the treatment of affected persons had lead to financial problems in many families in the area.
2. Women and children are worst affected, as they are more vulnerable to exposure.
3. Scheduled communities including Koraga's are also severely affected
4. Correlation of academic performance of students in the schools to Endosulfan exposure has shown the existence of memory related problems and learning disorders as reflected in the performance of students in the schools.
5. Taking care of the patients in the household denies women, especially mothers, the opportunities for social interaction, especially considering that the patients require constant attention.

5.0 Recommendations

5.1 General:

(1) This is the first time an effort has been made to assess the level of Endosulfan residues in the environment after stopping its application. For a better understanding of the long term implications of Endosulfan, it is necessary to monitor the level of persistence over a number of years. The present study has provided some useful benchmark information and there is a need to repeat the study to get a better picture of the long term changes.

(2) Considering that level of residues may also be subjected to seasonal variation, the monitoring of persistence of endosulfan in water/ soil/ sediment needs to be conducted in all the seasons.

(3) The monitoring should continue regularly and should be linked with monitoring of endosulfan in human blood samples.

(4) There are other areas in the State where Endosulfan has been applied on a regular basis as a crop protection measure. As such very little information is available on the environmental and human health impacts of such application. There is a need for systematic study on the multifarious impacts of such application and the level of persistence of Endosulfan in the environment. KSCSTE may take up this in collaboration with other organizations.

5.2 Socio Economic issues:

1. Panchayath level food gardens / orchards and value addition for products be developed and implemented as joint initiative with Panchayath. This could be implemented by PCK by providing the land required to grama Panchayath.

2. Home base cottage industries need to be promoted and district level marketing and promotional system to support the cottage industries are to be developed. Vocational training and employment generation by developing capacity for livelihoods and giving priority to the affected families

3. Organic farming should be expanded all over the district by an active district level programme that could be lead by the Agriculture Department, with the support and participation of all stakeholders in accordance with the State farming policy.

4. Regular awareness programme and sharing of progress in implementing remediation programme in grama sabha should be mooted.

5. The Endosulfan still stored in PCK estates are to be located and the same be returned back to manufacturers for safe disposal.

6. Moratorium of loan repayment and other relief measures need to be implemented to ease the financial burden of affected families.

5.2.1 Human Aspects

1. A protocol for identifying victims of Endosulfan should be developed by a team of experts in medicine, toxicology and sociology; local activists and doctors and Panchayat members and Government officials. This would serve the basis for any rehabilitation efforts and this protocol and the list of identified victims should be reviewed every 6 months by the Endosulfan victims relief and rehabilitation cell and the special team

2. An integrated approach for treatment using allopathy, ayurveda and homoepathy may be adopted and the medical team may be constituted for providing integrated medical care to the patients. A lady doctor (especially a gynaecologist) in the mobile medical unit may be included to address the health concerns of the women.

3. To develop further the existing health services available in the health system, especially the National Rural Health Mission. The Accredited Social Health Activist (ASHA), Anganwadi teachers and the Auxiliary nurse midwives (ANM) should be made part of the health team on rehabilitation.

4. Community based rehabilitation centres (CBR) should be created in each village depending on the nature of the terrain. These centres could be the focal point for information, training and health services for the endosulfan victims. A coordinated referral system from the CBR centres to the PHC and the district hospital should be established to prevent any delay in access to health services and to improve availability of calipers, shoes, spectacles or hearing aids and medicines.

5. A system of community based health insurance, the Rashtriya Swasthya Bima Yojana and any other scheme could be pooled to address the medical and health care needs of the victims.

6. The State should be able to reimburse/ support all opportunity costs of care takers over and above the solatium and pensions earmarked. To this effect, the State should earmark specific budget.

7. The case studies of medical care and rehabilitation should be documented and brought out in public domain. This would help in estimating the cost of relief, rehabilitation of a victim of chemical poisoning and help in future policy making and human health impact assessments.

There is need for transparency, democratic functioning and accountability for implementing the above recommendations on rehabilitation.

5.2.2 Economic and ecological assessment of Cashew Plantations

1) A cost – benefit analysis of cashew plantation in Kasaragod in terms of including ecological loss such as (a) damages on the general ecology, (b) impact of deforestation on rivers originating from the lateritic hills, (c) loss of ground water and, (d) a comprehensive analysis of these on local agriculture, economy, livelihood as well as socio-cultural practices. Such a study will also be useful for planning large scale plantations in future.
2) In areas where the forest was removed for plantation, especially in slopes, restoration of forests may be tried to recover the ecology of the area.
3) A five year comprehensive action plan for restoration of natural ecosystems and revival of biodiversity may be launched.

5.2.3. Biodiversity Monitoring

i) A three year multidisciplinary study on biodiversity covering all taxa; data should be collected in all the seasons.

ii) Monitoring of the indicative taxa and ecological parameters every three years following the methods adopted for the baseline study.

iii)Genetic studies on selected local species of birds (Jungle Babbler would be more suitable, as they are highly territorial) to assess the impact of endosulfan in the DNA structure.

(ii, iii, iv to be undertaken by Kerala State Biodiversity Board (KSBB))

5.2.4. Land use

After the lease period, the area should be used for food production depending on the nature of the area. Allotting such lands to the landless victims may also be considered with one condition that they will not use the land for any purpose other than farming.

6.0 Conclusion and Specific recommendation

As per the results obtained by the analysis of Endosulfan in water, soil and sediment samples collected from eleven panchayats of Kasaragod district, it can be concluded that endosulfan is still persistent in selected soil and sediment samples. This can be attributed to the presence of high acidic conditions prevailing in the soil and sediment of the area. The degradation rates of both endosulfan isomers are greatly affected by changes in soil, water content and temperature. Re-application of endosulfan, and day and night fluctuation of temperature had contrasting effects on the degradation of the two isomers and the net effect is the prolonged overall persistence of this chemical in the soil. The half lives for the combined toxic residues of Endosulfan (alpha Endosulfan and beta Endosulfan plus Endosulfan sulfate) as reported by the EPA range from 9 months to 6 years (US EPA, 2002). The results also indicate greater persistence of Endosulfan in soil and sediment samples than water samples because of greater adsorption of endosulfan on the sediment and soil than water. It was found to be below detection limit in water samples. Comparatively high concentrations of Endosulfan detected in the soil is because of the fact that endosulfan is fairly immobile in soil and is highly persistent.

A. Soil and water

A detailed study on the persistence of Endosulfan in soil water and sediment should be carried out covering all the seasons. A continuous monitoring system should be put in place in Kasaragod district to assess the pesticide persistence in the district.

B. Biodiversity

A three year multidisciplinary study on biodiversity covering all taxa; data should be collected in all the seasons. Monitoring of the indicative taxa and ecological parameters every three years following the methods adopted for the baseline study. Genetic studies on selected local species of birds (Jungle Babbler would be more suitable, as they are highly territorial) to assess the impact of endosulfan in the DNA structure.

C. Human aspects

An integrated approach of treatment using allopathy, ayurveda and homoepathy may be adopted by constituting the medical team for the above and also providing integrated medical care to the patients The National Rural Health Mission, The Accredited Social Health Activist (ASHA), Anganwadi teachers and the Auxiliary nurse midwives (ANM) should be made part of the health team on rehabilitation. Community based rehabilitation centres (CBR) should be created in each village depending on the nature of the terrain. These centres could be the focal point for information, training and health services for the endosulfan victims. A coordinated referral system from the CBR centres to the PHC and the district hospital should be established to prevent any delay in access to health services, implements like calipers, shoes, spectacles or hearing aids and medicines. The report prepared by the group is also given (Annexure VII).

EXECUTIVE SUMMARY

This report on "Monitoring of endosulfan residues in the 11 Panchayaths of Kasargod District Kerala" has been prepared in response to the direction from the Government of Kerala to assess the levels of the pesticide in soil, water and blood samples and its impacts on human health and environment. A Technical Cell was established to undertake the study and the Cell was requested to:

- Prepare the current status of the environment in the area,
- Establish protocols for periodic monitoring of changes in endosulfan residues in soil, water and blood;
- Undertake any other related tasks for assessing the economic, social and environmental impacts.

The study was conducted in the 11 Grama Panchayaths of Kasargod District, viz, Badiyaduka, Bellur, Enmakaje, Karaduka, Muliyar, Kumbadaje, Ajanur, Kallar, Panathady, Kayyur-Cheemani and Pullur-Periya. The technical cell discussed the various issues relating to monitoring endosulfan residues and analysing the water, sediment and soil samples of the area. Different study groups were formed to collect soil/sediment/water and blood samples from selected locations and to conduct endosulfan residue analysis from CWRDM, Kozhikode and SACON, Anakatty. Assessment of likely changes in biodiversity and socio-economic issues were also attempted by a third group.

Dr. Jayakrishnan from Kozhikode Medical College has conducted the study on endosulfan residues in blood samples from the affected persons and prepared a separate report.

The soil, sediment and water samples were collected from specific sampling points of the affected Panchayaths by taking into account of the hydrogeological features and prevalence of endosulfan related health problems. Identification of sampling points was done with the help of NGO's, Panchayath officials and health workers. Standard procedures were adopted in collecting samples and the analyses were done based on a standard protocol developed. Repeated samplings of water/soil/sediment and analyses were conducted to ensure consistency and accuracy of data in certain cases. Assessment of biodiversity changes is also attempted in the

area taking into account the overall status of plants, fishes, amphibians, honeybees, butterflies and bird population. The study was done both in endosulfan sprayed area and area where endosulfan was not sprayed. The socio-economic survey of the area was conducted through interviews and discussions with people from diverse background. The main findings are summarised below:

Persistence of endosulfan

- A total of 33 water samples collected from the selected sampling points in the area are found to contain endosulfan below 1ppb and reported as Below Detection Level.
- A total of 20 sediment samples were collected from 11 Panchayaths. Depth samples were also collected in certain instances. The maximum concentration of endosulfan detected was in the sample KAL 6 collected from Kallar Panchayath (6.22µg/Kg). The source of sediment was a valley slope where the runoff water from the nearby plantation area got clogged and sorted down.
- A total number of 10 soil samples were collected from 11 Panchayaths from an average depth varying from 0-30 cm. Out of 10 samples endosulfan was detected in 6samples. The maximum value for endosulfan in soil was detected by SACON in sample number BEL 4 (25.96 µg/Kg) from Bellur followed by KAL 5 from Kallar (20.85 µg/Kg).
- In the total analysis of 63 water/sediment/soil samples, majority of the samples reported the presence of the alfa-isomer only, which may be attributed to the chemical conversion of beta endosulfan into alfa endosulfan over a period of time. The concentration of endosulfan in water samples was comparatively lower than in sediment/soil samples and lie within the permissible limit of 20 µg/l prescribed by WHO.
- Endosulfan decays at a faster rate in water with increase in the factors such as temperature and humidity. Endosulfan is fairly immobile in soil and is highly persistent. Sorption is considered to be major route of disappearance from a water body, with volatilization, hydrolysis and biodegradation are minor routes. In the present study all the 63 samples were also analysed for the endosulfan sulphate, a degradation product of endosulfan.

- Endosulfan sulphate was found to be absent in water samples while present in 1 each of soil and sediment samples collected (soil sample collected from Bellur and sediment from Karadukka plantation area).

Biodiversity

- The biodiversity studies revealed a decline in plant biodiversity between 40-70% particularly of native species. Faunal biodiversity also followed the same trend. Honeybees, fishes and birds are also adversely affected.

Socio-economic aspects

- The impact of endosulfan spraying was evident in the socio-economic survey conducted. Impact of health related problems and the increase in expenditure for the treatment of affected persons had lead to financial problems in many families in the area. Women and children are worst affected. The academic performance of students in the schools found to be affected.

Recommendations

The recommendations of the study include monitoring the level of persistence of endosulfan during the next few years taking advantage of the benchmark information generated by the present study. The study also indicates the need for a more comprehensive multi-disciplinary assessment of biodiversity so that the actual long term impacts are better understood. The fact that Endosulfan and other pesticides continue to be used underpins the need for such comprehensive assessment.

കേരള സർക്കാർ

സംഗ്രഹം

032194

ആ.കു.വ. - കാസർഗോഡ് ജില്ലയിലെ എൻഡോ സൾഫാൻ ദുരിതബാധിതരുടെ ചികിത്സയ്ക്കും പുനരധിവാസത്തിനുമുള്ള ധനസഹായം അനുവദിച്ചത് - ഭരണാനുമതി നൽകി ഉത്തരവ് പുറപ്പെടുവിക്കുന്നു.

ആരോഗ്യ കുടുംബക്ഷേമ (ജി) വകുപ്പ്

സ.ഉ.(സാധാ) നമ്പർ. 1550/2010/ആകുവ തീയതി, തിരുവനന്തപുരം, 9.4.2010.

പരാമർശം:- 5.3.2010-ലെ ജി.ഒ.(എം.എസ്.) നം. 88/10/ആർ.ഡി നമ്പർ ഉത്തരവ്.

ഉത്തരവ്

കാസർഗോഡ് ജില്ലയിലെ എൻഡോ സൾഫാൻ ദുരിതബാധിതർക്ക് ചികിത്സയ്ക്കും പുനരധിവാസത്തിനും വേണ്ടി ആരോഗ്യ വകുപ്പ് ഡയറക്ടർക്ക് 1,25,00,000/- രൂപയും (നൂറ്റിഇരുപത്തിയഞ്ച് ലക്ഷം രൂപ മാത്രം) ഭാരതീയ ചികിത്സാ വകുപ്പ് ഡയറക്ടർക്ക് 3,00,000/- രൂപയും (മൂന്ന് ലക്ഷം രൂപ മാത്രം) മുഖ്യമന്ത്രിയുടെ ദുരിതാശ്വാസ നിധിയിൽ നിന്നും അനുവദിച്ച് മേൽ പരാമർശം മുഖേന ഉത്തരവ് പുറപ്പെടുവിച്ചിരുന്നു.

