Long Term Monitoring

The Impact of Pesticides on the People and Ecosystem (LMIPPE)

Part II

Report

Preliminary findings of the survey on the impact of Aerial spraying on the People and the Ecosystem

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CONSERVATION ACTION & INFORMATION NETWORK
Thiruvananthapuram, Keralam, India.

The sequence in the report

Preface

We bring this report with good hope. There have been mistakes and failures. We believe that admitting mistakes and an effort to undo such mistakes are signs of good and responsible governance.

Long back in the late 70's, the Plantation Corporation of Kerala started aerial spraying of pesticides at cashew plantations in North Keralam. Endrin was not banned and pesticide application was considered harmless in those days.

Persistence of these chemicals and harm to the fabric of life, which support all of us, is the concern today. The years following the publication of Silent Spring has changed the world, opened new blind spots and threw light at many ignorant actions. The publication of "Our Stolen Future" by Theo Colborn and others further consolidated the research that has gone into man-induced problems that are affecting our destinies and creating irreversible damages to life.

The Governments and organisations from all over the world reiterated their concern by negotiating and signing the Stockholm Convention which is a beginning to a new millenium that shows the world is changing.

But, for the Plantation Corporation of Kerala, the Pesticide manufacturing Industry and their "associated" scientists, the earth is flat. They still believe that pesticides are harmless and everything is fine. They do not hesitate to lie to the people, Government and even to the Honorable High Court.

But truth prevails- because it tells what reality is as it is. And the Government of Kerala recognized this. A bureaucratic faux pas had to be corrected and a political decision brought temporary relief. Endosulfan use in Kerala has been banned, but the critically affected lives still pull on unnoticed, unaddressed in remote villages in Kasaragod. The people now breathe a sigh of relief and is hopefully waiting for more actions from the Government.

This interim report is compiled as the part II of the first report on Long Term Monitoring of The impact of Pesticides on the People and Ecosystem (LMIPPE) at Kasargod. Part I of the report was brought earlier as a dossier on the issue. The last two years were times of learning and we are extremely relieved to find that the scientific works of many are forming the foundation that supports the allegation of the people. We also found that "Pesticide poisonings may go unrecognised because of the failure to take a proper exposure history...."

Thanal - team.

Acknowledgement

Thanal is a public interest research group and the work on Endosulfan has been time consuming and painful. Time consuming as there is poor documentation of the data and problems. Painful, especially because the gross injustice has caused tremendous damages and pain to the local population and it was difficult to interact with the affected people with detachment. We cried and felt deep anger when we came back after the days work. There was no reason and fact to support that endosulfan spraying was undertaken as an only option. The endosulfan spraying was based on manufactured assumptions and reasons. The decision was taken with out any plant protection concerns but at the instance of advice from Pesticide manufacturers.

The Issue took us close to people who are cheerful and compassionate. They taught us a lot about human values and shared their wisdom. We could share our understanding of toxicology and epidemiology and the scientific methods in investigating an issue. They had the faith to face the miserable realities of irresponsibility and injustice. They could laugh at the private interests of the organised scientists. The people gave us food, shelter, took us to houses and showed the realities on the ground. They gave us time and answers and shared their wisdom with patience. They also helped us to realise our limitations.

Thus we cannot acknowledge the names of each, as there are many. There are farmers, workers, labourers, and people of all age groups, class and caste. We are indebted to them. Panchayth members, cultural organisations, sports clubs, unorganised activists concerned about their own land and people, doctors and government officials also gave us lot of support and guidance. We also acknowledge them.

We also thank The Pesticide Action Network of North America, Asia Pacific and United Kingdom, for the extensive support they gave to take our work forward. Participating Organisations of International Platform for Eliminating POPs (IPEN), Jarmila Becka of WWF, Scientists working on Endocrine Disruptors and J.P. Myers one of the authors of "Our Stolen Future" gave us lot of inputs and scientific papers which helped to understand the issue better.

We acknowledge all the above people and the many many others for their help to Thanal and also to the work on Endosulfan. Thus here we are putting in the process that took us to this report. Thanking one and all, once again.

The issue

If what is chronicled in the Silent Spring could shock the world awake off the suicidal path that pesticide use would lead humanity to, then here in these villages one can see the most horrid reality of Rachel Carson's fears come true.

Today villages in Kasaragod District are complaining from peculiar and complex variety of diseases unprecedented in this part of the country. All these villages lie in the mid-lands and laterite hill area of Kasaragod District, the northernmost district of the Kerala State. None of these diseases were known to the people of the area about two decades ago. These diseases are uniform in nature in almost all these villages and there seems to be no section of the people who have been spared from being affected. The peculiar set of diseases has affected atleast 15 panchayaths in the District. The aerial spraying of endosulfan – a highly toxic organochlorine pesticide is being blamed as the cause for these diseases. The spraying is done by the Plantation Corporation of Kerala (PCK), a Government of Kerala undertaking, in the cashew plantations which lies in or borders these panchayaths. The PCK has been undertaking the aerial spraying ritually for the last 26 years in their 4600 ha of cashew plantations.

Incidence of increased number of children born with congenital anomalies, mental retardation, physical deformities, cerebral palsy and mental ailments like epilepsy are reported from many families across panchayaths. Many reports in all the prominent dailies and magazines were showing children with congenital physical deformities, stunted growth, mental retardation and cerebral palsy. Cases with hydrocephalus was also reported. Psychiatric problems are also on the increase and many young and old are succumbing to suicidal tendencies with apparently no reasons as such. Doctors have recorded many cases of cancer, especially of the liver and blood. Informal survey's have also revealed increased rate of breast, throat and intestinal cancer. Cancer among men is almost double that of women. Men are also suffering from infertility and undescended testis. Miscarriages and hormonal irregularities are being reported among women. More and more people are falling ill to rheumatic complaints. Paralysis is very common. Parkinson's Disease is also being reported. Endometriosis, a serious illness affecting the uterus has been diagnosed and is causing serious concern.

Many complain of Skin disorders like Psoriasis, Eczema, Leucoderma and other forms of dermatitis. Very pathetic cases were also found where a chronically affected person was scratching his wound with stone to stop the itching. Children have become susceptible to frequent illness, showing a deterioration of the immune systems. Doctors are forced to give high doses of antibiotics even to contain minor fevers. People were also complaining of hearing and vision loss. Asthma and breathing complaints were too common.

Since the middle of the nineteen seventies, nature has been sending warning signals of impending danger to people in these villages. It came in the form of mass death of honeybees, fishes, frogs and birds. Cows and chicken also started dying of sudden and mysterious reasons. Over some time, fox population started dwindling and there was many a mind that silently worried at these warning signals.