2. ആരോഗ്യ വകുപ്പ് ഡയറക്ടർക്ക് അനുവദിച്ച 125 ലക്ഷം രൂപയിൽ നിന്നും ആലോപ്പതി, ആയുർവേദ, ഹോമിയോ ഡോക്ടർമാർ, സ്റ്റാഫ് നേഴ്സ്, നേഴ്സിംഗ് അസിസ്റ്റന്റ്, ഹോസ്പിറ്റൽ അറ്റൻഡന്റ് എന്നിവർ ഉൾപ്പെടുന്ന മൊബൈൽ മെഡിക്കൽ ടീമിലെ ഉദ്യോസ്ഥരുടെ ശമ്പളവും ഡ്രൈവർ ഉൾപ്പെടെ വാഹനം വാടകക്കെടുക്കുന്നതിലേക്ക് വേണ്ടി വരുന്ന ഒരു വർഷത്തെ ചെലവിലേക്കും 20 ലക്ഷം രൂപ അനുവദിച്ച് ഉത്തരവാകുന്നു. പ്രസ്തുത മൊബൈൽ ടീം ഒരു ദിവസം ഒരു പഞ്ചായത്ത് എന്ന കണക്കിന് എൻഡോ സൾഫാൻ ബാധിത പ്രദേശങ്ങളായ 11 ഗ്രാമപഞ്ചായത്തുകൾ സന്ദർശിക്കേണ്ടതും ആവശ്യമായ വൈദ്യ സഹായങ്ങൾ നൽകേണ്ടതുമാണ്. കൂടാതെ ആരോഗ്യ വകുപ്പ് ഡയറക്ടർക്ക് അനുവദിച്ച 125 ലക്ഷം രൂപയിൽ നിന്നും കാസർഗോഡ് ജനറൽ ആശുപത്രിയിൽ ഫിസിക്കൽ മെഡിസിൻ & റീഹാബിലിറ്റേഷന്റെ ഒരു യൂണിറ്റ് തുടങ്ങുന്നതിലേക്ക് ആവശ്യമായ ഡോക്ടർമാരുടെയും മറ്റ് അനുബന്ധ ഉദ്യോഗസ്ഥന്മാരുടെയും ഒരു വർഷത്തെ ശമ്പളയിനത്തിൽ 17.5 ലക്ഷം രൂപയും വാർഡ് സജ്ജീകരിക്കുന്നതിന് 5 ലക്ഷം രൂപയും യൂണിറ്റിന് ആവശ്യമായ യന്ത്രസാമഗ്രികളും ഉപകരണങ്ങളും വാങ്ങുന്നതിനുള്ള ചെലവിനത്തിൽ 37.5 ലക്ഷം രൂപയും അനുവദിക്കുന്നു. കൂടാതെ എൻഡോ സൾഫാൻ ബാധിതരിൽ ഓപ്പറേഷനും പ്രത്യേക ചികിത്സയും ആവശ്യമായവരെ പരിയാരം മെഡിക്കൽ കോളേജിലേക്കും കൊണ്ടുപോകാൻ

മെഡിക്കൽ കോളേജിലേക്കും റഫർ ചെയ്യുമ്പോൾ ആവശ്യമായ യാത്രാ ചെലവുകൾ വഹിക്കുന്നതിലേക്ക് എൻഡോ സൾഫാൻ വിക്റ്റിംസ് റമഡിയേഷൻ സെല്ലിന്റെ ചെലവിലേക്കായി 15 ലക്ഷം രൂപയും, മണ്ണ്, ജലം, രക്തം എന്നിവയിൽ അടങ്ങിയിട്ടുള്ള എൻഡോ സൾഫാന്റെ അളവ് കാലാകാലം കണ്ടുപിടിക്കുന്നതിനുള്ള ചെലവിലേക്ക് 10 ലക്ഷം രൂപ സെന്റർ ഫോർ സയൻസ് & ടെക്നോളജിക്കും 10 ലക്ഷം രൂപ കോഴിക്കോട് മെഡിക്കൽ കോളേജിലെ കമ്മ്യൂണിറ്റി മെഡിസിൻ വിഭാഗത്തിനും എൻഡോ സൾഫാൻ മേഖലയിലെ ജനിതക പഠനത്തിനായി തിരുവനന്തപുരത്തെ രാജീവ്ഗാന്ധി ഇൻസ്റ്റിറ്റ്യൂട്ട് ഓഫ് ബയോ ടെക്നോളജിയെ ഏർപ്പെടുത്തുന്നതിലേക്ക് വേണ്ടിവരുന്ന ചെലവിനത്തിൽ 10 ലക്ഷം രൂപയും അനുവദിച്ച് ഉത്തരവാകുന്നു.

ആയുർവേദ വകുപ്പിന് അനുവദിച്ച 3 ലക്ഷം രൂപ എൻഡോ സൾഫാൻ ബാധിത പഞ്ചായത്തുകളിൽ രണ്ടിടത്ത് താല്ക്കാലിക ആയുർവേദ ഡിസ്പെൻസറി തുടങ്ങുന്നതിന് ആവശ്യമായ ചെലവിലേക്കും അനുവദിച്ച് ഉത്തരവാകുന്നു.

ആരോഗ്യ വകുപ്പ് ഡയറക്ടറും ഭാരതീയ ചികിത്സാ വകുപ്പ് ഡയറക്ടറും പ്രസ്തുത തുകയുടെ വിനിയോഗം സംബന്ധിച്ച റിപ്പോർട്ട് യഥാസമയം നൽകേണ്ടതാണ്.

(ഗവർണറുടെ ഉത്തരവിൻ പ്രകാരം)

മനോജ് ജോഷി,
ഗവൺമെന്റ് സെക്രട്ടറി

പ്രിൻസിപ്പൽ സെക്രട്ടറി, റവന്യൂ വകുപ്പ്
സെക്രട്ടറി, ഭക്ഷ്യ പൊതുവിതരണ വകുപ്പ്
അഡീഷണൽ ചീഫ് സെക്രട്ടറി, ധനകാര്യ വകുപ്പ്
സെക്രട്ടറി, സാമൂഹ്യക്ഷേമ വകുപ്പ്.
സെക്രട്ടറി, കൃഷി വകുപ്പ്.
സ്റ്റേറ്റ് മിഷൻ ഡയറക്ടർ, എൻ.ആർ.എച്ച്.എം.
ആരോഗ്യ വകുപ്പ് ഡയറക്ടർ, തിരുവനന്തപുരം.
ഭാരതീയ ചികിത്സാ വകുപ്പ് ഡയറക്ടർ, തിരുവനന്തപുരം.
ഹോമിയോ ഡയറക്ടർ, തിരുവനന്തപുരം.
സ്റ്റോക്ക് ഫയൽ/ഓഫീസ് കോപ്പി.

ഉത്തരവിൻ പ്രകാരം.

സെക്ഷൻ ഓഫീസർ

മേൽ ഉത്തരവ് no. പി.ഐ3/20908/2010 ആ.കു.ഡ. തിയതി. 28/4/2010
നടപ്പാക്കൽ നടപടികൾക്കായി സർക്കാർ ഉത്തരവിന്റെ പകർപ്പ് തിരുവനന്തപുരം സെന്റർ ഫോർ സയൻസ് ആൻഡ് ടെക്നോളജിക്ക് നൽകുന്നു. (ശാസ്ത്രഭവൻ, പട്ടം, തിരുവനന്തപുരം)

ആരോഗ്യവകുപ്പ് ഡയറക്ടർക്ക് വേണ്ടി

KERALA STATE COUNCIL FOR
SCIENCE, TECHNOLOGY AND ENVIRONMENT

KSCSTE – Endosulfan persistence in Kasaragod and its impacts on human health and environment at Kasaragod – Constitution of a technical cell to design and implement the study – sanctioned - Orders issued.

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Council (M) order No. 104/2010/KSCSTE Dated, Thiruvananthapuram, 29.06.2010

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Ref:- (1) G.O. No. 1550/2010/H&FW, dated: 09.04.2010

ORDER

As per G.O. No. 1550/2010/H&FW, dated: 09.04.2010 the Govt. has sanctioned an amount of Rs. 10,00,000/- (Rupees Ten lakh only) to Kerala State Council for Science, Technology and Environment for monitoring endosulfan persistence in Kasaragod and its impacts on human health and environment.

A preliminary discussion was held on the issue of monitoring endosulfan persistence at Kasaragod and it was decided to constitute a technical cell to design and implement the study as required by G.O. No. 1550/2010/H&FW, dated: 09.04.2010.

In the above circumstances, the Council is pleased to constitute a technical cell consisting of the following:

1. Dr. Ajayakumar Varma - Chairman
   Member Secretary, KSCSTE

2. Dr. V.S. Vijayan - Member
   Former Chairman
   Kerala State Biodiversity Board

3. Dr. S. Muralidharan - Member
   Head
   Division of Eco-toxicology
   Salim Ali Centre for Ornithology &
   Natural History (SACON), Anaikatty
   Coimbatore-641108, Tamilnadu

4. Dr. C Jayakumar - Member
   Director of Thanal
   Thanal, L-14, Jawahar Nagar, Kowdiar P.O,
   Thiruvananthapuram - 695 003, Kerala.

5. Prof. (Dr.) Chandramohana Kumar. N. - Member
   Professor & Head
   Department of Chemical Oceanography
   Cochin University of Science & Technology
   Fine Arts Avenue,Cochin-682 016

6. Dr. P. Jayakrishnan - Member
   Assistant Professor
   Department of Community Medicine
   Kozhikode Medical College
   Kozhikode

7. Mr. Purushan Eloor - Member
   Clean Production Centre, Janajagratha
   Eloor Depo, Udyogamandal – 683 501

8. Dr. Sukanya - Member
   Community Health Cell
   85/2, First Main, Maruthi Nagara
   Bangalore, Karnataka – 560 068

9. Shri. Madhavan Nambiar - Member
   Co-ordinator
   Endosulfan Victim Relief & Remedial Cell
   District Panchayath Office (Civil Station),
   Vidyanagar, Kasaragod

10. Dr. P.S. Harikumar - Member
    Scientist
    CWRDM, Kozhikode

11. Dr. Kamalakshan Kokkal - Member Convenor
    Joint Director, KSCSTE

The technical cell will undertake the following tasks:

a) Prepare a report on the current status of the environment in the area where Endosulfan was sprayed earlier, including an assessment of the residues in soil, water and human blood and the state of biodiversity.

b) Establish protocols for periodic monitoring of changes in endosulfan residues in soil, water and blood and undertake necessary analysis to provide information on the changes at regular intervals.

c) Undertake any other related tasks that may be required in assessing the economic, social and environmental impacts stemming from the past use of endosulfan.

(Dr. C.T.S. Nair)
Executive Vice President

To
All Concerned
Copy to: PS to EVP, CA to MS, CoA, AO, FO
Stock File/Office Copy

Annexure - III

STATUS OF THE ENDOSULFAN DISASTER

Dr. C Jayakumar
Director of Thanal
Thanal, Thiruvananthapuram

In brief

The endosulfan case of Kasaragod district, Kerala, India is now well known to everyone. It is considered by many experts in the field of community health and toxicology as one of the worst pesticide disasters. This extended tragedy occurred due to a constellation of reasons that included the recommendation of the use of the pesticide in a populated, water body rich, and hilly area. Also, the application procedure was conducted by aerially spraying endosulfan over the cashew plantations, which was done for a period of 20 years by the Plantation Corporation of Kerala, without monitoring its collateral impacts. This also opened up discussions on pesticide use and safety in the context of conditions of use and in addition to that the unethical behavior of manufacturer's.

After several studies, court cases and years of public protests, the High court of Kerala banned the sale and use of endosulfan within state borders in the year 2003. The magnitude and the nature of the health problems and damage to environment in the area were brought to the notice of the government by the local people and various organizations like, Smt.Leelakumari, Prof.M.A.Rahman, Thanal, Endosulfan Spray Protest Action Committee (ESPAC), Punchiri Sports and Arts Club, Muliyar and Endosulfan Virudha Samithi Kasaragod. This led the government to setup the Endosulfan Relief and Remediation Cell in the year 2007, and since then this body has been working under the Kasaragod Zilla Panchayath (Local Self government at the District level) to give some relief to the affected people. Non-governmental rganizations and individuals from the region are also working for the welfare of the affected communities in their own ways.

History of the disaster

The aerial spraying of endosulfan over the cashew plantations in Kasaragod was initiated in 1978 after some trials in PCK estates. The recommendation for aerial spraying was to save labour cost as it is estimated that one day aerial spraying can save about 500 man days. The spraying was

done three times a year covering areas under 11 Gramapanchayaths (Local Self Government at the village level) in Kasaragod district. Right from the start there were many warning signals, including the mass deaths of bees, fishes, frogs, birds and foxes. The situation progressed to congenital deformities in newborns of domestic animals. Independent health observations by a local doctor, Dr. Y.S. Mohankumar revealed that there was a rising incidence of cases of mental illness and congenital anomalies in Kasaragod. He initially considered the possibility of heavy metal or radioactive contamination of the surface water in the area as some of the health disorders occurred more frequently in the people staying near the water sources. He wrote a letter about this to the Indian Medical Association and it was subsequently published in their journal. He appealed to researchers to conduct a study in the area and also took action by writing to the media and other doctors.

The struggle of the villages

Since 1979 there had been outcry from local residents, farmers and media concerning the health effects of the pesticide spraying. The first article published on this issue was in English and Kannada languages in 1979 by Sri. Shree Padre. This was followed by several reports and concerns in the local media and demands to stop aerial sprayig by voluntary organizations. Smt.Leelakumari Amma, a resident of Kasaragod, was an employee at the Krishi Bhavan (Agriculture Department's office at the village level) at Periya. She shifted with her family to an area, which happened to be affected by the aerial spraying of endosulfan, and soon afterwards her children suffered from loss of voice and hormonal problems. She lodged a complaint at the local court along with couple of other farmers to stop the aerial spraying in the interest of the people's health and the environment. Her efforts bore fruit when a Sub-court temporarily stopped the spraying of endosulfan in Pullur -Periya Panchayath in 1998. This was a crucial moment in the campaign against the aerial spraying of endosulfan. Such efforts from civil society members gave the necessary boost for the rest of the community to raise their voices.