In 1979, a farmer in Padre realised that reason for three of his calves born with deformed limbs and having stunted growth could not be just attributed to his fate. Moreover, he had just read that pesticides like Endrin (Referring to the The Handigodu Syndrome which was very much in the news then) could actually cause such effects. The evidence towards such an hypothesis was lacking then, but still he reported it to a local journalist Shree Padre who wrote the first article "Life cheaper than Cashew" in "The Evidence" (dec.1981) and raised a doubt that Endosulfan, which was being aerially sprayed in the plantations in his village was the cause for such environmental problems. The first warnings were already there. The people started complaining. In 1984, two panchayaths passed resolution not to spray pesticide by air as there is large-scale drift and problems caused for cattle and people. When the local MLA Sri. Subba Rao becomes Minister he ordered the suspension of the aerial spraying. The aerial spraying in some areas was suspended for nearly two years. In 1988, the PCK wrote to National Research Centre for Cashew (NRCC) for advise on the crop protection against the Tea Mosquito Bug which was affecting their plantation. The NRCC recommended endosulfan use at 0.05% concentration. All through these years aerial spraying of endosulfan was continuing. But it is now learnt that this recommendation was never followed as it was found to be ineffective to control the bug. More and more news of health problems started being reported from all other places in Kasaragod as well. Local sports and arts clubs, cultural clubs and community organisations were taking serious view of these problems. Many of them passed resolutions and also complained to the District Collector, who is the authority to permit aerial spraying. In 1994, the Kerala Sastra Sahithya Parishad (KSSP) alleged that the problem is caused by insecticide and asked for stricter regulations in the aerial spraying. By this time, the local print media including the major dailies started reporting the issue of health problems and spread of strange diseases and health disorders. The people also started agitating. Surprisingly, in 1997, Dr. EVV Bhaskara Rao, the Director of NRCC recommended aerial spraying at 1% concentration of Endosulfan 35EC. He added that " In this connection I am also to mention that aerial spraying trials were conducted in the PCK orchards and the spraying method was standardised for the first time in the country". (Letter No. F. PA (TECH.ADV)/97 dated 26 December 1997 to the Manager, PCK Ltd). It is indeed appalling that aerial spraying of endosulfan was going on for more than 20 years before it was standardised.

At the same time, Dr. Mohankumar, a local medical practitioner of Enmakaje, concerned with the large number of strange diseases wrote to IMA and other psychiatric specialists drawing their attention to the mysterious nature of the problems there. He felt the root of the problem lies in the water in the area. Dr. Mohankumar reported that there were abnormally high numbers of psychiatric and epileptic cases in his village. Almost at the same time Leelakumari a mother of two children and Agriculture Assistant working in the Periya Krishi Bhavan, who had moved to her new home in Periya village, realized that her son who is a good singer is loosing his voice and suffers from depression. Her daughter also developed some hormone problems and she put her up in a hostel outside the area till the spray drift recovers. She found that she herself was suffering from loss of voice and hormonal problems. She appealed to the PCK, the District Collector and all the authorities to stop poisoning their fields and wells. The Kerala State Pollution Control Board collected water from their well and reported that the well was not contaminated, but the procedure they followed in testing and their very lackadaisical attitude in monitoring and controlling pollution was later criticized in various forums. The KSPCB Chairman also made a statement in a prominent magazine that they lacked information about endosulfan. Leelakumari along with Kottan, a farmer and local politician and others appealed to the Munsif Court for

stay of spraying in 1998. The Hon'ble Munsiff, while issuing the stay order observed that "The Stand taken by the respondents (the PCK) is that of a heartless industrialist. They say that use of insecticides would bring more profit and more foreign exchange. But it cannot be at the cost of human lives.... Certainly we have power to destroy nature, but the question is whether we have the wisdom to preserve it..." . Many local environmental groups, led by the Society for Environmental Education in Kerala (SEEK) also joined in support of the struggle of the people and filed separate petition in the High Court asking for stopping aerial spraying in Periya Division. Two separate fact finding teams, one led by SEEK and later one by Thanal reported incidence of similar diseases in all the panchayaths that have plantations or are close to them. The survey also found that PCK has violated the Insecticides Act in precautionary and safety measures and even in concentrations of the chemical sprayed. In many places the PCK workers themselves reported health disorders but requested anonymity out of fear of the management. Soon after, Thanal, supported by SEEK and many community and local groups decided to conduct a long term monitoring of the area to study the endosulfan caused problems. This was launched in October 1999. A preliminary report was submitted to the District Collector.

In December 1999, inspite of all the hue and cry over the unmindful spraying of endosulfan over the plantations and the people's dwellings and waterbodies, the PCK was getting ready for the next round of spraying. The environmental groups – SEEK, INTACH(Natural Heritage), NAPM, Earth Society, KPSS, and Thanal - named PCK as the worst polluter of the State and declared the area as a silent Bhopal caused by PCK while remembering the 15th Anniversary of the Bhopal disaster. They also released "The chemical free century - Declaring a toxic free future" on this occasion.

In January 2000, the School Resource Group meeting in the Govt. High School in Vaninagar in Enmakaje observed that students coming from the backside of the school was generally found to be mentally and physically backward and their learning capabilities were also poor. The SRG wondered why this was happening. Later it was realsied that the plantation was in the backside of the school. LP section of the school has about 152 students, 40 of those who come from the back side is suffering from some sort of congenital anomaly, mental retardation, physical deformity. Many other are frequently taken ill.

In October, 2000 the Munsif Court of Hosdurg ordered permanent prohibition of use of any insecticide by air. The court also restrained PCK from using other methods which may cause harm to others properties. This order was on a case filed in Periya Plantation area only and was not operational to other areas. The PCK, inspite of massive and widespread protests from other areas, especially Muliyar and Perla plantation area, restored to aerial spraying of endosulfan, after arresting hundreds of people who were asking for their wells and other waterbodies to be covered, as per the Insecticides Act and the directions of the District Collector.

It was soon after this that Sports and Arts groups, cultural groups, panchayaths and environmental groups came together and formed a larger network to protest against the endosulfan use and aerial spraying and to find an alternate solution to this issue. All these groups recognised that information about toxicity of endosulfan and the problems it created was lacking. Information from various national and international sources was collected and their worst fears were confirmed. The people realised that they were exposed to a chemical which has been classified as an "extremely hazardous" pesticide affecting the Central Nervous

system, Reproductive system, Immune System, Liver, Kidneys and Skin. The Government machinery and the Insecticides Act could do nothing to protect them from being poisoned. The Scientists at the KAU were still asking for evidence of contamination and were terming this pesticide as a "safe" pesticide, pointing out to its use in IPM. Separate surveys by Thanal, Dr Mohankumar and Link-Trada revealed that there is matching of the diseases in the panchayaths and the possible diseases that could be caused by endosulfan. Central nervous system disorders - psychiatric cases, Parkinson's disease, epilepsy, cerebral palsy, mental retardation, congenital anomalies, Reproductive system disorders, infertility, hormonal disturbances, asthma and respiratory problems, skin diseases, gynecological problems, cancer of the liver, throat, blood and uterus were just some of them. The people then approached the NRCC and KAU enquiring whether they had done any study of long term efficacy of endosulfan on the pests, long term toxicity studies on the people and environment. Both had never done any studies and maintained a silence on these queries. The truth was that PCK had also never in the last 26 years done even the mandatory medical examination of the workers.

The groups then tried to get in touch with other scientific labs in the country to find out whether it was possible to find out if the area was contaminated.

The Centre for Science and Environment finally responded and sent their researchers to collect the samples and analyze at CSE lab. The whole process was done by a team led by Dr. Padma S Vankar Senior scientist in charge of the Facility for Ecological and Analytical Testing at the IIT, Kanpur. Retd. PVC and Coordinator of the Environment Centre of the KSSP, Prof. M.K.Prasad , And Dr. Raghunandan, Associate Professor and Veterinary Toxicologist from IRTC (On deputation from KAU) supervised the sampling. 25 samples were picked from the village. The CSE found alarming level of endosulfan in all the samples. They publicly released the report in February 2001. Not only was this a shocking revelation, but the CSE also showed what public-interest science was all about – transparency and responsibility.