Several national and international groups conducted health and toxicological studies between 1998 and 2005; and arrived at the conclusion that the unusual health problems at Kasaragod were due to endosulfan. The commonly noted diseases were neurobehavioral disorders, congenital malformations in newborn females and abnormalities of reproductive tract in males1. Another report showed increased rates of cancers and gynecological abnormalities as well2. The Kerala State health department also conducted medical camps later on in various regions and

subsequently conducted a study. This report reaffirmed the connection between endosulfan and the health problems in Kasaragod. In 2002 the Kerala High Court banned the sale and use of endosulfan in Kerala, and following this the State Government also issued a ban order in 2003. Local efforts for relief and rehabilitation started at Kasaragod with the help of the local Panchayath, local organizations and the Medical institutions in 2003. In 2005 the Central Government issued an order that the labels on the pesticide bottles must carry a message that this pesticide is not for sale in Kerala.3 This order does not seem to have been implemented by the Central Government effectively. Facilitated by Thanal and the Kasaragod Zilla Panchayath, a consultative workshop was conducted in August 2005, which was attended by various health experts and social workers to formulate a plan to bring the relief and rehabilitation package to reality. The Special Purpose Cell for Implementing Relief, Remediation and Rehabilitation was set up by 2007 with the support of the State Government of Kerala. It is an independent body with Zilla Panchayath President, Chairperson and District Collector as convener of the Cell which looks into all aspects of the relief work – health, social, environmental, policy and financial. There are limitations in terms of fund raising and covering the entire area and population but the cell is making very good effort in coordinating the relief and remediation work. Recently the State Government has set up additional coordination mechanism with State Health Department monitoring the remediation and relief work and a Deputy Collector is the coordinating officer at the District Collectorate. The State Government is also drawing a detailed package for compensation and remediation. In the meantime District Medical Officer has started special efforts to health remediation. District administration, SSA,ICDS, NPRPD and all other district level departments are also actively involved in one way or the other.

Chronology of reports and events in the endosulfan tragedy – Kasaragod

Even before the Kasaragod incident came into limelight, there were attempts from the pesticide regulating agency, the Central Insecticides Board (CIB) to restrict the use of Endosulfan. But all these attempts failed, possibly in the wake of efforts by the pesticide lobbies to continue the use of endosulfan. The court cases that were fought in the Kasaragod issue brought to the table many of these matters. In 1989, the Central Insecticides Bureau, the agency mandated to regulate pesticide use in India, appointed committee under the chairmanship of **Dr. Banerjee** to review the continuing use of some of the pesticides. The committee had Endosulfan also in the list of pesticides to review.

While giving its nod for continued use, the committee recommended that "the Registration Committee should not allow the use of Endosulfan near rivers, lakes, sea and ponds, which are expected to be polluted". This was upon recognition that Endosulfan was a highly aquatic toxic chemical. The committee also recommended putting this in the certificate of registration as a condition and a warning on the labels and leaflets in the containers. These recommendations were never implemented.

In 1999, the CIB appointed one more committee under the chairmanship of **Dr R.B. Singh** to do the same old task of reviewing the use of pesticides including endosulfan. This committee found that none of the recommendations for restrictions on endosulfan by the Dr.Banerjee Committee were implemented. Subsequently, the R B Singh committee also recommended that the restrictions on use near water bodies be implemented, and that it be put on the labels. Dr. R.B. Singh Committee also recommended that endosulfan should not be sold in small packets and the minimum container size must be 1kg, so as to avoid misuse. Incidentally, none of these restrictions have been implemented even today. This is despite the fact that both the Registration Committee (195th) and the Inter ministerial committee (10th) to review the use of Insecticides and hazardous chemicals also recommended implementation.

The above-mentioned restrictions were important, especially considering the ecology of Kasaragod. It is a land full of small ponds, rivulets, streams, wells and water harvesting systems such as surangas and tanks in almost all homes. One can be sure that no aerial spraying would be possible without contaminating these water bodies. Even ordinary hand spraying would be dangerous. Had these recommendations been implemented in 1991, the misery that the people of Kasaragod now suffer could have been avoided to a considerable extent. But the vested interest and callousness of a few scientists, officials and the huge chemical pesticide industry prevailed over the possibility of saving the lives of thousands of villagers.

1979-80

Shree Padre is a local farmer and an active freelance Journalist based in Vaninagar in Enmakaje Panchayath. He is the founder editor of a unique farm monthly magazine in Kannada, Adike Patrike. Way back in 1979 – 80, he had investigated and written articles in English, Malayalam and Kannada newspapers about the negligent way in which endosulfan was being aerially sprayed. He found that it had resulted in the birth of four calves in a farmers (Somaje Mahalinga Bhat, Enmakaje) house with deformed limbs. He also found symptoms of stunted growth among

cattle. The articles have raised the suspicion that it is the pesticide Endosulfan that has caused this. This was the first evidence that Endosulfan was causing physical deformities in life forms exposed to it.

1997

Dr YS Mohan Kumar, who is a local MBBS doctor conducting private practice in Vaninagar in Enmakaje Panchayath, was puzzled on realizing that there is a large incidence of Central Nervous System related ill- heaths, cancer etc in Padre. He wrote to the *Kerala Medical Journal* in February 1997 about this trying to draw the attention of medical researchers to this. While writing this letter, he had no idea about the factors causing this high incidence of ill-health but found that people staying around Kodenkari stream were having the highest incidence of diseases.

1998 - 2000

Smt. Leelakumari Amma, who was working as an *Agricultural Assistant* in Periya Krishi Bhavan, Kasaragod district raised the first voice against ill-effects on human health as a result of aerial spray of Endosulfan in Kasaragod district. Period: 1998 – 2000. For her, there were more reasons than one to do so. She had recently moved into her own new house in Periya which was almost stones-throw distance from the cashew plantations of PCK (Plantation Corporation of Kerala). First and foremost, her son who was studying in 8th standard, who always stood first in music competitions started losing his voice. Within a year his male voice sounded as feminine one and subsequently he became reluctant to go to school. Earlier, Leelakumari Amma's brother who supervised the construction of this house for her died soon after the house was occupied due to some strange illness. When she enquired, 12 of her neighbors told that they too were experiencing similar health problems. This prompted Leelakumari to file a complaint with PCK asking them to exempt spraying from near houses. The General Manager of PCK and other officers, instead of studying the problem started threatening her. The PCK also filed complaint against Leelakumari Amma and 12 others in the police station accusing them in false case. In November 1998, Leelakumari Amma's also started losing her voice. By his time PCK had announced another aerial spray. Leelakumari complained to Principal Agriculture Officer, State Pollution Control Board etc, but in vain. Finding no other way to stop spraying, spending from her hard-earned money, she approached an advocate at Kanhangad and filed a case in the Hosdurg Munsiff Court against PCK to asking for a stay of the spray and related operations .The

grounds on which the case was filed was under article 21 of Indian constitution and the court stayed the spraying operations in the area. PCK went to District Court, which upheld the judgment of the Munsif court. PCK then moved to Kerala High Court and started issuing press statements that Rs 75 lakhs would be sought as compensation from her. By this time, she had exhausted all her savings and was finding it difficult to fight the case. Some local people joined her along with THANAL and other environment and social organizations.

1999

Thanal submitted the first report of documentation and observation of health disorders to the district collector and asked to ban aerial spraying and suspending the endosulfan use. This report was limited to Pullur Periya Panchayath. The report looked at the conditions in the area and argued how Indian insecticide act will be violated and thus asked for stopping of the aerial spraying.

2000

Kerala Sastra Sahithya Parishith (KSSP) KSSP responded to the debate by undertaking an extensive survey of houses with in 500m from the plantation and they covered over 4000 houses and found that over 750 houses report health disorders. This was also the first survey which documented the impact on environment . This was also the first assessment of the health and environmental impact in the entire plantation areas in the district as all the previous studies was limited to a few Panchayths. **Punchiri Sports and Arts Club, Muliyar** continued the fight further in and around Muliyar. On hearing that Leelakumari Amma got a stay against spraying (the stay was limited to Periya); they also filed a case, but couldn't succeed. Earlier to this, they represented to PCK and held a series of meetings and protests against aerial spray. They assembled to protest against aerial spraying in December 2000. They were arrested and released. Since then, they started the campaign and efforts for relief of the local people. **Endosulfan Spray Protest Action Committee (ESPAC),** Perla on December 26th, 2000 represented by a few farmers, youngsters and some villagers protested against endosulfan spraying and told PCK that they won't allow aerial spraying. But PCK successfully pushed them away by calling the police. Dr Shripathy Kajampady, another local doctor who runs a nursing home in Perla also got involved in physically stopping the helicopter. That day, they floated the organization, ESPAC (Endosulfan Spray Protest Action Committee) to fight the case systematically. Dr Y.S. Mohankumar, Shree Padre and Dr Sripathy Kajampady and ESPAC activists devoted

considerable time and resources to bring the issue to the limelight and to fight for justice for their people and environment.

2001

February 2001 – The **Hosdurg Munsif Court** bans the use of endosulfan in Kasaragod in the case filed by Smt. Leelakumari Amma and this gave momentum for the local activist to move court and get similar order for other parts of Kasaragod and thus the Aerial spraying was stopped in Kasaragod in PCK plantations since 2001.

February 2001 - Centre for Science and Environment report on the "contamination of endosulfan in the villagers". (CSE) New Delhi sent researchers from the Pesticide Monitoring Lab, collected 25 samples including coconut oil, mother's milk, adipose tissue of cow, leafy vegetables, blood samples etc and analyzed them for the presence of endosulfan. Shockingly, they found traces of the pesticide in all the 25 samples. This was a solid proof, the first powerful and scientific evidence to the people's fight. CSE did all these analyses free of cost, which otherwise could not be afforded by the villagers of Kasaragod. CSE went to Padre to organise the collection of samples with technical guidance from M K Prasad Kerala Sastra Sahithya Parishith (KSSP) and V.R. Raghunanndanan senior scientist of Integrated Rural Technology Centre (IRTC) , Sripathy Kajampady, a doctor who runs a nursing home in the neighboring Perla Village. CSE Concludes that endosulfan should be banned.

February 2001 - Kerala Agriculture University Report

"Investigating The Environmental Effects Of Aerial Sprayed Endosulfan In Perla Area of Kasaragod". This report was in response to CSE Report .The report of the visit of the Expert Team to investigate the environmental effects of the aerial spraying of endosulfan on cashew plantations in Perla. Dr Abdul Salam, KAU, headed the committee. The committee came to Conclusion that there is no quick and reliable method to assess the level of contamination in the environmental samples such as soil, plant, drinking water, animal and human samples" but further recommended "need based spraying".

May 2001 – STED (Science, Technology and Environment Department) committee report to government of Kerala on "The Suspected Spreading Of Unusual Diseases In Enmakaje Gramapanchayath and adjoining areas of Kasaragod District" The report was made by STED (six

member committee), the committee made extensive study in geology, environmental impacts, socio-economic impacts and health impacts in the endosulfan affect areas and the committee comes with the observation.

1)Environmental problems are prevailing in this area.

2)unusual diseases are common in this area

3)As the area under consideration is away from urban and semi-urban area, the environmental problem related to any industries or waste is of remote possibility.

4)The particular anthropogenic activity that needs special mention is the aerial spraying of endosulfan, many of the health problems faced by the inhabitants are similar to the effects endosulfan may cause. They recommended that Government may order a detailed Environmental Impact Assessment study on endosulfan incorporating Clinical/epidemiological aspects so as to find out the residues of endosulfan, if any, still persistent in the environment including the biotic components. The committee also emphasise the necessity for implementation of sustainable agricultural practices in the midst of allowing a minimum period for the resilience of the environment. In case any pesticide other than endosulfan is found suitable (preferably bio-pesticides) for eradicating Tea Mosquito Bug, the aerial spraying shall be allowed only on certain stringent conditions which are detailed in the recommendation part of this report. Constitution of a monitoring committee and an evaluation committee are also envisaged in the report. The Committee felt that Government may also extend the medical aid and other rehabilitative measures to the victims in the area affected by the unusual diseases.

http://kerenvis.nic.in/files/pubs/endosulfan/sted.html

August,2001 - FIPPAT Report.

"Evaluation of Residues Of Endosulfan In Human Blood, Cow Milk, Fish, Water, Soil and Cashew Leaves". This Study was taken by FIPPAT and funded by PCK, FIPPAT a private firm Chennai collected the samples and came with the conclusion that there is no endosulfan present in any of the samples and problems are not due to endosulfan. The report was criticized later by Zilla Panchayath challenging the study saying the samples were not collected from Kasaragod and also not from people near plantations who were exposed. Later Down to Earth came with an investigative report on how the FIPPAT Report was fraudulent the media exposed the fraud behind this report, as it was released in Calicut by the Pesticide Manufacturers and formulators association in India (PMFAI) and not PCK. This also exposed how the pesticide industry was able to influence and use the public resources for promoting pesticides and increase their private

profits. The report was released by the pesticide industry all over India by holding meetings and has been using in global forums to argue that Kerala State government is wrong.

August, 2001- Government of Kerala imposes a ban on use of endosulfan in cashew plantations in the state. The State government of Kerala banned the use of endosulfan and first response by a state government in the country to protect public health. This is the first instance of state action on a pesticide regulation in India but the lack of political will to retain resulted in lifting the ban citing Indian insecticide act which do not give powers to the state government to ban or regulate pesticides. All political parties supported the ban even when the issue was still a very early stage.

September 2001 - White Paper on "Investigating The Environmental Effects Of Aerial Sprayed Endosulfan In Perla Area Of Kasaragod". report by KAU. This is a report from ESPAC (Endosulfan Spray Protest Action committee) , this is a white paper on the KAU report. The report extensively quotes and argues how KAU report hides the facts and how it selectively reported on the issue to favor endosulfan.

October, 2001 - Thanal Report "Long Term Monitoring The Impact Of Pesticides on the People and Ecosystem"(LMIPPE) was a comprehensive findings based on the elaborate survey carried out and including the scientific references and opinions on the issue .The report conclusively argued that the health problems reported from Kasaragod is caused by the pesticide endosulfan and also suggested measures to be taken to address the issue. http://www.endosulphanvictims.org/resources/Endosulfan_Report_Thanal.pdf

November 2001 - Dr Achuthan Committee report on endosulfan.