Several cases were now filed at different courts including Munsif Court and High court. The Munsif Court of Kasargod stayed all pesticide applications in Kasargod taluk in February 2001. The CSE report, which was only an exercise to find evidence and alert the public, succeeded in bringing a lot of national and international attention to the problem.
The Cashew Export Promotion Council immediately responded and wrote to the Directorate of Cashew and Cocoa and they in consultation with NRCC advised PCK to refrain from aerial spraying. The NRCC then sent a notification to all the Cashew growing agencies in the country withdrawing the recommendation for endosulfan use in Cashew.

Soon after, a KAU team of experts rushed to the field, collected samples and visited a number of families affected by the diseases. They alleged that the CSE study is not scientific. The report of the KAU study has also not been published, even after 6 months.

The Kerala Government has meanwhile upheld the precautionary principle and responded to the issue by banning endosulfan use in the State.

Meanwhile, FIPPAT, a private lab near Chennai was commissioned by the PCK to study the problem. The report was released in a press conferences by the Pesticide Manufacturers and Formulators Association of India (PMFAI). This has clearly sent the signals to the people and have made them all the more clear of the unholy

liaison between the PCK and the pesticide industry. The Enmakaje Panchayath has already disowned the FIPPAT study for all the secrecy, which shrouded the study and the panchayath not being informed of the study.

The demand from the PCK and the industry is that they be allowed to continue the use of endosulfan and that the Government do a thorough study of the reported health problems in Kasaragod and identify the cause of them. At the same time the scientists of the KAU and the NRCC have openly stated their position that it is not fair to blame endosulfan and punish the culprit without scientific evidence. This position is contradictory to the precautionary principle which India is bound to follow as a signatory of the Rio Declaration. The Precautionary principle clearly states that "*In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.*" . The Agenda 21 document prepared by the Ministry of Agriculture of the Government of India also outlays a vision to move away from pesticide use.

Hypothesis

The primary aim of a hypothesis is to start at an "educated guess" or a "tentative assumption" and this should be guided by the most probable/ possible / plausible option from a set of answers or in this case causative factors for a problem of this nature.

Hence on the onset, we ask the question – Why did the people conclude that endosulfan was the cause for their ailments ?

Most families in many of these villages once believed that the health disorders that they were suffering from was because the local god was angry with them for some unknown reason. For example, in Enmakaje, the people believed that Jadathari (the Lord Shiva) was angry with them and people conducted special pooja's and rituals like theyyam for appeasing him. People like Dr. Mohankumar believed that there must be something in the water that they use, from the stream nearby that must be contaminated by radiation or heavy metal. But slowly, as time passed by and the ailments were mounting to threatening proportions, the evidence were all pointing towards one possible chemical whose presence was there in abundance in their midst atleast three times every year. Endosulfan was the only chemical, or rather the only pollutant externally introduced into their lives for the last 26 years. So, why did the people conclude that endosulfan was the causative factor ? – primarily because there was no other source of pollution or possible poisoning other than this chemical.

Added to this are other reasons –The people have been seeing this kind of strange diseases in their families only since the middle of nineteen seventies and early nineteen eighties. There was no such incidence of congenital anomalies among the people born before the nineteen eighties.

Many other villages in Kasaragod have also reported such health problems at various times in the last decade and the only common factor to which all these villages were exposed, invariably happened to be endosulfan and nothing else. Members of the same family but living in various villages find that the diseased are only in the villages which are close to the PCK plantations. This again shows that the problem is not of genetic and familial nature.

In this context, it would be interesting to point out a matter that occurred in 1998. During an earlier study of the Grasim factory and its pollution which caused Cancer in a number of homes in Vazhakkad and surrounding villages, a Health Inspector working at Vazhakkad observed in one of his talks with our researcher that "cancer incidence was not very high in Vazhakkad, and was only comparable to those in Panathadi panchayath" where he used to work before being transferred to Vazhakkad. This anecdote is pointed out here, because Panathadi panchayath is in Kasaragod and one of the most affected area, and has been exposed to endosulfan spray and if one is to give due weightage to a Health Inspectors observation, though unofficial and passing, the semblance is indeed worth pursuing. Moreover, Panathadi has no such hazardous / chemical industries, like in Mavoor.

In the preliminary survey itself it was found that the people were complaining about the acute health problems which resulted soon after the spraying. Irritation to the skin, convulsions, vomiting tendencies, sickness, dizziness etc were common to many of the exposed people. The school children were the worst affected, especially because they had to go to school, many a time through the shortcuts via the plantation area and soon after they reached school had to be taken to a doctor. But, it was learnt that soon after the aerial spray many of the chronic cases underwent a resurgence and sometimes these then had to be treated anew. Skin diseases, descending of the testis, swelling of the testis, disruptions in menstrual cycles, sudden changes in blood sugar levels, frequent fever among children, asthma, breathing difficulties increased among the chronically ill people during and after spraying season. Swelling of lymph glands and scrotum was reported soon after spraying. One girl in Periya reported that her periods stop soon after the spraying and she suffers from a lot of hormonal problems and weakness for the ensuing 3-4 months, after which her periods reoccur. Evidently, it is clear that endosulfan spraying is linked to the triggering of the chronic problems as well.

The local doctors whom our researchers interviewed also corroborate these findings. The veterinary doctors in many panchayaths also report of diseases to cattle and to domestic animals. In Padre, the spraying this year caused serious diseases among the cattle. Many cows miscarried, soon after the spray and some had very violent deaths. People reported that this was very common especially among the cows, which graze in the plantation.

Local people and panchayath representatives also revealed that the health effects were most prominent in villages which have the PCK plantations lying within it or borders it. Villages close by the plantation had markedly reduced incidence of diseases and villages which were distant from the plantations were not affected by these kind of health problems. This again supported the hypothesis that endosulfan is the primary causative factor. Moreover, the similarity in complaints as stated by the families in various villages – up north in Enmakaje and Bellur and down south in Cheemeni area were largely similar in nature.

It was also observed that most of the employees of the PCK and their families were also affected, though only comparable with the non-employees living in the same area. This must have been primarily because of aerial spraying, which did not discriminate between employees and non-employees. Adding to this observation was the fact that some of the workers were suffering from very serious chronic illness, like throat cancer and chronic skin diseases. But, these workers revealed that they were directly involved in the spraying many a time as mixers or applicators. The researchers also observed endosulfan spraying in new saplings of cashew using hand-sprayers. The employees also reported that they were not given any protective clothing or gear during such spraying which is mandatory under the Insecticides Act.

All these singularly points to the fact that the health disorders were very much linked to the proximity of the villages with the PCK owned cashew plantations. The plantations have been consistently sprayed with endosulfan, aerially for the last 26 years, 3 times every year, violating all the precautionary measures (many a time because it would be impossible to take precautionary measures in an area like Kasaragod, as noted by the KAU scientists and the NRCC) and the rules of pest control. And hence it is concluded that the use of endosulfan in the plantations must be the primary suspect for all these health disorders caused in the villages in Kasaragod.

Nevertheless, it is felt that the study must also consider other possible causative factors as well. The causative factors must either be due to some human-induced activity or due to some natural phenomenon.

Health and Environmental problems of this nature can also be caused by human-induced activity which involves industrial processes especially of hazardous nature related to radio active substances, heavy metals or chemically hazardous substances. Fortunately, no such activity can be found anywhere in Kasaragod District. Hence there is no possibility of any other human-induced activity, other than endosulfan exposure to be the causative factor. Moreover, there were also no possible sources of contamination of air or water from across the borders of the State from Karnataka.

The other possible causative factor raised by many scientists in the KAU and also suspected by Dr. Mohankumar in 1997 (though he does not endorse it now) is the possibility of a background natural radiation or heavy metal release. But the problem that has been identified have a maximum history of only 26 years and not more than that. This is an important matter that needs to be kept in mind while spelling out the causative factors. It is very difficult to believe that background radiation or heavy metal contamination can occur suddenly, out of the blue, 26 years ago, from the surrounding hills and water sources. The only activity, which can possibly trigger such radiation or heavy metal contamination, is a large scale mining operation as in the UCIL in Jarkhand, where large-scale mining for Uranium (a radio-active substance) has triggered an unprecedented health crisis among the surrounding communities. Moreover, there is always the possibility that the background natural radiation/ heavy metal exodus, if any, may not have been noticed or recorded earlier. If so atleast its effects must surely have been felt earlier itself. In this case, no such effects has been reported before 1979. Hence it is impossible that any sources of radiation or heavy metal contamination is a possible causative factor.

Health impacts

The next important logical step is to ask the question- Are the aberrant health problems seen in the villages in Kasaragod related to endosulfan ?

For establishing this crucial link, it is important to find out what acute health problems were caused when endosulfan was aerially sprayed and what are the aberrant health problems seen and reported from the suspected areas.

Acute effects during and immediately after the spraying

The following acute effects were reported from places exposed to endosulfan aerial spray

- A Noxious smell fills the air and people find it difficult to breath.
- The whole area carries a smoggy look.
- Eye irritation, itching , sometimes with tears in the eye
- Headaches and dizziness.
- Suffocation and choking feeling.
- Coarse feeling in the throat.
- Skin itches, with swelling when scratched.
- Seizures among grazing animals, sometimes leading to death. Bleeding leading to abortion and sometimes death if the animal (cow, dogs) were pregnant.

General issues of health.

- People were found to be generally weak, getting tired quickly. Most of the people were laborers or were involved in work mostly of physical nature. They complained that they are not able to work as they used to some years back. Earlier where they used to work for more than 8 hours, today they are not able to work for more than 2 or 3 hours.
- Many people, including women and children were found to be anemic and ailing from frequent fevers and diseases, indicating effects on the immune system.
- People, especially women look over aged.
- Men, especially young men who were under grown, physically. 25 to 35 year old men looked only in their teens or early twenties.
- People disclosed about many cases of infertility, which was high among men. The local doctors also confirmed that infertility cases were high.
- Many people were being treated with hormones for a variety of problems. The doctor also mentioned about cases of breast enlargement in boys (gynaecomastia) which was an alarming revelation.
- Women were suffering from serious gynecological problems. Many of them have had problems that have resulted in their Uterus removed. A large number of women disclosed to the women members of our team that they have menstrual problems.
- There were cases of women taking hormonal treatment to correct their hormonal cycles before their marriages
- The ailing people approach the local doctors who find it difficult to cure many of these chronic ailments and refer them to specialists

at Kanhangad or Mangalore. If their disease is complicated and need special treatment or surgery they usually go to Mangalore.

- Many of the ailments have not found a proper cure and now people know that diverse unknown diseases are inflicting them. They even know that the doctors are not able to diagnose their problems. So they simply continue taking the high doses of medicines that are being given.

Problems affecting the Skin

- A number of people have skin problems ranging from small, frequent itches to chronic cases like Psoriasis and Eczema . Many of them are being locally treated as allergies and the doctors are generally not inclined in finding the cause.
- Rashes are found in the hands and the inner palms, with itching which turns to septic boils.
- Discolored patches appear on the skin with itching sensation.
- Swelling of legs and hands, darkening of the skin. The swelling is specifically reported by many of the plantation workers who are directly in contact with the pesticide mixing and spraying operations.
- One ex-worker disclosed that most of the plantation workers have some sort of skin diseases or other. His daughter complained of frequent swelling of the body and getting tired very quickly. She disclosed of having gynecological problems as well. She revealed that her periods stop soon after the spraying season and resume only after 3-4 months, during which time her blood sugar level also goes down and she suffers from a variety of problems.
- Some women reported frequent swelling of the whole body.

Problems affecting the Lungs, Throat etc.

- A number of people were suffering from Cancer of the throat. Some of them could not be interviewed as they had been hospitalised. One case had only recently been diagnosed and their relatives asked us not to meet him as he did not yet know he had cancer.
- There were multiple cases of people, mostly men, who gradually lost their voice and finally when pain set in, the disease was diagnosed as Cancer of the throat or larynx.
- Many men suffered from pain in the throat.
- A very large percentage of the children were suffering from difficulty in breathing, asthma etc. Children seem to have been the most affected by this. They also get very frequent fevers, which sometimes last for a month. We found one infant (6 months) suffering from a mild cold, but administered with Amoxicillin tablets.
- Many complained that soon after the spraying, they have throat problems and some complained of loss of voice. Many have difficulty raising their voice when speaking.

Problems affecting the Eye

- Generally, people complained of itchiness and watery eye during the spraying. The irritation sometimes continues for atleast three days, during which the whole area bears a foggy look with visibility much reduced.
- a large number of people had problems related to vision, though it is not known whether it is directly due to spraying. But it is now known that long-term exposure to organochlorines can affect the nervous system affecting hearing and vision.

- Some plantation workers disclosed, on promise of anonymity, that almost all the workers suffer from eye itching, burns, chronic headache and sometimes loss of vision also.

Problems affecting the Stomach and Gastro-Intestinal system.

- A good number of people, especially men get frequent stomach ache's. Sometimes vomiting accompanies such ache's especially in children
- The Staff Nurse at Navodaya Vidyalaya school at Periya reported that in 1988 she had conducted a health survey of the locality with participation from her school children. The report is unfortunately misplaced now, but she remembers having seen a lot of cases of stomach and intestinal problems.

Even though a number of such disorders were reported, some of the aberrant diseases which had reached alarming proportions and are of concern were also identified. It is felt that these have to be discussed separately, due to its fatal and threatening nature.

Cancer

Survey conducted in Periya-Pullur , Muliyar, Cheemeni and Rajapuram reported that a number of people were suffering from Oral cancer, cancer of the throat and stomach, prostrate cancer and intestinal cancer. Local doctors and the doctor at the Public Health Centre at Periya also said that incidence of cancer especially the ones mentioned above was high. Women at the same time seem to be affected more with breast cancer. The comment by the Health Inspector of Vazhakkad who found that cancer cases in Pananthadi (Kasaragod) were as common as in Vazhakkad (Calicut, affected by the pollution from Grasim Industry) corroborates the findings. Dr. Mohankumar, a doctor practicing in Enmakaje has found from his observations of his patients that there were 51 cancer deaths in just 126 houses near the Kodenkeri Stream at Enmakaje Panchayath. He enlisted 4 living cancer cases now in these houses. Many of these cases, the doctor remembered were cancer of the liver and blood. A survey done by Link-Trada of Mangalore also identified 11 cancer deaths in just 52 families in the last 5 years.

An analysis of the death records of some of the panchayaths also suggested an increasing pattern of cancer deaths over the years. For example, cancer deaths recorded in Enmakaje panchayath alone have increased from 37 (1982-87) to 49(1988-93) and to 71 (1994-99). This means an increase of 33% in just 6 years and 92% in 12 years. Incidentally, this data does not include the deaths in the panchayath which could have got recorded at Kasaragod Municipality, Mangalore, Kanhangad or elsewhere were many of the patients die in hospitals. Considering this also would only add to the already alarming percentage of increase.