The State government appointed a expert committee to study the issue with well known environmentalist Dr. Achuthan. "The Committee to Study and Analyse The Effects Of Aerial Spray Of Endosulfan In the Cashew Plantations Of PCK LTD, in Kasaragod District" completed its work and submitted the report after detailed public consultations and hearings. Dr Achuthan Committee asked the government to “Ban aerial spraying of pesticides in all the cashew plantations of PCK Ltd”. and a five-year pesticide holiday in Kasaragod plantation area. The recommendations are quoted in the report below http://endosulphanvictims.org/resources/KeralaGovt_FinalReport.pdf

2002

2002 – Endosulfan Poisoning in Kasaragod, Kerala, India Report of a Fact Finding Mission by Pesticide Action Network Asia and Pacific. (PANAP). PANAP send Dr. Romeo F Quijano from Phiippines and Ms. Revathi Ramachandran from Malaysia , two medical doctors from Community Health Cell , Banglore also joined the team. This was the first elaborate medical team visit. The team also had consultation with local doctors, and a consultative meeting with around 100 medical doctors. Toxicological information on pesticide poisoning specially on endosulfan was shared with medical doctors. The report concluded that **"The use of endosulfan should be permanently banned. A comprehensive health and environmental survey of the villages which were likely exposed to endosulfan should be undertaken to determine the extent of adverse health and environmental damage."**
http://www.panap.net/en/p/post/pesticides-cpam/234

July 2002 – National Institute of Occupational Health, Ahmedabad The Report of **"Investigation Of Unusual illnesses Allegedly Produced by Endosulfan Exposure in Padre Village of Kasaragod District",** carried out by the Dr H.N Saiyed, National Institute of Occupational Health, Ahmedabad. The report's Gist as follows.
It collected a total of 248 serum samples and it was found that endosulfan residues present in 85% and 75% of female and male subjects. The report makes the following important conclusions
1)There is a close similarity between the spectrum of the health effects observed in the study population and those described in animal experiments. This supports the hypothesis of endosulfan as a causative factor for the end points observed in the study
2)The possibility of endocrine disrupting effect of endosulfan observed in the study.

August 2002- The **Kerala High court** bans the use of the endosulfan in the state of Kerala, pending a decision from the Central Insecticides Board (CIB) of the union government. A division bench, comprising Chief Justice B N Srikrishna and Justice G Sivarajan, banned the pesticide and made it clear that it cannot be used in any of its formulations or under any of its brand names. The interim order was passed on two public interest litigations filed by the Thiruvamkulam Nature Lovers Movement, the People's Council for Social Justice and the Samatha Law Society seeking a ban on the deadly pesticide.
http://elaw.in/public/insecti/endosulfan.htm

2003

March 2003- The Ministry of Agriculture, Government of India setup a **committee under Dr O P Dubey** to investigate the issue. The committee did not even visit the affected villages. Inspite of the available report of the NIOH, they concluded that "there was no link between use of endosulfan and the health issues" Later it was found through investigative exposes by Down to Earth ,April 15, 2004 that the committee had actually recommended that Endosulfan should be banned in India. But the Chairman overruled this decision and brushing aside all dissent within his committee, sided with the invited members of the committee, two Endosulfan manufacturing company representatives, and gave a clean chit to the pesticide. Dubey completely ignored the report of NIOH, and the answers given by them to the queries raised, and instead chose to depend on the report of a private laboratory the Fredrick Institute of Plant Protection and Toxicology (FIPPAT) (now known as the International Institute of Bio-technology and Toxicology). The committee functioning was severely criticized for its vested interests and it lost credibility because of the presence of two representatives of endosulfan manufactures.

September 2003- HEALTH HAZARDS OF AERIAL SPRAYING OF ENDOSULFAN IN KASARAGOD DISTRICT, KERALA. Dr PK Sivaraman High power committee set up by Kerala government submits its report. Health department additional director was the convenor of the committee with members from the Kerala pollution control Board and the state agriculture department. The committee concludes that endosulfan is the cause of the health problems in Kasaragod. They recommend that health facilities be provided to the victims.
http://endosulphanvictims.org/resources/KeralaGovt_FinalReport.pdf

2003 IMA report on "The Endosulfan Controversy In Padre Village"

A brief report of a study conducted by Dr.P.V.Ramachandran (North Zone vice President of IMA - 2002-03) and Dr.V.Mohanan nair (Convenor, IMA Research Cell) for Kerala State Branch of Indian medical Association) concludes. No civilized community and medical profession can turn a blind eye to the human suffering in the village. It is high time that medical profession rise to the occasion to fetch help to the hapless lot in the village. Not only should the profession join in the activism to scientifically evaluate the role of Endosulfan into the causation of the tragedy in Padre but also should join ranks to fetch them medical help, social and economic support and rehabilitative avenues. Below link has the report.
www.pvramachandran.com/publications

2004

December 2004 – Following the widespread protest and non-acceptance of the maligned Dr O P Dubey Committee report, the Central Government setup another committee under Dr C D Mayee. This committee submitted its report relooked at the Dr O P Dubey Committee report and reiterated the findings of the Dr O P Dubey Committee report. But considering the apprehensions of the people of Kerala, the committee recommended that Endosulfan may be withheld in Kerala. This committee was also questioned and criticized for completely ignoring the reports of the NIOH, and other independent health studies

December 2004 – The Kerala State pollution control board bans the use of endosulfan in the state. On December 7, 2004, the PCB suspended aerial spraying of Endosulfan in Kasaragod district until a final decision was taken in the matter. The PCK did not make any study results available to the PCB. However, monitoring conducted by the PCB in 2008-10 showed the presence of Endosulfan in the water samples collected from the areas of aerial spraying and hence the decision to ban use of Endosulfan across the State.

2005

August 2005 – A two-day workshop was organised by the Kasaragod District Panchayath along with Thanal and other organizations to plan for a remediation and relief activities. The workshop came out with a comprehensive plan for relief and remediation of the victims of Endosulfan. An Endosulfan Victims Relief and Remediation Cell was planned to be setup to coordinate the planned activities
http://www.endosulphanvictims.org/remedy.htm

October 2005 – Dr A Sukumaran report **Geographical Mapping of Mental Retardation and physical deformities and a case control study of mental retardation in Kasaragod district of Kerala.** The committee concludes endosulfan has affected. “The women are at higher risk of adverse impact of pesticides with many cases of abortions and still births.” This report says these effects due to chronic exposure to persistent organic pollutants.

December-2005 - Union ministry of agriculture issues gazette notification

withholding sale and use of Endosulfan in Kerala. This was the first official recognition of the Central Ministry of the ban of Endosulfan in Kerala.

http://www.thanal.co.in/images/docs/endosulfan_Notification13Dec.pdf

2006 -2010

The Endosulfan Victims R&R Cell is the outcome of the consultative workshop held in 2005 between the Kasaragod Jilla Panchayath, Gramapanchayaths of the affected villages, health, social and agriculture departments of the Government of Kerala and civil society groups like Thanal and ESPAC. The Cell was initiated formally in 2007 and is located in the district headquarters of the Kasaragod Jilla Panchayath. It is a government-approved body and has 34 members – 10 members from the government including the Jilla Panchayat, 11 members from the Gramapanchayaths of the affected villages and 13 members from civil society. Meetings are held almost every 2 or 3 months to discuss the issues related to the remediation measures for the victims and the future activities of the Cell. The initial amount that was allocated by the state government for the relief and remediation measures was Rs. 50 Lakh. It was decided by the Cell that the allocated amount should be used as follows: Rs. 37 Lakh for compensation (medical and other) of affected families, Rs. 6 Lakh for research work in the affected area and Rs. 7 Lakh for aids like wheel chairs and spectacles.

Main activities in the relief work:

1) Conducting health surveys and medical camps to create 'victim lists' at the level of each Panchayath with the help of the associated Primary Health Centre (PHC).

The initial surveys revealed 103 people who required tertiary medical and surgical care and were sent for treatment to Kasturba Medical College, Mangalore (KMC). Of these, 63 received treatment there and the rest needed rehabilitative measures. Surgical care has been provided for all the patients who required it; the major surgeries have been conducted at KMC Mangalore. The Cell has borne the costs of the surgery and hospital stay.

2) The survey had revealed a high rate of physical disability and these patients have received aids such as wheel chairs, hearing aids and spectacles. A total of approximately 250 such aids have been distributed and the project continues as the need arises.

3) A solatium of Rs. 50,000 have been given for the families of the deceased victims. In

the first phase 123 families were given the amount; and now in the second phase another 45 families have received the amount. Presently about 300 more families of the deceased have been cleared for payment of solatium, making the total approved list of deceased endosulfan victims to nearly 550.

4) The medicines are also being provided for most of the patients at the closest Primary Health Centre (PHC). Medicines for seizure and the other psychiatric conditions have been made available at these PHCs and have helped in symptomatic relief for the patients. These medicines are usually not available in PHCs in India.

Community Remedial efforts:

Apart from the measures initiated by the Endosulfan Cell, relief activities are also being conducted by a non-profit organization called Solidarity Youth Movement (SYM) and an educational program by the Central Government called Sarva Shiksha Abhiyan (SSA).

SYM is providing food and other basic provisions for affected persons on a monthly basis since 2007. They are also constructing houses for affected families lacking decent housing facilities. Medical support through camps and paramedical care is also being provided.

Some of the children and youth are also being supported for higher education. The SSA has initiated a pilot project in Kasaragod in an effort to mainstream 108 physically and mentally challenged children. This is being conducted through weekly meetings, parent training and medical and rehabilitation measures. The children have been assessed for the level of disability and are being provided with whatever aids that have been prescribed for them. They are being taught exercises and are given opportunities for social interaction; and the children with mild mental disability will be given formal education

2010

November, 2010 - Kerala state pollution control board (PCB) issues notification to ban endosulfan. Even though they had issued a notification in 2004 itself, it was following the High Court Order.

This time the ban was announced under provisions of Water (Prevention and Control of Pollution) Act, 1974 and the Air (Prevention and Control of Pollution) Act, 1981 in view of apprehensions of people that aerial spraying of Endosulfan in the cashew plantations of Kasaragod district had led to health problems. The PCB took the decision after it found presence

of Endosulfan in water and sediment samples collected from Shiriya river in Kasaragod district, inspite of the ban in the State. This warranted a stricter implementation of the ban. A violation of the ban under these Acts would lead to imprisonment of upto six years and fine.

December, 2010. The National Human Rights Commission ordered an enquiry by ICMR and the commission has been considering the issue since then and finally Commission visited Kasaragod in December 2010 and issued the orders in December itself.

It recommended to the Government of India, that:-

1. The Government to take administrative and legislative action to ban the use of endosulfan.
2. Conduct a nation-wide survey of populations that have been affected by the use of endosulfan, particularly sprayed from the air, to determine the scope of relief and rehabilitation that may be needed.

http://www.nhrc.nic.in/dispArchive.asp?fno=2175

General

Kasturba Medical College Manipal , Manipal Institute of Technology Manipal, National Institute of Technology Calicut three well known institutes in the region have done several studies and student projects on the subject of Endosulfan and health impacts. Several hundred media enquiry and case studies are also available on the issue . Exhibitions of photographs and paintings are also been organized by environment groups As well as Mathrubhumi Publishing house on the issue. The first film “living dead” documented the victims in 2001 and there were nearly 10 documentaries which analyzed different aspects of the issue made and released on the topic . The Kerala State human rights Commission and Kerala State Legislative Committee on environment had sittings and in depth enquiry in to the issue.

Reference

1. Final report of the investigation of unusual illnesses allegedly produced by endosulfan exposure in Padre Village of Kasaragod district, National institute of Occupational Health, October, 2001
2. Dr. Mohan Kumar, Interview by PANAP fact finding team, Padre village, Enmakaje, Kasaragod, January 2002.
3. Central government notification: Notification No.: S.O. 1533(E) dated 25.10.2005

and Corrigendum No. S.O. 1707(E) dated 05.12.2005 regarding the restriction of use of Endosulfan in the cashew plantations of Kerala.

4. Does Endosulfan have an alternative? Non Pesticidal Management – A large-scale success story from Andhra Pradesh, India May 2009

5. Final report of the investigation of unusual illnesses allegedly produced by endosulfan exposure in Padre Village of Kasaragod district, National institute of Occupational Health, October, 2001

6. Health hazards of aerial spraying of endosulfan in Kasaragod district, Kerala A Comprehensive report of the Expert Committee appointed by the Government of Kerala, 2003.

7. India's Endosulfan disaster - A review of the health impacts and status of remediation - report by Dr.Aditya of Community health cell, Bengaluru.

8. Endosulfan - Fact sheet and Answers to common questions - An IPEN Working Group project (A comprehensive fact sheet on endosulfan produced by Thanal (India), 2004)

9. Long Term Monitoring - The Impact of pesticides on the people and eco-system - Part II Report (Preliminary Findings of the survey on the impact of aerial spraying of endosulfan on the people and ecosystem in Kasaragod, Kerala, India by Thanal (India),2002

10. NEWSCAPE, April 2005 Issue (A quarterly newsletter of the Community Action for Pesticide Elimination (CAPE)

11. www.thanal.co.in

12. http://www.endosulphanvictims.org

13. www.panap.net

14. www.unep.int

15. http://chm.pops.int/Convention/POPsReviewCommittee/

Annexure IV

PROTOCOL

Dr. P.S. Harikumar
Scientist
CWRDM, Kozhikode

1.0 Endosulfan

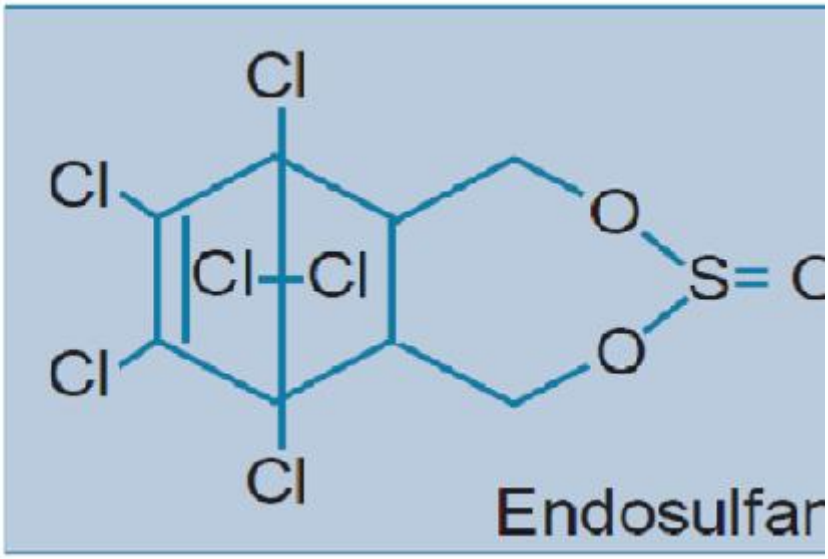
Endosulfan is a pesticide belonging to the organochlorine group of pesticides, under the Cyclodiene subgroup. Introduced in the 1950's, it emerged as a leading chemical used against a broad spectrum of insects and mites in agriculture and allied sectors. It acts as contact and stomach poison and has a slight fumigant action1. It is used in vegetables, fruits, paddy, cotton, cashew, tea, coffee, tobacco and timber crops. It is also used as a wood preservative and to control tse-tse flies and termites

1.1 Chemical Name

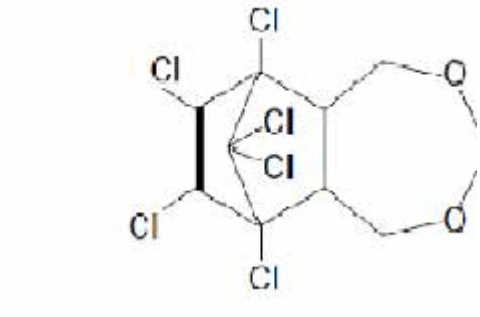
6,7,8,9,10,10- hexa chloro- 1,5,5a,6,9,9a- hexahydro – 6,9- methano- 2,4,3-benzodioxathiepine-3-oxide.

Chemical Formula $C_9H_6Cl_6O_3S$

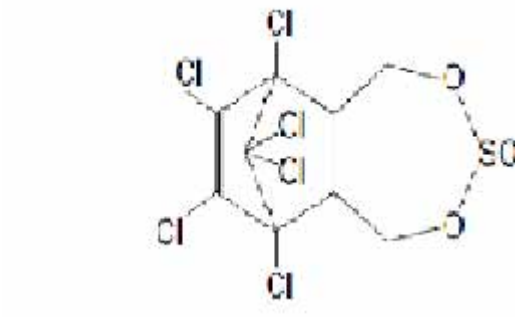
In pure form endosulfan exists as colourless crystals. But the technical product is brownish crystals with slight odour of sulphur dioxide3. Technically endosulfan is a mixture of two isomers - alpha-endosulfan and beta-endosulfan in the ratio 7:3. Technical grade endosulfan contains 94% alpha-endosulfan and beta-endosulfan and other related compounds like endosulfan alcohol, endosulfan ether and endosulfan sulfate. Endosulfan is only very slightly soluble in water, but it dissolves readily in xylene, chloroform, kerosene and most organic solvents and is a non-combustible solid



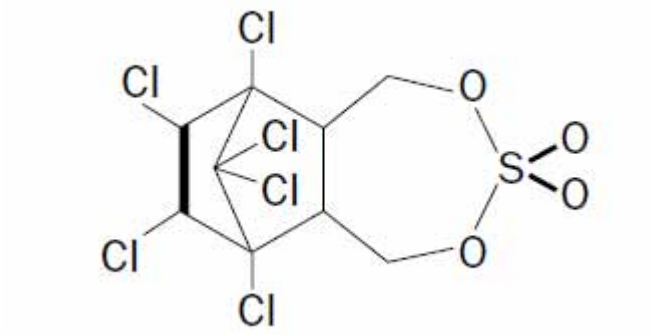
Alpha -Endosulfan



Beta Endosulfan



Endosulfan sulphate



2.0 Protocol for the Monitoring of Endosulfan

2.1 Introduction

To achieve consistency in data sets and to assist in interpretation and comparison of results, common protocols be established for sampling, data production and reduction, validation and completeness, for use by the separate projects of the joint program. It was recognised that the methods of analysis vary slightly to suit local needs of each laboratory and project, but a common basis was necessary for assessment of data, to provide consistency and for valid comparisons to be possible.

The quality assurance objectives involve measurements of data in terms of precision, accuracy, representativeness, completeness and ease of comparison.

Each sample container should be clearly marked using permanent ink or laser-printed labels with the following information:

- date and time of collection;
- place of collection; and
- sample type and identification

A chain of custody procedure would ensure the legitimacy of each sample. Logbooks and sample collection forms should contain information such as:

- site of sampling;
- date and time sampled;
- sample identification code;
- sample matrix (soil, water, composite);
- treatment such as preservation, if any;
- identity of sampler;
- method of transport;
- destination;
- specific analyses required (if applicable);
- date and time of arrival in laboratory; and
- Name and signature of person taking custody.

2.2 Soil sampling

All analytical data for soil was to be reported on a moisture-free basis, using dry weight obtained in a forced-air oven on exposed soil sub-samples dried overnight at 60–105°C. Particularly with volatile pesticides such as endosulfan, care should be taken to prevent losses by using soil samples for extraction with minimum preparation. Thorough mixing of soil, preferably at the time of sampling to ensure homogeneity for sub sampling, is to be carried out on a stainless steel or glass tray using a clean or disposable spatula.

Equipment can be cleaned by brushing, washed with detergent and tap water, rinsed in acetone or isopropanol, and rinsed three times with clean tap water and allowed to air dry or by use of a clean paper towel.

2.2.1 Storage

Soil samples shall be best stored in airtight solvent-washed or brand-new glass jars, verified as pesticide free, sealed with aluminium or Teflon foil liner, fitted with new plastic screw-caps Jars should be transported to the field with caps fitted, to minimise the possibility of contamination. Field samples should be cooled to 4°C or less as soon as possible for transportation and then held in a deep-freeze until it is possible to perform solvent extraction. The use of polythene bags for storage at ambient temperature, of material freshly sprayed with pesticides such as endosulfan, is not encouraged, unless samples can be extracted immediately.

2.2.2 Samples

Each soil sample shall be selected from a bulked composite of at least 10 well mixed cores, to reduce the sample variance. Depth will depend on the purpose of sampling and the nature of each chemical. For estimating total soil burden of a chemical not subject to leaching (such as endosulfan), either 5 or 10 cm deep cores would be appropriate, or to cultivation depth. Sampling depths must be specified.

Sufficient samples should be taken to establish spatial variability in pesticide residues. Samples taken for such purposes should be clearly labelled, indicating location in the field, whether from top, the particular edge or bottom of furrow, and depth

2.2.3 Extraction of soil for GLC

Extraction of pesticides from soil requires more polar solvents than hexane or dichloromethane alone. A mixed extracting solvent with added acetone, or the use of methanol as the primary extracting solvent, provides improved extraction of residues. The effectiveness of whichever solvent is used should be verified by spiking of soil with pesticide standards

2.2.4 Extraction procedure for endosulfan residues in soil

1 Organics are extracted by shaking with a solvent mixture of chromatographic grade dichloromethane and acetone (80:20, v/v). The coextractives are removed from the concentrated extract on an alumina column and the eluate is chromatographed on a 30 m capillary column and determine by electron capture detection.

2 Weigh a 25 g sample accurately into a clean 250 mL conical flask sealed with a ground-glass stopper. Weigh accurately a further 10 g sample onto a watch-glass for moisture determination by drying for two days at 110°C. Re-weigh and determine moisture content by difference.

3. Extract the soil in the conical flask with 150 mL of 25% acetone in dichloromethane or hexane by shaking on an orbital shaker at 165 rpm overnight

4. Decant the solvent carefully through a fluted filter paper containing 1–2 g of anhydrous Na_2SO_4 and collect 75.0 mL for analysis.

5. Evaporate to 5 mL.

6. Prepare a clean-up glass chromatography column using a cotton wool plug to retain 7 g of alumina (7% H2O, w/w), overlaid with 1 g of anhydrous Na_2SO_4.

2.3 Water/sediment samples

Extraction was to be performed on water or turbid water to obtain total pesticide content, or after removal of particulate matter by filtration (GFA, 1.2 mm glass membranes) or centrifugation at 2,000 rpm in glass vessels, with separate extraction of water (soluble or colloidal fraction) and sediment where sediment loads are significant. The sediment load should be determined on all water samples, to establish the eroded fraction. The concentration of pesticide residues should be given as mg/L (ppb).

2.3.1 Storage

Water samples of 1 L shall be stored in solvent-washed or brand-new (amber) glass bottles verified as uncontaminated, sealed with aluminium foil or Teflon, fitted with new plastic screw-caps and chilled immediately to less than 4°C in a refrigerator. Organic solvent (eg. dichloromethane) can be added immediately where convenient to limit volatilisation or hydrolysis, although care to prevent leakage is essential. Extraction of water samples with organic solvent shall be made within 48 hours and immediately on receipt. Even so, it can be anticipated that samples containing endosulfan isomers will lose chemical by volatilisation if jars are not properly sealed, ideally with Teflon, or by hydrolysis if the pH of the water is above 8. Freezing of samples for longer-term storage may also be desirable where facilities are adequate, provided bottles are only half-filled to prevent breakage and there are no other problems. The half-life of endosulfan by chemical hydrolysis to endosulfan diol in river water at pH 8.5 is claimed to be less than two days at ambient temperatures and it may be desirable to adjust pH to below 7 by addition of phosphate buffer (pH 6) or acetate buffer (pH 5.4) to 1–5mM, even for cold storage.

2.3.2 Dichloromethane or hexane extraction of water samples

Water samples have to be extracted two or three times with dichloromethane or hexane , the extract concentrated and the sample has to be cleaned up on an alumina column. The eluate, diluted in hexane, can be analysed using gas chromatograph with electron capture detector on a 30 m capillary column.

2.3.3 Gas chromatographic analysis

All aspects of good laboratory practice are expected to be in force in analytical laboratories. All sample handling, extraction, cleanup, analysis, chromatography and confirmation should be referenced to the laboratory manual and standard operating procedures (SOPs). In reporting results, the precision and accuracy limits as defined in the standard operating

procedure of a method should be maintained. Duplicate analyses with more than 15% coefficient of variation should be repeated for that sample. All negative results should be reported as below these established detection limits rather than as not detected.

2.3.4 Gas chromatographs and chromatographic columns

It is anticipated that analysis will usually be performed on capillary columns, thus reducing problems of sample cleanup

2.3.5 Standards

Calibration standards, like internal standards, should be prepared from certified standard material and kept no longer than six months with new preparations being evaluated against the old standard.

2.3.6 Calibration procedures

2.3.6.1 Instruments

All instruments used in the production of data for these projects should be calibrated according to procedures as prescribed in the SOPs of each method. For example, balances should be calibrated at least once according to manufacturer's specifications and the calibration log book maintained for each balance. Class S weights should be used to verify electronic calibration.

2.3.6.2 GC/ECD

GC should be calibrated at four levels of standard, one very close but above the noise level of the instrument and then at intervals of 10 times for each analyte.

2.3.6.3 Retention time

Windows for each analyte should be established at base line separation. These retention times should be established before each batch of analysis. Instrument log books shall be maintained and will contain information regarding the usage and maintenance, problems and corrective actions

2.3.6.4 Procedure

1. Add a 500 mL aliquot of the water sample to the separating funnel. Prepare a batch as per worksheet list (to include reagent blanks, duplicates, replicates, recovery blanks and recovery Samples).

2. Depending on the analytical method, check the pH of the sample, adjust the pH or add phosphate buffer (25 mL)

3Add dichloromethane (30 mL) or hexane to the separating funnel seal, then shake for two minutes with frequent venting at the stopcock.

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4 Allow the two layers to separate and collect the organic layer in an Erlenmeyer flask. If an emulsion forms, and cannot be separated, transfer the organic phase plus the emulsion to a smaller separating funnel.

5 Repeat steps 4 and 5 twice and combine the three extracts. If an emulsion has formed, combine all extracts into a small separating funnel, remove the organic phase then add saturated aqueous sodium chloride to break up the remaining emulsion. Add additional dichloromethane to ensure quantitative extraction of the organic compounds.

6 Depending on the analytical method, extracts obtained at different pH values are combined or treated separately. These modifications are noted in the procedures for individual methods.

7 The eluate is chromatographed on a 30 m capillary column and determines the concentration by electron capture detection

3.0 Sampling Network

Water, sediment and soil samples will be collected in the 10 panchayts sitated near and below the plantations where endosulfan had been sprayed serially. A total number of 3 samples will be collected from each panchayath from streams, wells and canals. Few samples (5 nos) will be collected from control areas away from the affected areas. The details of the panchyaths from where samples will be taken is shown in fig1.