Comparatively, Meenja Panchayath which is an unexposed area away from the PCK plantations did not show any significant increase in cancer deaths over the same period. The recorded cancer deaths were 40 (1982-87), 32(1988-93) and 47(1994-99).

Reproductive System ailments

Almost all the families that had participated in the surveys and the informal interviews revealed some sort of gynecological problem or other in most women living near, in and around the plantations. Most of the women at Periya, Cheemeni, Muliyar, Rajapuram were found suffering from irregular periods, sometimes even

twice or thrice a month, showing a clear case of hormonal disruption, much possible with organochlorine induced chronic toxicity effects. Many of them were suffering from profuse bleeding during the periods and were in acute pain. There are cases of periods getting stopped much before the menopause age. One girl complained that soon after the spraying, her periods get stopped and she suffers from hormonal problems. The periods then reoccur 3-4 months after the spraying season. Most of the married women with children have gynecological problems, leading to the uterus being removed. Many young women have irregular periods and other related problems like pain, headache's, dizziness, weakening of the body etc. Women around the age of 30 looked beyond their age. They were also found tired and weak, unable to do the work that their age should be allowing them to do. It was understood from them that women take hormonal treatment to correct their menstrual cycles, so they would not have marital problems. Infertility and Miscarriages were also high. Some cases of endometriosis have also been reported. Organochlorine pesticides are known and proven to cause endometriosis and breast cancer.

Men were found to be more elusive in talking about their reproductive health problems. But some of them disclosed that they were suffering from undescended testis. Infertility was also high in the area, especially among men. It was learnt, with shock that boys had retarded sexual growth and this was also leading to some sort of desperation. But social ostracism was feared, especially related to reproductive health and it was understandable that young boys and girls of age would not wish or be allowed to disclose their sexual growth and reproductive health related problems.

Central Nervous System related problems

The many surveys by the panchayaths along with local groups, especially at Belur, Enmakaje and Muliyar and the survey done by SEEK and Thanal in other villages revealed the presence of diseases which could be connected to some form of Central Nervous System disorders. There were too many cases of congenital anomalies with brain disorders like cerebral palsy, retardation of mental growth, epilepsy, physical deformities like stag horn limbs, deformed or part grown limbs. Psychiatric problems, which is traditionally considered a mental health problem is also on the increase. Today modern science do not consider psychiatric problems as just a mental health problem, but also as a nervous system problem which can be caused by neurotoxins. There is growing evidence that suicides and suicidal tendencies may also be caused by prolonged exposure to neurotoxins. Dr. Mohankumar in his study has revealed that there are 38 cases of mental retardation, 49 psychiatric cases, 33 epilepsy cases and 11 suicidal cases in just 126 houses he surveyed. Similar cases have been reported from other villages like Kumbadaje, Muliyar, Bellur also.

The deaths due to Rheumatism, Paralysis and arthritis are also on the increase. Data from death records of Enmakaje Panchayath reveal a nearly five fold (488%) increase of deaths due to rheumatic complaints, arthritis, paralysis etc in the last 12 years. These are also linked to weakening of the CNS as well.

While discussing congenital anomalies it is important to note that many of the conventional understanding of toxicity and effects being related to exposure levels and applied concentrations are being questioned and have been rendered meaningless with newer findings.

A study " A case-control study of pesticides and foetal death due to congenital anomalies" reported recently in the journal Epidemiology (12:148-156) by Bell EM, Hertz-Picciotto and JJ Beaumont have revealed that there is " a strong association between exposure to commercially applied agricultural pesticides during a crucial period in foetal development and the likelihood of foetal death due to congenital defects" The study revealed that foetal death is more likely among mothers who are living within a 9-square mile area in which commercial pesticide spraying takes place during pregnancy. It was also discovered that risk of foetal death is greater for exposures in week 3-8 compared to week 1-20. This 3-8 weeks period is considered as the most vulnerable period in human development (the period of "organogenesis")

The exposure of organochlorine pesticides which are endocrine disruptors can cause a variety of health ailments which may not be directly linked to the causal substance. The endocrine disruption during early development stages, even at insignificant levels can trigger malfunctioning of thyroid gland and leading to failure in brain development and complex development disorders in the foetus. In "Our Stolen Future", Theo Colborn et al concludes a chapter- Altered Destiny saying *"As we wrestle with the question how much chemical contaminants are contributing to the trends and societal patterns we see – in breast cancer, prostrate cancer, infertility, and learning disabilities – it is important to keep one thing in mind. Scientists keep finding significant, often permanent effects at surprisingly low doses. The danger we face is not simply death and disease. By disrupting hormones and development, these synthetic chemicals may be changing who we become. They may be altering our destinies."*

A deeper and better understanding of the issue at Kasaragod is called for and one needs to explore whether the problems like congenital anomalies found in Kasaragod are just the direct effects on the CNS and the endocrine systems or whether they are related to such complex problems as developmental stage exposures.

A literature survey of health effects that endosulfan can cause

Now the question that has to be answered is whether toxicological, epidemiological or medical studies have shown that endosulfan can cause these aberrant diseases.

Endosulfan is an organochlorine insecticide of the cyclodiene subgroup. It acts as a poison to a wide variety of insects and mites on contact and as a stomach acaricide.

Human Beings may be exposed to endosulfan from

- breathing air near where it has been sprayed
- drinking water contaminated with it, from direct application, spray drifts or runoffs;
- eating contaminated food;
- touching contaminated soil;
- smoking cigarettes made from tobacco with endosulfan residues;
- working in an industry where it is used or living near its vicinity.

Acute toxicity

Endosulfan is classified as a highly toxic substance. It is acutely toxic to birds, marine and freshwater fish, and mammals. Like other chlorinated cyclodienes,

endosulfan is a neurotoxin affecting the central nervous system (CNS) of aquatic organisms as well as mammals.

People who are occupationally exposed to endosulfan are advised to avoid eye and skin contact as well as inhalation exposure. Symptoms of acute toxicity in humans are restlessness, irritability and hyperexcitability, followed by headache, dizziness, nausea and vomiting, blurred vision, unconsciousness, insomnia, lack of appetite, loss of memory, albuminuria, haematuria and in some cases, confusion.

Chronic toxicity

Chronic exposure to endosulfan may result in general toxicity symptoms such as liver and kidney damage as well as effects on the CNS, immune system and the reproductive system.

Neurotoxicity

Endosulfan may have adverse effects on the CNS of aquatic organisms, birds and mammals. The main mechanism of action of endosulfan in the CNS is inhibition of brain acetylcholinesterase, causing uncontrolled discharges of acetylcholine. Abnormal behaviour has been observed in fish and mammals being chronically exposed to endosulfan.

Carcinogenicity

Even though, endosulfan was not classifiable as to its carcinogenicity (due to lack of sufficient data), studies have shown that it can be carcinogenic. Reuber, 1981 showed that endosulfan was carcinogenic in male and female rats at all sites examined. It also induced liver tumours in female mice. Another study(Fransson-Steen, 1992) found that endosulfan promoted the growth of altered hepatic foci in rats in a similar manner as the structurally related chlorinated insecticides, chlordane, aldrin and heptachlor did, indicating that endosulfan is a potential liver tumour promoter.

Immune System

Endosulfan is also known to affect the immune system. Target organs are the kidneys and liver. A number of studies have shown endosulfan to hepatotoxic. Endosulfan inhibits leukocyte and macrophage migration causing adverse effects on the humoral and cell mediated immune system.