4.0 References

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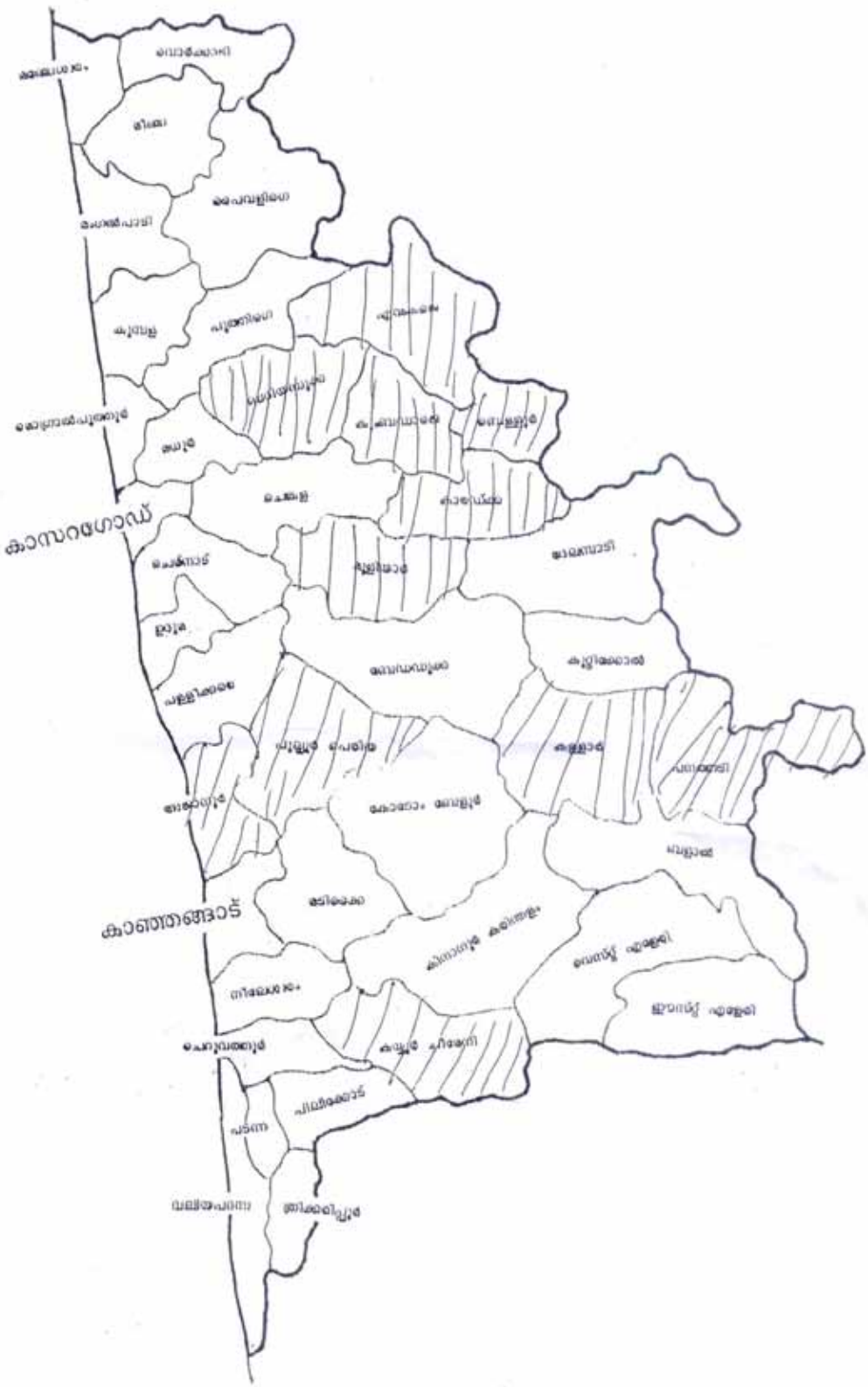

Fig 1 Map of Kasaragod district showing the endosulfan affected Panchayths

Annexure - V

ENDOSULFAN, CASHEW PLANTATION, ECOLOGY, BIODIVERSITY AND PEOPLE IN KASARAGOD – A RAPID ASSESSMENT WITH SUGGESTIONS FOR WAY FORWARD

V. S. Vijayan
Salim Ali Foundation

Background

Cashew plantation in Kasaragod commenced in the late 1960s replacing largely the rich original moist deciduous forests and, the subsequent aerial spray of endosulfan, a persistent neurotoxin and endocrine disruptive pesticide, to contain the tea mosquitoes of Cashew plantation have brought in inexplicable human sufferings, loss of life, virtually wiping out biodiversity and, seriously damaging the ecology, especially the hydrological cycle of the area.

Responding to the severity of the impact of endosulfan brought out by criminal suites, the Honourable High Court of Kerala banned its aerial spray in 2001, a practice continued for almost 22 years, and its use and sale in Kerala during 2002. Although it was a welcome step, the enormity of the problem continued. The sufferings of the people aggravated. Relief packages, although inadequate, started coming up.

However, one of the most neglected aspects was the impact of cashew plantation and the aerial spray of endosulfan on the ecology and biodiversity of the area; the severity of ecological damage and the loss to the biodiversity. The present effort is aimed at just to rapidly evaluate these and suggest mechanisms to monitor them on a long-term basis.

Methodology

One of the major handicaps in evaluating the biodiversity loss was the absence of any data prior to the aerial application of endosulfan. The only available source was to interact with elderly persons having intimate knowledge on the area and have been working here for more than three decades, well before the aerial spray began. It may be noted that Charles Elton who coined the word ecology, considers the local people as expert in the ecology of the area as they adopt the agricultural practices and livelihood needs based on the ecological conditions of the area.

A rapid survey was conducted by a team of scientists from different disciplines such as plants, fishes, amphibians, butterflies, and birds following standard methods between 1 - 16 December 2010. Samples were taken from areas where endosulfan was sprayed and not sprayed. Further, discussions with elderly persons were held to gather information on the biodiversity prior to the

spraying of endosulfan. These were corroborated with the data from the area where endosulfan was sprayed and not sprayed. All 11 Panchayaths where endosulfan was sprayed, namely Enmakaje, Badhiyadukka, Kumbadaje, Bellur, Karaduka, Muliyar, Ajanur, Pullur-Periya, Kallar, Panadathadi, and Kayyur-Cheemeni were surveyed. Apart from these, the Panchayaths lying close to the above, where the impacts of endosulfan were reported, were also surveyed. One Panchayath, namely Meencha, lying quite far from the sprayed and affected Panchayaths, and where the endosulfan was not sprayed was also covered. An attempt has been made to assess the loss of forest in the district to have an indirect idea about the damage to the ecology of the area.

Major findings

Ecology

(1) Kasaragod has lost 97% of its forests since 1950. The extent of forests, mostly moist deciduous, was 78,921.75 ha during 1950 as per the vegetation map of French Institute, whereas it is plummeted to just 2,461.65 ha in 2005 (NRSA 2005).

(2) Total cashew plantation in the district spreads over to about 5,176 ha; most of which are at the cost of moist deciduous forest and some of agricultural land.

(3) Ecological impacts of large scale conversion of forests in the area are yet to be studied, mainly the impact on water availability.

(4) Farmers report that there has been a scarcity of water in and around the plantations, especially in areas where the plantations replaced the forests, demands a study on the water requirements of cashew plantations.

(5) Open water tanks in the comparatively higher areas, a characteristic of the area for irrigation purposes, got dry for two - three months in summer after the commencement of the plantations.

Impacts of aerial spray of endosulfan on biodiversity

Flora

(6) The endosulfan sprayed area showed a decline in plant diversity between 40 and 70%, particularly for native species, compared to the natural habitat.

(7) Some of the conspicuously absent species in the sprayed area are: *Hopea ponga, Cinnamomum malabatrum, Premna serratifolia, Ixora polyantha, Nothapodytes nimmoniana, Syzygium carryophyllatum, Desmos lawii, Embelia cheriyan-kottan.*

Fauna

(8) In general, the area, particularly those close to the forests were rich in wildlife, birds and butterflies as reported by the local communities. In Kallar area even elephants were reported. In Rajapuram Estate where the plantation is contiguous with forests, elephants are present even currently.

(9) In Enmakaje Panchayath a traditional farmer reports that a large number of wildlife, including, Nilgiri Langur, Tiger, Jackal, Wild Boar, Jungle Cat, Mouse Deer, Mongoose, Squirrels, Flying Fox, Blacknaped Hare, Sparrow, Parackeets, Crows, Frogs, Honey Bees, Snails were present in the area. He says "everything else, except the human beings, disappeared during the spray"

(10) Except for a few species, it is true for all other areas as well where endosulfan was sprayed.

(11) Death of fishes, frogs, and snakes were noted in the very first year of the spray itself.

(12) Abnormalities/deformities were recorded in cattle in the area of spraying

(13) Once common Jackal, Porcupine, Wild Boar, Civet Cats, and Bats have completely disappeared during the spray. A pack of Jackal was heard howling in one of the early mornings by the team at Perla in Enmakaje Panchayat

(14) Dead snakes, squirrels, hares, peacocks, crows were found in the cashew plantations and adjacent areas during the period of spray. However there has been a sign of their return since the last two –three years; i.e. 5 -6 years after stopping the aerial spray.

(15) Honey bees which were abundant and were a source of income for most farmers, became almost completely absent during the period of spray.

(16) Butterflies abundant prior to the spray became absent during the spray, although some of them appeared to be on the path of recovery as noted by us.

(17) Fishes which are common in streams of the region are absent in streams running through areas where endosulfan was sprayed. Balitorine loaches, the true indicators of the hill stream habitat is absent in many streams, and when present, their abundance is extremely low. *Mesonemachilus triangularis* and *M. guentheri* reported earlier could not be located during the present survey. *Channa gachua* and *C. marulius* are represented only by one specimen

(18) Of the 18 species recorded from 12 streams covering sprayed areas of various Panchayats, only two species, namely *Rasbora daniconius,* and *Puntius fasciatus* had a

wider distribution, found in more than seven streams. *Salmostoma sp, Bhavania australis, Puntius ticto, Barilius bakeri, Barilius atensis, Awaous gutum, Channa orientlais, Channa marulius, Puntius mahecola,* and *P.filamentosus* were found only in one or two streams. Most of the streams had only four to five species.

(19) The highly specialized, typical hill stream fishes of the southern Western Ghats such as *Tor khudree*, *Garra mullya*, *Mesonemacheilus triangularis* and *Mesonemacheilus guentheri* are extremely rare in the streams surveyed. It is also important to note that these species are highly sensitive to any change in the environment.

(20) Of the 20 species reportedly had in the regular catch of the fisher folk for commercial purpose prior to the aerial spray, only 10 are present currently. They have also reported massive death of fishes during the spray

(21) Some of the species had a discernible size difference between those collected currently from Kasaragod and those from elsewhere. Those from the rivers of Kasaragod are smaller; *Bhavania sp. and Mesonemacheilus* where only > 2cm, while usually they are 5-7cm, and the stone sucker (*Garra sp.*) was only > 6cm as against their usual size of up to 17cm.

(22) Only two species of frogs, namely *Rana verrucosa* and *Nyctybatrachus major* were recorded by the team. Species such as *Micrixalus*, and *Rana temporalis* adapted to the torrential streams were also absent.

(23) Most of the common birds such as Crows, Mynas, Parakeets, Drongos, and Koel have become completely absent during the period of spray. It is reported that since crows were absent, certain communities felt incompleteness in performing their religious rites after death.

(24) In the current study, 121 species of birds were recorded; 79 in plantations/homesteads and 94 in natural habitats. 42 species were found only in natural habitats, whereas 52 were common to both habitats and, 27 were recorded only in plantations.

(25) Major species of birds missing in the plantations were flycatchers, babblers, and endemics such as Small Sunbird, Crimsonthroated Barbet, and Whitebellied Tree Pie.

(26) Common birds absent in the plantations were, Fairy Bluebird, Large Cuckoo Shrike, and Large Wood Shrike.

Recommendations

These data, based on a rapid assessment of only two weeks, bring out quite convincingly, that the cashew plantation has changed the ecology of the area completely and that the aerial spray of endosulfan was a disaster to the biodiversity. It needs to be seen as how it would recover. This would require a detailed data base on the current status and a monitoring scheme for at least 15 years. The following specific recommendations are to be considered:

Economic and ecological assessment of Cashew Plantations

i) A cost – benefit analysis of cashew plantation in Kasargod in terms including ecological loss such as (a) damages on the general ecology, (b) impact of deforestation on rivers originating from the lateritic hills, (c) loss of ground water and, (d) a comprehensive analysis of these on local agriculture, economy, livelihood as well as socio-cultural practices. Such a study will also be useful for planning large scale plantations in future.

ii) In areas where the forest was removed for plantation, especially in slopes, restoration of forests may be tried to recover the ecology of the area.

iii) A five year comprehensive action plan for restoration of natural ecosystems and revival of biodiversity may be launched.

Biodiversity Monitoring

iv) A three year multidisciplinary study on biodiversity covering all taxa; data should be collected in all the seasons.

v) Monitoring of the indicative taxa and ecological parameters every three years following the methods adopted for the baseline study.

vi) Genetic studies on selected local species of birds (Jungle Babbler would be more suitable, as they are highly territorial) to assess the impact of endosulfan in the DNA structure.

(ii, iii, iv to be undertaken by Kerala State Biodiversity Board (KSBB))

Land use

vii) A policy decision may be taken by the Government not to renew the lease for cashew plantation; in many cases the lease period would be over by 2012.

viii) In no case shall the land leased out for cashew be allotted for rubber plantation in violation of the lease agreement.

ix) Similarly, in no case shall the Forest land be given for rubber, violating the Forest Conservation Act, 1980. (It is reported that in some such areas, the Plantation Corporation of Kerala has already started rubber plantation which may be inquired into and action taken)

x) After the lease period, the area should be used for food production depending on the nature of the area.

xi) Allotting such lands to the landless victims may also be considered with one condition that they will not use the land for any purpose other than farming.

xii) It was reported by local people that cultivation of upland paddy was a successful practice in the area. This may be tried with organic methods in tune with organic farming policy of the State Government.

Human aspects of endosulfan and remedial measures

The team, apart from the biodiversity studies, also had to visit the houses of some of the victims of endosulfan. Although they refuse any study team to enter their houses, we were treated with a kind of faith and expectation as we had with us some of the local persons working for remediation. The seriousness of the victims and the irrecoverable conditions of some and, on the top of that the in-affordability for treatment by most give a traumatic and tormenting picture.

It must be admitted that the devastating effect of endosulfan on human population, much of which are already known, demands a more sincere approach from the Government, as the entire issue is rooted on the casual approach of the Plantation Corporation of Kerala. The issue would not have taken such a serious dimension, had the Plantation Corporation responded to the early warnings of the disastrous consequences of aerial spray as evidenced by the mortality of frogs and fishes in the waters and the disappearance of honey bees in the very first year of the spray. The continued aerial spray invokes legitimate fundamental question of accountability and social justice. Continuance of the aerial spray for more than two decades, unmindful of the hue and cry of the local people and, even disregarding the scientific reports - that too revealing harmful effects of endosulfan - would legitimately qualify the present human sufferings and the loss of biodiversity in Kasaragod as a “State sponsored crime”. Therefore, the state is duty-bound to provide total support to the victims

till their life time or till they are recovered completely and able to earn themselves. Realising these, we recommend the following:

1. A thorough survey of the victims with a team of doctors along with a committed social worker and respective Ward Member be made to ascertain the number of victims, the category of health issue and to make a preliminary decision as to the kind of remedial measures and action to be followed. (NRHM)
2. The team must contain a lady doctor, as many of the victims are women and conservative and would not like to divulge the problems to a male doctor.
3. The survey should cover not only the 11 Panchayaths where endosulfan was sprayed, but also the adjacent Panchayaths from where the impacts have been reported.
4. Impact of endosulfan, if any, on the reported alarming decline in the population of Koraga, a primitive Tribal Community, in Badiadka Panjayath may also be verified during the survey and necessary steps taken to treat and protect them.
5. A Rehabilitation Centre with modern facilities for treatment of all the victims of endosulfan be established
6. Satellite Rehabilitation Centres may be opened one each for a panchayat so that accessibility of the family of the victims could be made easier.
7. Doctors from allopathy, ayurveda, sidha, and other branches of treatment may be made available to the victims' choice.
8. A system has to be provided to physically support the invalid victims at their respective homes
9. Appropriate occupation for victims depending on their physical and mental condition may be offered, not primarily for income generation but for keeping them engaged.
10. Monitory support to the victim's family may be provided on a monthly basis.
11. Since most of the families of victims have borrowed heavily from local money lenders on extremely high interest rate, necessitated exclusively for treatment of the victims, and considering the meager income of the victims' families, it is beyond any reasonable doubt that they will ever be capable of clearing the debt. The Government should do a thorough survey and find out the exact amount spent for the treatment of each of the victims and make arrangement to support them by clearing the debt. This, certainly, is a responsibility of the Government. A onetime grant may be given for the same.