Reproductive Effects

A number of studies have shown a potential for adverse effects of endosulfan in the reproductive system of aquatic organisms and mammals. Histological changes in reproductive organs were seen in aquatic organisms following exposure to endosulfan at concentrations as low as 0.00075 mg/L (0.75 µg/L). Endosulfan treatment in male rats was reported to cause a dose-dependent reduction in sperm counts, sperm abnormalities and decreased daily sperm production as well as decreased testis weight.

Endocrine disruptive action

In vitro studies show endosulfan is estrogenic (in the E-SCREEN assay). Endosulfan I competes with [^{3}H]17β-estradiol for binding to the estrogen receptor. Endosulfan sulfate inhibited binding of [^{3}H]R5020 to the progesterone receptor by

40-50 per cent. Low levels of endosulfan (1 nM, 0.41 ppb) can inhibit the human sperm acrosome reaction, initiated by progesterone and glycine, but the inhibition is not complete. Endosulfan II and endosulfan sulfate decreased β-galactosidase activity of progesterone (Jin *et al.*,1997).

In vivo studies showed that Endosulfan decreased plasma vitellogenin levels in catfish (Chakravorty *et al.*, 1992). Endosulfan also decreased the number and size of oocytes in fresh water teleost fish, and increased the number of deformed oocytes, damaged yolk vesicles, and dilated gonadosomatic index. It caused a dose-dependent reduction in sperm counts in rats, reduced the number of spermatids, caused sperm abnormalities and decreased daily sperm production.

Genotoxicity and Mutagenicity

Several independent studies have shown that endosulfan is genotoxic. Data from in vitro and in vivo mutagenicity studies generally provide evidence that endosulfan is mutagenic, clastogenic and induces effects on cell cycle kinetics. (Syliangco, 1978; Adams, 1978; Yadav et al., 1982). Endosulfan was also found to cause chromosomal aberrations in hamster and mouse, sex-linked recessive mutations in Drosophilia, and dominant lethal mutations in mice(Velasquez et al., 1984; Naqvi and Vaishnair, 1993). Studies in human cells both in vitro and in vivo also showed that endosulfan caused the occurrence of sister chromatid exchanges indicating chromosomal damage(Sobti et al., 1983; Dulout et al., 1985). Very recently, a team of researchers in Japan found further evidence of endosulfan genotoxicity using sister chromatid exchanges, micronuclei, and DNA strand breaks as detected by single cell gel electrophoresis as biomarkers (Yuquan Lu et al., 2000).

Comments

From literature and the studies available from all over the world one recognises that endosulfan is a highly toxic chemical, used widely as a pesticide but with toxicological properties comparable with the likes of DDT and Dieldrin, which have been banned in the country and is slated for a global phaseout.

Endosulfan has been recognised as a chemical which can cause endocrine disruptions, reproductive system disorders, central nervous system disorders, liver and kidney dysfunctions in many studies on animals and human beings – in vitro and in vivo. It has been shown to display genotoxic, mutagenic and carcinogenic effects.

The health problems seen in the villages adjoining the PCK plantations in Kasaragod have much in similarity to the kind of effects that can be perpetuated by the prolonged exposure to endosulfan. The presence of endosulfan in the environment is confirmed not only because CSE studies established the same but primarily because endosulfan was sprayed for more than 20 years, three times every year and its cumulative presence in the environment is a non-negotiable reality. The presence of these aberrant health issues and the various studies confirming the toxicological and health effects of endosulfan are equally non-negotiable realities.

The hypothesis of the people in the villages, suspecting endosulfan as the causative factor for their various health problems is indeed true and is supported by scientific studies on health effects of endosulfan exposure.

In these circumstances, there is a primary responsibility to acknowledge that there is a problem existing suspected to be caused by endosulfan exposure. It is now a proven fact that endosulfan is capable of causing the health problems as seen in the villages in Kasaragod. It is extremely sad to note the attempts from industry and associated scientists to label endosulfan as a "safe" and "soft" chemical by alienating themselves from new scientific findings and the realities.

What one needs to explore is

⇒ what were the overall and specific conditions that led to such a homicidal exposure to endosulfan
⇒ what were the specific and overall mechanism that failed in preventing such an exposure and consequent health issues
⇒ who were responsible, to what extent and how such exposures and poisoning can be avoided in future
⇒ how such a chemical banned/restricted in many countries and also recommended for restriction in India continued to be so recklessly used
⇒ what are the health problems that need to be remediated and compensated and what is the mechanism for the same
⇒ what are the environmental problems that endosulfan use has triggered and the mechanism for remediation

Attachment -1

ENDOSULFAN – A SHORT SUMMARY

Endosulfan is an organochlorine insecticide of the cyclodiene subgroup. It acts as a poison to a wide variety of insects and mites on contact and as a stomach acaricide.

Uses

It is used as an insecticide for vegetable crops; control of aphids; thrips, beetles, cutworms, bollworms, foliar feeding larvae, mites, bugs, borers, whiteflies, slugs and leaf hoppers in citrus deciduous and small fruit fibre crops, forage crops, oil crops, grains, coffee, tea, forestry, tobacco and ornamentals. It is used to control tse-tse flies and termites and is also used in rice and legumes in India.

Formulations of endosulfan include emulsifiable concentrate, wettable powder, ultra-low volume (ULV) liquid, granules and dust.

Production Use and Status

Endosulfan is produced by the reaction of hexachlorocyclopentadiene and cis-butene-1,4-diol in xylene, followed by hydrolysis of the adduct to the cis-diol or dialcohol. Endosulfan is then produced by treating this bicyclic dialcohol with thionyl chloride. Technical endosulfan is made up of a mixture (7:3) of two molecular forms (isomers) of endosulfan, the alpha- and beta-isomers. Technical grade endosulfan contains at least 94 per cent of the alpha- and beta- isomers. It may also contain up to two per cent endosulfan alcohol and one per cent endosulfan ether as well as endosulfan sulfate. Of these the alpha-isomer is more toxic than the beta-isomer, while the beta-isomer is the more stable and persistent isomer.

Endosulfan is sold in India in various trade names, some of them are Agrosulfan, Aginarosulfan, Banagesulfan, Seosulfan, Endocel, Endoson, Endonit, Endomil, Endosol, Endostar, Endodaf, Endosulfer, E-sulfan, Endorifan, Hildan, Chemusulfan, Kilex-endosulfan.

Characteristics and Toxicity

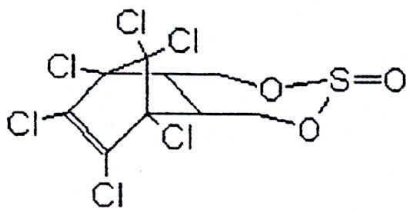
Endosulfan is chemically very close to Dieldrin, substituting a heterocyclic sulfur in place of the saturated bicyclic ring system. The other well known chemicals in cyclodiene sub-group are Aldrin, Endrin, Dieldrin, Heptachlor, Chlordane and Mirex. All these cyclodienes, except endosulfan are already banned in India and is going to be globally phased out by the Stockholm Convention signed by World Countries in May 2001 under the auspices of the UNEP. Of the 12 chemicals (Dirty Dozen) to be initially phased out, nine are pesticides of which six of them belong to the Cyclodiene sub-group.

Endosulfan is considered to be highly toxic. It can adversely affect human and wildlife exposed to it. It has been shown to cause damage to the nervous system, as well as other parts of the body, with the liver and kidney being target organs for chronic exposure in mammals. Endosulfan is proven to show carcinogenicity and is a liver tumor promoter. Endosulfan is genotoxic, mutagenic and cytotoxic. It is suspected to be teratogenic, it is shown to affect the reproductive system and

disrupts the endocrine system. Its teratogenicity could not be reliably proven due to the maternal toxicity it showed on the experimented animals. Its effects particularly, estrogenic properties can have wide and disturbing effects on the human and wildlife health. Endosulfan is extremely toxic to Fish and many other aquatic organisms. It is toxic to insects and also to mammals. It is toxic to honey bees.