12. At no point of time, other than the purpose mentioned above, a onetime grant of huge amount be thought off, as it will never serve the purpose.
13. Insurance coverage for treatment to victims with the State paying the premium could be one of the options that could be explored.
14. Each Panchayath could be allocated with 20 – 25 Acres from PCK land for starting food crop gardens and the same could be used as demonstration and extension centres of organic farming involving all stakeholders and beneficiaries preferably families of victims.
15. The District Panchayath may be encouraged to set up a district level coordination and marketing mechanisms of the produces and their value addition
16. The Rehabilitation Centres and also other supports to the victims and their families should be run by an independent Society registered under the Societies registration Act, 1862.
17. Members of such a Society should include members of the families of the victims, local Panchayath Ward member, President, Block Panchayath members from the respective area and the Jilla Panchayath President. Society should also have representative of NGOs who have been working for helping the victims, apart from Doctors of eminence. The President of the Society shall be the Honourable Chief Minister
18. There shall be an Executive Committee for the Society to look after the day- to –day affairs of the Society
19. The Society shall be run by its own rules and regulations, and in no way should the governmental bureaucracy be allowed to take it over.

The team of the present study comprises: Drs. Lalitha Vijayan (Ornithologist, Salim Ali Foundation), P. Shajee (Icthyologist, Kerala State Biodiversity Board), Dr. P. Sujanapal (Botanist, Kerala Forest Research Institute), Ms. Prathibha (M. Sc. student, Kannur University; working with Thanal for dissertation), Mr. C. Jayakumar (Thanal), and Dr. V. S. Vijayan (Salim Ali Foundation). Mr. Harish, a lawyer by profession, but a committed conservationist from Kasaragod took care of all the logistics of the programme and accompanied us in the field.

Annexure - VI

MONITORING SOCIO-ECONOMIC ASPECTS AS PART OF THE PESTICIDE-MONITORING PROGRAMME ON ENDOSULFAN CONTAMINATION AT KASARAGOD.

Dr. C Jayakumar
Director of Thanal
Thanal, Thiruvananthapuram

Study Team and Methods

The study team comprised of Sri. C. Jayakumar, Sri. Lakshminarasimhan , Ms. Prathibha Manikkoth, Ms. Rarima K., Ms. Shijina Kotakkateri and Sri.Harish V. Namboothiri were involved in the study. The field visits and surveys were undertaken during 26th November 2010 to 13th January 2011. Dr. V.S. Vijayan and team shared the information they gathered on socio economic aspects while doing the assessment of biodiversity. Sri. Sridhar R. and Ms. Usha S. also shared the inputs from their rich experience in Kasaragod.

Local resource persons were requested to help the study team Smt. Leelakumari Amma , Sri. Shri Padre, Dr.Y.S. Mohankumar , Dr.Shripathy Kajampady , K.B. Mohammed Kunhi and Prof M.A. Rahman shared their insights and provided valuable guidance. Shri. Anand Singh I.A.S, Kasaragod District Collector, extended all support, provided information and also gave time for detailed discussions.

We had wide consultations and interview with older people (75 persons), President and members of Grama Panchayath (18 persons), political activists (30persons), social and cultural activists (25 persons), officials at Panchayath institutions (10 persons), District Panchayath officials and Kasaragod District Panchayath President, District collector and media. We have also undertaken socio-economic survey of 181 houses in Kallar Panchayath, survey of honeybee farmers (50 people) and survey of academic performance of schools (2 schools).

Limitations

The surveys and interactions were of rapid appraisal and could not get the detailed assessment with large sample size. The socio economic assessment also had difficulties as the most of the discussions and actions are centered on compensation to dead and treatment to the

most affected victims. Additionally these have raised lot of expectations and make it difficult to even engage on conversations without touching the aspect of assistance. The random survey was often slowed by demands to visit additional houses, which claimed to have victims even though we wanted to restrict to the random samples we choose.

We had limitations of time so tried to look at aspects that are not currently known so that the extent of impact on lesser known areas could be brought out by this work. This also helps us to suggest monitoring of those areas so that we will be more comprehensive.

Findings.

Based on the direct interactions, surveys and analysis of data we gathered we have arrived at the following findings.

1. Contamination in environment and community

1) The impact of Endosulfan spray is visible and measurable and all realms of life of people and environment are affected.

2) The assessment of impact on social and economic aspects is complicated as it need to be assessed from all parameters and using different tools.

3) We also find that the problems in poor houses significantly high as they were using fuel wood that was collected from the pesticide area so wood contaminated by endosulfan.

4) The local streams and ponds do not have fish the surveys clearly point to the loss due to endosulfan spray respondents shared the fish kills they witnessed.

5) The crows have disappeared from the area and the people were complaining about the incompleteness to life as the religious rites could not be completed without crow coming and eating offerings and this many tell along with their observation of
disappearing birds, jackals and other animals.

6) All the respondents are reporting re appearance of crows and some birds and jackals and they believe that this is because of the ban on use of endosulfan.

7) The general practitioners give a good account on the disease profile of the area. Since the ban on the aerial spraying they have seen considerable drop in many diseases. Dr. Y.S. Mohan Kumar reports that he has not encountered any case of a child being born with congenital anomalies in the last one year. There have been no new cases of children with neurobehavioral

abnormalities. The number of abortions has also reduced considerably in comparison to late nineties.

8) The survey in ward number 13 of Kallar Panchayath reveal that out of 88 household that kept livestock 56 report serious diseases and death of cattle and chicken. There are several cases - 11 cows, 5 calves and 9 goats and 12 chicken are reported dead during the spraying period from these 56 houses. They also report stillbirth, infertility and abortion among cattle.

9) The expenditure at household increased considerably in houses that had patients and victims of endosulfan in the house hold level survey 75 houses in ward 9 of Kallar Panchayath the average expenditure in houses that do not have diseased members had an average expenditure of Rs.1603/- per month before spraying of pesticide and their current expenditure is only Rs4167/- where as the families with patients the expenditure of Rs2064.60 during the pesticide use and it rose to current expenditure of Rs.12104.6o. These averages indicate the problem in financial terms and need to be quantified for all the houses Panchayaths. The total bank loan in the affected area is estimated by ICDS as over 20 crores and this could become many fold when we calculate the total expenses of the families in the affected area.

10) The current calculations of houses with patients in Panchayath do not bring the accurate picture. The affected houses are in clusters or in area in the ward. In Kallar Panchayath ward 9 out of the 75 houses surveyed 42 houses have family members with health problems. This when looked at from the Panchayath will dilute and when we assemble to the impacted area total population the gravity of the problem is lost. There is no specific remediation plan for affected disease hotspots. Total 4879 families are estimated as affected families by ICDS and if these families are located in the hotspots and clusters but when reported as out over 50,000 families the seriousness is diluted.

2. Impacts on vulnerable population

1) Women and children are worst affected, as they are more vulnerable to exposure.

2) Scheduled communities like Koraga's **1** and other scheduled communities are also worst affected, as they were more dependent on commons and biodiversity, which increased their exposure to endosulfan.

3) We have looked at SSLC Academic performance of one school, which shows interesting information that can be correlated to Endosulfan exposure, and its known ability to cause memory related problems and learning disorders are reflected in the school performance.

4) The health survey did not include gynecological cases. The household level survey in Kallar Panchayath ward 9 reports 7 gynecological cases in 42 houses that have health problems and in ward 13 has 10 gynecological cases in 55 houses that report health problems. So the current rapid assessment is only preliminary data and there is large number of victims not included and counted.

5) The mother and women in the house is generally taking care of the patients in many cases which cuts them from all possibilities of social interactions as they have to stay at home and take care of the bedridden cases

3. Loss of livelihood

1) We have gathered extensive data on honeybees and it added another dimension to the economic loss. The annual loss for 45 beekeepers and honey collectors at 2008 market value with an assumption that the production did not increase from 1970 level is over 29 lakhs. The respondents in Kallar also report decline in Honey production so if an assessment is done on the loss in the affected area it could be estimated to several crores.

2) Livestock all the conversations reported different problems to domestic animals. The first public article in 1979 was on the calf with twisted limbs. The cow, goats, chicken and pets like dogs were severely impacted by endosulfan exposure. The loss in terms of livelihood and family income is to be estimated to find the extent of impact it had on household income especially in poor households.

3) The surveys by various NGOs report opportunity loss to the people to work and earn a living. Victims / patient at home generally ties down the parents and care taker to home and the study found various forms of stress to the care givers including livelihood loss. In the ICDS survey 2751 families have reported loss of wages.

4) In general the loss of human resources and productivity as a result of endosulfan exposure is yet to be quantified.

4. General impact on society

1. We find that the endosulfan spray for more than two decades ignoring the warning signals from nature and local community exposes failure of governance and accountability. The state government need to bring accountability back to the system that erred in protecting people and environment which amount to failing the constitution of India and set up an enquiry in to lapses.
2. The conversations revealed the rich food crop and thatching materials that was gathered from the land besides, medicinal plants and other benefits of biodiversity of those land that is now cashew land. There is several complaints about devastation in areas that is recently converted to rubber. These changes in the land use without any community involvement in decision making have caused disaster in the midland hill ecosystems.
3. The exposure of pesticide linked disease burden have created social stigma and opportunity hindrance is resulted now. The severe stress visible is on marriages. The preference is lost and siblings of victims stay unmarried. There are also cases of divorces resulting from children born with disabilities and several cases of medically advised termination of pregnancy are reported. The dimensions are not easily captured in the rapid survey and there is no social intervention or an awareness campaign as well as medical screening and counseling centre available in the area.
4. There is old stock of 1500 liters of endosulfan stored in three estates of PCK sealed by state pollution control board and PCK. The same is reported in the media as unsafe and with out any plans for handling the same stored with a threat of contamination.
5. Local community and activits allege that large quantity of endosulfan is buried at "Nanchan parambu" Aadoor, Karadukka Panchayath in PCK estate area we could not verify this and is not the proper way to handle a toxic pesticide and cause serious threat. The number of new health problems and diseases are reported from this region and this is an issue that needs urgent consideration.
6. The local activists are of the opinion that PCK is using different pesticides and did not implement the five year Pesticide holiday to the region recommended by Dr. Achuthan committee
7. Benchmarking and monitoring not done for the affected area so there is information gap and common protocol for assessment is also not compiled for selecting the victims and patients.
8. People especially poor depend on common resources like streams and such dependent people are more affected with health impacts

9. Remediation plan not based and addressed to disease hot spots or clusters and different department programme are not coordinated

10. It was also reported that many families do not have the basic requirements of housing, drinking water, education facilities and infrastructure to take the patients frequently to hospitals and the medical relief are demanded at household level.

Recommendations

(I). Monitoring Children as indicators

1. Monitoring academic performance in schools is an easy tool that could be set up with help of teachers and Parent Teachers Association in schools. The benchmark information may compiled same for all the schools in the district and impacted areas may plan could be developed to monitor academic performances. The Endosulfan cell at the district Panchayath could be asked to develop the methodology and train the teachers for monitoring.

2. Children to be screened on the basis of development milestones and memory test. The known methodology developed by anthropologist Dr Elizabeth Gillette may be customized and given to ICDS and SSA and a mechanism of regular monitoring of the
children in the area will be useful to find the recovery from pesticide.

3. The Children need to be trained as biodiversity monitors and each school could develop an action research of monitoring their local area. The endosulfan cell at the district Panchayath may be tasked to develop the same and help the schools by handholding for first two years.

(II) Social monitoring of environment

1. Focus group discussions on behavior of students with the parent s facilitated by Mother PTA and then special teachers and special education to help them mainstream.

2. Grama sabha could be the venue of assessing the improvement of environment, status of patients and related aspects. Each ward should actually set up a ward level monitoring committee

3. Ward level monitoring should be made in to periodical reports and submitted to the District Panchayath and District collector for compiling at district level to monitor the same from a district level perspective.

(III).Monitoring sustainable resource use and livelihoods

1. Monitor Livelihoods of local community at clusters in a ward so that we can compare the situation and also look at the revival of the environment by assessing the community engagement on livelihoods. A plan could be developed for the same and Endosulfan cell at District Panchayath and Social Welfare Department should be responsible for that.
2. The honeybee farmers need to be compensated for their loss and special programme launched for eco-restoration by planting natural trees. The effort must be enrich the local plant diversity so as to help revival of bee population.
3. We recommend asking Kerala State Biodiversity Board to draw a package for reviving the streams the local communities could implement this and that could be coordinated at district Panchayath as a programme. Currently in Kerala we do not have expertise in stocking traditional fish stocks. The fisheries department has lot of expertise in introducing fishes that are alien species so the revival of local species and the work at Kasaragod will benefit state in similar revival packages elsewhere.

(IV) Support to enable communities to come out of trauma.

1. Livestock development programme do not have an endosulfan remediation package. This opportunity could be used and developed as a programme for reviving Kasaragod dwarf cattle and the farmers and beneficiaries could be selected from the affected areas. This could be augmented as part of the organic Kasaragod programme and revival of the native variety will have national relevance. There could be also one programme for poultry development.
2. People depended on streams are more affected so it may be important to provide community tanks or other common access for water.
3. We recommend a component of the revival of package to start Panchayath level fuel wood plantations Land may be given by PCK and MNREGS could be very easily utilized for this.
4. Cottage industries need to be revived to improve the financial earning of the families. We recommend the same being conceived as a programme and activities like households level units making jackfruit Papadams and many other local food products and unique products may be given priority.
5. The District Panchayath should develop a marketing window for this using Kudumbashree or other systems which they consider appropriate for the same.

6. Cluster based care giving systems should be planned for caregivers relief.

7. Remediation plan to be decentralized to cluster of patients in proximity to plantation or exposed areas.

8. Number of impacted houses and victims to be re listed and checked on the basis of disease clusters so that the it will be easy to assess the progress and effectiveness of remediation at ward level. The additional advantage will be that the seriousness will not be lost in the statistical dilution.

9. Residential facility for differently abled children, patients and victims be started by NPRPD so that the care giving can be go beyond day care. This will be great relief and could be central to the relief package. The institute could be a developed as organic campus with fulltime residential staff and doctors and training facility hostel for accommodating victims. This could also be additionally used to run vocational courses and training for generating jobs and rehabilitation of the victims.

10. Palliative care institutions should be developed owned by local community funded by the Panchayath and reporting to the Panchayath

11. Every school should add a remediation component and have a team of special educators including part time Braille tutor and other paramedical staff who could handle the special children. SSA may be provided with additional resources and equipped to do this as a time bound programme.

(V) Special support for ethnic communities

1. Koraga1 tribe is badly affected by the exposure and we need to develop special relief package so that these ethnic heritage is not lost. A detailed remediation to ensure their needs with provisions for access to biodiversity be developed. The package should also be developed with participation of the community.

2.Kasargod is rich with scheduled communities and their culture it could be thus appropriate to develop a socio economic rehabilitation package developed to enrich natural and ethnic heritage of the area. There could be a area approach and programme implemented by the district administration in close partnership with Panchayath Institutions

(VI) General recommendations

1. Panchayath level Food gardens / orchards and value addition for products be developed and implemented as join programme with Panchayath. This could be implemented by PCK providing the land required to gramapanchayath.
2. We find that the impacted areas with victims in houses will not be able to come up for collective activity based on self help group so we need to develop home base cottage industry.
3. Setting up of district level marketing and promotional system to support the cottage industries
4. Organic farming should be expanded in all over the district by an active district level programme that could be lead by the agriculture department and supported and participated by all stakeholders.
5. Vocational training and employment generation by building capacity for livelihoods giving priority to the affected families
6. Regular awareness programme and sharing of progress in implementing remediation programme in grama sabha.
7. The manufacturer of Endosulfan still stocked in safe custody in PCK estates be located and the same be returned back to them for managing the same. Alternatively the same should be send to HIL the only pesticide manufacturer in the state and be managed under the supervision of the state PCB including the transport and clean up of stores in the estates.
8. We understand that the financial burden on families in overcoming the illness much worse than estimated there are several houses with bad debt. District Collector estimate the burden of loan to over 20croress a immediate moratorium of loan and some relief measures need to be developed.
9. Opportunity loss is one of the key problem and a programme to asses and support be developed
10. There are several cases of failure to get marriage proposal for the men women so a special programme need to be developed to address this counseling and medical support is required to overcome this stigma
11. The current activities and programme are implemented by different agencies. The government need to develop a coordination mechanism our suggestion is to strengthen the endosulfan cell at the district Panchayath. NGOs active in remediation should be encouraged to share the work in the gramasabha and also at the cell meetings. So that there will be better

transparency and accountability besides ease to measure the effectiveness. Jayakumar C., Team leader ,Thanal, Kerala

This paper is for KSCSTE as part of assessment by Technical Cell for monitoring endosulfan persistence in Kasaragod.

Footnotes

1. The Koraga community of south India is considered as one of the most primitive communities of India. According to UNESCO “Koraga” is one of the languages in Danger, or at risk of extinction. Now confined in 55 hamlets in Kasaragod and Manjeswaram blocks bordering Karnataka, their number dwindled to a mere 1,579 as against 1651 according to the 1991 Census.

Annexure – VII

PUBLIC HEALTH CONCERNS OF ENDOSULFAN AND REMEDIAL MEASURES

Dr. Sukanya
Community Health Cell
Bangalore

The team, apart from the biodiversity studies, also had to visit the houses of some of the victims of endosulfan. Although they refuse any study team to enter their houses, we were treated with a kind of faith and expectation as we had with us some of the local persons working for their rehabilitation and remediation. The serious nature of the illness of most victims and the long term incurable conditions and the in-affordability for treatment t reveal the heavy price borne by the people of Kasaragod.

1. Environmental health concerns

It must be admitted that the devastating effects caused by endosulfan on the human population, demands a sincere approach from the Government, to rehabilitate the people socially, economically and also help them regain their well being. The issue would not have taken such a serious dimension, had the Plantation Corporation of Kerala responded to the early warnings of the disastrous consequences of aerial spray as evidenced by the mortality of frogs and fishes in the waters and the disappearance of honey bees in the very first year of the spray. The continued aerial spray of endosulfan for more than two decades, unmindful of the consequences to the environmental health amounts to a fundamental breach of accountability by the PCK and the State who has to safeguard the rights of its people. The State has taken up various steps to assess the extent of damage to environmental health, to provide services for the victims and also set up the Endosulfan Victims Relief and Remediation cell under the district Panchayath- a first of its kind in India.

This committee would like to reiterate that it is the State's responsibility to ensure a safe environment necessary for people to live and pursue their livelihoods. The State has to ensure the organization, management, education, enforcement, consultation, research and emergency responses for the purpose of prevention of environmental health hazards and the promotion and protection of the public health and the environment. In Kasaragod, concerted, coordinated action is required in the following areas: ***food protection; land use; community livelihoods ; solid,***

liquid, and hazardous materials management; drinking water quality; water sanitation; and remediation of soil and water bodies.

This will necessarily require monitoring of the environmental media (air,water, soil) for endosulfan and other toxins so as -

a) to understand the persistence nature of the chemical;
b) to detect illegal use of endosulfan and other pesticides in the district despite an official ban
c) to do research to find ways of remediation of the water and soil

Monitoring of the environmental media has to be linked with monitoring of the chemical in agricultural produce, animals, birds and human beings. This is further explained below in the section on Bio monitoring.

2.Public health concerns

The story of the tragedy in Kasaragod reveals immense burden of sickness, ill health and diseases among those who have lived through the decades of the aerial spraying and the future generation. The study of school going children in 2 Panchayaths conducted by the National Institute for Occuptaional Health (NIOH), a premier institute of the Indian Council for Medical Research (ICMR) in 2001 revealed delayed sexual maturity among adolescent boys and delayed scholastic development among school children exposed to endosulfan spraying. The study findings with its methodological limitations indicate that the nature of diseases due to the toxic effects of endosulfan is largely unknown. This study also put forth many questions regarding the persistence nature of endosulfan.

There have been many studies done by individual doctors, researchers and organizations since 1997 that have highlighted the following-

1) enormous burden of morbidity among the people
2) women are affected but the nature and severity of their reproductive health problems needs a comprehensive epidemiological study
3) there is a huge need for appropriate and affordable health care services

There is an urgent need to streamline all interventions towards improving PUBLIC HEALTH (preventing disease, prolonging life and promoting health) of communities affected by chemical contamination through the organized efforts involving the society, voluntary and people's organizations, public and private, communities and individuals.

Taking all of this into consideration, we recommend that the State should focus on these main areas :

1. HEALTH MONITORING and RESEARCH
2. REHABILITATION
3. HEALTH CARE SERVICES

2.1. Health monitoring and research

Health monitoring in Kasaragod would require an assessment of the body burden of the chemical endosulfan and an assessment of the magnitude of the health morbidity.

Biomonitoring is the assessment of human exposure to chemicals by measuring the chemicals or their metabolites in such human specimens as blood or urine . Blood, serum, urine, fat and breast milk levels reflect the amount of a chemical that actually gets into the body by all routes of exposure, including ingestion, inhalation, and skin contact. The measurement of the chemical in a person's biological media is an indication of exposure, an indication of the body burden of the chemical and an indication as to the circumstances of exposure for individuals and communities. In the case of endosulfan, biomonitoring of the people of Kasaragod will throw light on the

1) nature of persistence of the chemical
2) body burden levels in different age and sex groups, especially women and children
3) help in linking of health effects to the residue levels
4) help in tracking progress of the remediation efforts after the official ban on endosulfan use

Such biomonitoring will have to be linked to monitoring of endosulfan levels in environmental media to map out exposure patters, trends in exposure and identify hot spots of chemical contamination and disease burden. The scope of biomonitoring could be broadened to include other persistent organochlorines, newer pesticides, toxic metals and organic solvents.

There are ethical implications in measuring environmental chemicals in the context of limited knowledge of the nature of health effects and the absence of specific treatments. Therefore biomonitoring should be integrated into regular health surveys conducted in the country like the National Family Health Survey or the District Reproductive Health Survey. The National Report on Human exposure to environmental chemicals (NRHEC) in the USA is linked to the National Health and Nutrition Examination Survey (NHANES) conducted in the USA every 2 years. This

ensures systematic sampling and standardized survey techniques and also a comprehensive understanding of the health status of populations.

The committee would like to recommend

1) To conduct periodic biomonitoring of chemicals like endosulfan in Kasaragod by a health institute that has the expertise to coordinate such activities with other organizations.
2) This has to be linked to monitoring of environmental media (water and soil) in coordination with bio monitoring.
3) Research studies, separate from these data, to determine patterns and trends in body burden and environmental burden of endosulfan; and patterns of disease or any adverse effect.
4) Epidemiological studies on reproductive health of women and children; Studies on Developmental growth of children (upto adolescent age) and Neurological disorders among all age groups should be the first step.
5) Existing Health monitoring surveys, research studies by medical colleges and other public health institutes should be compiled to build a database and bring out estimates of the magnitude of disease burden.
6) Ongoing monitoring mechanisms like the Cancer registry should focus on the patterns of cancers emerging from the population in Kasaragod.
7) Social and economic consequences faced by the communities need to be studied to understand the economic burden on families, social cost in caring of victims and the social mechanisms of coping and redressal adopted by communities.
8) Interdisciplinary research (chemical analysis, epidemiological studies, sociological research) has to be coordinated by a Nodal organization/department of Public health for coordinating and disseminating the research findings as the issue is of a sensitive nature.
9) The National Rural Health Mission with its component of community monitoring could be one of the spaces to involve people in participating and monitoring the various research activities.

2.2 Rehabilitation

The social and economic cost of the people of Kasaragod due to the health problems and loss of traditional livelihoods has been well recognized. This mandates a comprehensive rehabilitation focusing on social, economic and physical rehabilitation. This section will focus on the

framework of Rehabilitation that can guide further action. The difficult terrain and distant villages in Kasaragod necessitate a decentralized, accessible system of rehabilitation services.

Presently, a mobile medical unit with a team of 3 doctors, speech therapist, physiotherapist, special educator and psychiatric social worker conduct twice monthly clinics in every PHC area every month in 11 Panchayats of Kasaragod. The team also do home visits during the clinics.

The committee would like to recommend the following

1) To include a lady doctor (especially a gynaecologist) in the mobile medical unit to address the health concerns of the women.
2) An integrated approach of treatment using allopathy, ayurveda and homoepathy in the medical team and also providing integrated medical care to the patients. The experience from the Bhopal victims tell us that chemical contamination causes multiplicity of health problems and no one system of medicine has all the solutions for disease alleviation. Kerala with its rich knowledge and experience in Ayurveda should be able to offer many treatment protocols for the endosulfan victims also.
3) A protocol for identifying victims of Endosulfan should be developed by team of experts in medicine, toxicology and sociology; local activists and doctors and Panchayat members and government officials. This would serve the basis for any rehabilitation efforts and this protocol and the list of identified victims should be reviewed every 6 months by the Endosulfan victims relief and rehabilitation cell and the special team.
4) To build on the existing health services offered by the health system, especially the National Rural Health Mission. The Accredited Social Health Activist (ASHA),Anganwadi teachers and the Auxiliary nurse midwives (ANM) should be part of the health team on rehabilitation.
5) Community based rehabilitation centres (CBR) should be created in each village depending on the nature of the terrain. These centres could be the focal point for information, training and health services for the endosulfan victims.

CBR is a mechanism through which affected people are given medical care, vocational training and opportunities for livelihoods, social support structures to take care of sick people by other community members when the primary care giver finds it difficult and all the more, CBR offers a space for social inclusion and to improve quality of life. The CBR framework incorporates mechanisms for victims to access their social and economic benefits.

6) A coordinated referral system from the CBR centres to the PHC and the district hospital should be established to prevent any delay in access to health services, implements like calipers, shoes, spectacles or hearing aids and medicines.
7) A system of community based health insurance, the Rashtriya Swasthya Bima Yojana and any other scheme could be pooled to address the medical and health care needs of the victims.
8) The District Hospital and a group of referral centres should serve the health care needs of the people with state of the art facilities in all medical and surgical specialties.
9) The State should be able to reimburse/ support all opportunity costs of care takers over and above the solatium and pensions earmarked. To this effect, the State should earmark specific budget.
10) The case studies of medical care and rehabilitation should be documented and brought out in public domain. This would help in estimating the cost of relief, rehabilitation of a victim of chemical poisoning and help in future policy making and human health impact assessments.

    There is need for transparency, democractic functioning and accountability for implementing the above recommendations on rehabilitation.
11) The system of CBR should be established as a separate independent Society registered under the Societies registration Act, 1862. Members of such a Society should include members of the families of the victims, local Panchayat Ward member, President, Block Panchayat members from the respective area and the Jilla Panchayat President. Society should also have representative of NGOs who have been working for helping the victims, and expert doctors and doctors of the respective institutions who provide services. The President of the Society shall be the Honourable Chief Minister. The Society shall be run by its own rules and regulations, with the Executive Committee monitoring the day to day affairs.

2.3 Health Care Services

This section will be elaborated by a separate report submitted to the Department of Health Services .

3. Conclusion

There is need for coordinated effort of all departments of the State to address the concerns of the communities of Kasaragod. It is important to build coordinated mechanisms using the existing spaces of the health system , the opportunities provided by the National Rural Health Mission, the existing solidarity of the people based movements like the Endosulfan Spray Protest Action Committee (ESPAC),the environmental clubs, youth groups and organizations like the Solidarity Youth Movement and the local providers of health care.

Though it has been 10 years since aerial spraying of endosulfan and many years since the Government of Kerala has taken several steps to address people's problems, there is need for a broad vision to develop and implement a plan for monitoring the persistence of endosulfan and address the health care, livelihood needs of the people and their right to a safe living environment.

We hope the recommendations of this technical cell will help in formulating this broad vision and set an example for the future.