Physical and Chemical Properties

Chemical name: 6,7,8,9,10,10-Hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiopin-3-oxide
Chemical formula: $C_9H_6Cl_6O_3S$
Chemical Structure:



Melting point:
Pure (100%): 106°C
Technical (90%-95% pure): 70°- 100°C
Odour: Slight odour of sulfur dioxide
Solubility in water at 22°C: 0.16-0.15 mg/L
Partition coefficients:
Log K_{OW}: 3.55 and 3.62
Log K_{OC}: 3.5
Vapour pressure at 25°C: $1*10^{-5}$ mmHg
Vapour pressure at 80°C: $9*10^{-3}$ mmHg
Henry's law constant at 25°C: $1 * 10^{-5}$ atm m^3/mol
Bioaccumulation factor (BCF): <3000

Classification

Endosulfan is classified in India as an "Extremely Hazardous" pesticide (ITRC,1989). Endosulfan is classified as a "Moderately Hazardous" chemical by WHO (Class-II). The European Union and the U.S Environmental Protection Agency (USEPA) have classified Endosulfan as Class Ib (Highly Hazardous) . The USEPA has listed the compound in the Extremely Hazardous Substances List under the Environmental Standards. Endosulfan is classified as a "highly toxic" substance as per many other agencies(EXTOXNET, 1998). The classification of WHO was found to be inappropriate considering the classification followed in countries all over the world. It is alleged that the WHO has classified endosulfan as a Class II or "Moderately hazardous" pesticide based mainly on LD50 value taken from company generated acute toxicity data (Quijano R.F, 2000).

Fate and Degradation in the Environment

The two isomers of endosulfan have different fates in the environment. beta-endosulfan is more persistent than alpha-endosulfan (NRCC, 1975). Endosulfan sulfate is the main degradation product of both isomers, and is itself persistent in the environment (NRCC, 1975). Whereas, endosulfan diol is their hydrolysis product which tends to form in alkaline aquatic environments (NRCC, 1975).

Drift from aerial applications and volatilization from water and plant surfaces are the primary ways of endosulfan entry into the atmosphere. It has been found that some of the endosulfan sprayed on crops and water will volatilize to the air (Simonich and Hites, 1995;Terranova and Ware, 1963). The volatilization half-life from surface water varies from 11days to one year and from plant surfaces from two to three days (Callahan *et al.*, 1979). In air, endosulfan is carried over long distances. Traces of endosulfan have been found in Arctic air as well as snow samples (Gregor and Gummer, 1989).

In water, endosulfan undergoes hydrolysis and microbial degradation. The rate of hydrolysis is influenced by pH. The hydrolytic half-life can range from five weeks at pH 7 to five month at pH 5.5 (Greve and Wit, 1971; Schoetteger, 1970). Microbial degradation products of endosulfan in water include endosulfan sulfate and endosulfan diol (NRCC, 1975). The half-life of endosulfan in water varies from three to seven days to about five months, depending on the dissolved oxygen content and pH of the water as well as the degree to which the water is polluted (NRCC, 1975).

In soil, endosulfan binds strongly to soil particles and is not readily leached out to ground water. The bulk of endosulfan residues is bound to the top 15 cm of soil surface layers. In experimental conditions, 90 per cent of the endosulfan residues were found in the top 15 cm horizon of the soil surface, nine per cent at a depth of 15-30 cm, and only one per cent was found at the depth of 30-45 cm after 503-828 days (Stewart and Cairns, 1974).

In soil, endosulfan is subject to photolysis, hydrolysis or biodegradation. Major products of degradation processes in soil are endosulfan diol and endosulfan sulfate (Martens, 1976; El Beit *et al.*, 1981). Endosulfan isomers show different rates of dissipation from soil. Endosulfan sulfate is more persistent than the parent compound (Stewart and Cairns, 1974). In experimental applications of endosulfan 50 per cent of α–endosulfan disappeared within 60 days, versus 800 days for β–endosulfan. In another report, the half-lives of α- and β–endosulfan were estimated as 35 and 150 days, respectively (EXTOXNET, 1996).

Endosulfan is less persistent on plant surfaces and rapidly degrades to endosulfan sulfate and endosulfan diol. The estimated half-life of endosulfan on plants ranges from 1.95 to 2.74 days.

Residues

Endosulfan is released to the environment mainly as a result of its use as an insecticide. High concentrations of endosulfan, as alpha--endosulfan, beta-endosulfan and endosulfan sulfate, have been detected in tree bark samples throughout the world, particularly in India and the Pacific Rim (Simonich and Hites, 1995). It was speculated that the high concentrations of endosulfan in these areas were due to its use on rice.

In aquatic ecosystems, endosulfan partitions to plants and animals and also accumulates in sediment. Both endosulfan and endosulfan sulfate have a longer half-life in sediment. Concentrations of endosulfan in sediment have been reported to be 32,000 times higher than in the water column (NRCC, 1975).

Although generally low concentrations of endosulfan have been found in surface water, lethal concentrations may be found in ponds and streams in the vicinities of spraying areas. A study using water containers indicated that drift from aerial agricultural spraying could produce concentrations lethal to fish in shallow exposed water bodies 200 m away from the target spray area. Levels of 1.7 mg/L and 0.04 mg/L were found in water containers in the vicinities of the spraying areas and 200 m away. These levels are found to be lethal to fish (Ernst *et al.*, 1991). This experiment confirms that the agricultural practice of applying endosulfan aerially may lead to increased pesticide concentrations in waters off-site, which could result in fish kills in unexpected areas.

Globally, endosulfan is one of the most commonly identified chemical in any residue analysis in fruits and vegetables, for which it is mostly used. In a study sponsored by Indian Council of Agriculture Research (ICAR) – the All India Coordinated Research Project (AICRP) on Pesticides Residues in 1999 -out of 422 farm-gate vegetables tested for residue of endosulfan 322 (79%) were found to be contaminated. The residue levels ranged upto 18.63 mg/kg (the second most contaminating after residues of copper, upto 75 mg/kg, which is a metal and does not undergo degradation). The allowable Maximum Residue levels of endosulfan in food is 0.5 to 2 mg/kg. Moreover, the contamination percentage of endosulfan (79%) was second only to Lindane (96%).(Toxics Link, 2000)

Exposure

Human Beings may be exposed to endosulfan from

- breathing air near where it has been sprayed
- drinking water contaminated with it, from direct application, spray drifts or runoffs;
- eating contaminated food;
- touching contaminated soil;
- smoking cigarettes made from tobacco with endosulfan residues;
- working in an industry where it is used or living near its vicinity.

Wildlife may be exposed to endosulfan in the environment by consuming plants that have been sprayed with endosulfan, ingestion of soil or dermal contact with soil. Additional exposure can occur through inhalation of air in the area of agricultural application. Exposures in aquatic environments may occur due to surface runoff following agricultural application, or upon deposition of endosulfan following long-range transport in the atmosphere. Fish have been exposed to sufficient quantities of endosulfan in agricultural run-off to cause mortality (Frank *et al.*, 1990).

In the mammalian system, the alpha-isomer of endosulfan persists in the body longer than beta-endosulfan, particularly, in brain tissue and plasma. Male rats fed with technical-grade endosulfan had detectable levels of alpha-endosulfan in brain tissue and plasma, with less beta-endosulfan, and almost no endosulfan sulfate detected (Gupta, 1978). Similarly, in rabbits, which died following acute exposure,

alpha-endosulfan residues were also detected in liver and brain tissue (Ceron *et al.*, 1995), but no residual beta-endosulfan or endosulfan sulfate was found.

Acute toxicity

Endosulfan is classified as a highly toxic substance. It is acutely toxic to birds, marine and freshwater fish, and mammals. Like other chlorinated cyclodienes, endosulfan is a neurotoxin affecting the central nervous system (CNS) of aquatic organisms as well as mammals.

People who are occupationally exposed to endosulfan are advised to avoid eye and skin contact as well as inhalation exposure. Symptoms of acute toxicity in humans are restlessness, irritability and hyperexcitability, followed by headache, dizziness, nausea and vomiting, blurred vision, unconsciousness, insomnia, lack of appetite, loss of memory, albuminuria, haematuria and in some cases, confusion.

Chronic toxicity

Chronic exposure to endosulfan may result in general toxicity symptoms such as liver and kidney damage as well as effects on the CNS, immune system and the reproductive system.

Neurotoxicity

Endosulfan may have adverse effects on the CNS of aquatic organisms, birds and mammals. The main mechanism of action of endosulfan in the CNS is inhibition of brain acetylcholinesterase, causing uncontrolled discharges of acetylcholine. Abnormal behaviour has been observed in fish and mammals being chronically exposed to endosulfan.

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Even though, endosulfan was not classifiable as to its carcinogenicity (due to lack of sufficient data), studies have shown that it can be carcinogenic. Reuber, 1981 showed that endosulfan was carcinogenic in male and female rats at all sites examined. It also induced liver tumours in female mice. Another study(Fransson-Steen, 1992) found that endosulfan promoted the growth of altered hepatic foci in rats in a similar manner as the structurally related chlorinated insecticides, chlordane, aldrin and heptachlor did, indicating that endosulfan is a potential liver tumour promoter.

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Attachment 2

Endosulfan – Regulations and Violations

(A note on the regulation in India and how it was violated in the PCK owned plantations of Kasaragod)

The Central Insecticides Bureau

The Central Insecticides Bureau (CIB) is the Central Govt. Agency, which regulates pesticide use in India. They have periodical reviews of use of pesticides and is the agency for registering its manufacture, sale and use.

The Designated Licensing officer in the States issue licenses for manufacture, sale, stocking and use of pesticides.

Aerial spraying of Endosulfan

Among other conditions like giving prior information to the people in the area advising them to keep away from the area of application for a period of 20 days, covering all the water sources during spraying etc as stipulated by the Insecticides Act 1968, the CIB prescribed that the spraying of endosulfan should be undertaken at a height of not more than 2 to 3 metres above the foliage. This was always violated in the PCK plantations.

It has also come to light now that aerial spraying of endosulfan was never allowed by the CIB from 1993. The CIB had given approval for aerial spraying of endosulfan only till December 1992. But the PCK, the Department of Agriculture in Kerala and the District Collector has been issuing aerial spraying orders even after 1993 up to the last season, without the approval of the CIB.

General Use of Endosulfan

Dr. Banerjee committee -1991

In 1991 the CIB appointed a committee under the chairmanship of Dr. Banerjee to review whether some pesticides, including endosulfan should be continued to be used in India. Among other recommendations this expert committee concluded

1. *That the use of endosulfan be continued*
2. *That the registration committee should not allow the use of endosulfan near rivers, lakes, sea and ponds, which are expected to be polluted. 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.*

Dr. R B Singh committee - 1999

In 1999, the CIB appointed an expert committee under the chairmanship of Dr. R B Singh to review the continued use of some pesticides including endosulfan.
This Committee also recommended the continued use of endosulfan and among others it recommended that

- Labeling should be made mandatory in bold letters to avoid use of endosulfan near water sources.

The Registration Committee meeting

The 195th Registration Committee (of the CIB) meeting held on 14th December 1999 agreed for the continued use of endosulfan and suggested to incorporate a warning statement on the labels and leaflets indicating that endosulfan should not be used near water sources.

Inter-ministerial Committee

The 10th meeting of the Inter-Ministerial Committee to review the use of insecticides and hazardous chemicals held on 29-12-1999 also recommended among others that

1. the continued use of endosulfan in the country
2. incorporating the warning in the labels and leaflets that endosulfan should not be used near the water resources

The Central Insecticides Bureau and the Ministry of Agriculture has not yet implemented the restrictions suggested by the various committees, while always approving the continued use of endosulfan.

Endosulfan has been aerially sprayed in 4600 ha of cashew plantations owned by the Plantation Corporation of Kerala for nearly 25 years now. It is quite evident as per the recommendations that

- **it has been officially recognized that endosulfan is highly toxic to aquatic beings especially fish and contaminates water**
- **and that it cannot be used anywhere in Kerala where water bodies are plenty in the form of sea, rivers, lakes, backwaters, rivulets, streams, surangams, ponds, wells etc.**

In this context had the recommendations been implemented in 1991 the miseries and the toxic burden of the villagers of Kasaragod could have been avoided. Even today, the recommendations are kept aside for reasons unknown and the use of this highly toxic chemical continues to steal the future of many many innocent children of Kasaragod and elsewhere.

In this context the State Government had taken the precautionary measure of suspending all use of endosulfan in Kerala. But the chemical should be suspended from use permanently.

Attachment-3

World wide regulatory status of Endosulfan

The last decade (1990-2000) has been a period when countries all over the world has taken a very progressive and precautionary look at pesticide use. In our knowledge there are so many countries that have banned/severely-restricted endosulfan for farm and agriculture use.

Columbia is the latest to ban endosulfan in all its crops in March 2001. The State Council (Consejo de Estado) the supreme administrative court of Columbia in a landmark judgement banned all use of endosulfan. The court originally considered a ban on use in coffee but after considering its toxicity and risk to human health, it ordered a ban of endosulfan use in all crops.

Endosulfan			
	Banned	**Severely Restricted**	**Priority for re-evaluation**
Africa (1 country)	Belize		
Asia Pacific (16 countries)	Singapore	Bangladesh (*Ban in Rice*)	Pakistan
	Tonga	Cambodia	
	Syria	Japan	
	Indonesia	Korea (*Ban in Rice*)	
		Khasakisthan	
		Kuwait	
		Philippines (*allowed only for Pineapple*)	
		Lithuania	
		Sri Lanka	
		Taiwan	
		Thailand (*Ban in Rice*)	
Europe (12 countries)	Germany	Denmark	Luxembourg
	Sweden	Yugoslavia	Portugal
	Norway	Netherlands	Spain
		Finland	
		United Kingdom	
		Russia	
South and Central America (4 countries)	Brazilian State of Rondonia	Venezuela	
	Colombia	Dominica	
North America (2 countries)		United States Canada	
Australia		Australia	
Total	**10**	**22**	**4**

Most of the countries have banned/severely-restricted endosulfan due to its toxicity to aquatic organisms and mammals. A developing country like Syria follow very practical and scientific criteria based on the precautionary principle for canceling the registration of a pesticide. A pesticide is banned in Syria

- if the pesticide was unhealthy
- if it is banned in the source country or in two other developed countries
- If it is banned by a resolution issued by any international organisation
- If there are available excuses for any pesticide registering committee to cancel it depending on scientific researches and reports carried out by any Arabian or international side.