

**SOCIO-ECONOMIC AND HEALTH
CONSEQUENCES OF PESTICIDE EXPOSURE:
A CASE STUDY OF ENDOSULFAN TOXICITY IN PADRE
VILLAGE, KASARGODE DISTRICT, KERALA**

*Dissertation submitted to the Jawaharlal Nehru University in Partial
Fulfilment of the requirements for the award of the degree of*

MASTER OF PHILOSOPHY

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CERTIFICATE

This dissertation entitled "Socio-Economic and Health Consequences of Pesticide Exposure: A Case Study of Endosulfan Toxicity in Padre Village, Kasargode District, Kerala", is submitted in partial fulfilment of six credits for the award of the degree of MASTER OF PHILOSOPHY (M.PHIL.) of this university. This dissertation has not been submitted for the award of any other degree of this university or any other university and is my original work.

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LIST OF ABBREVIATIONS

ADI	Acceptable Daily Intake.
ATSDR	Agency for Toxic Substance and Disease Registry.
BHC	Benzene Hexa Chloride.
CIAA	Coordination of Inter American Affairs.
CSE	Centre for Science and Environment.
DDT	Dichloro Difenyl Trichloro ethane.
DNA	Deoxiribo Nucleic Acid.
EPA	Environmental Protection Act.
EXTOXNET	Extension Toxicology Network.
FAO	Food and Agricultural Organisation.
FPA	Fertiliser and Pesticide Authority (of Philippines).
GOI	Government Of India.
HIL	Hindustan Insecticide Limited.
IAESD	International Association of Economic and Social. Development.
IARC	International Agency for Research on Cancer.
IBEC	International Basic Economy Corporation.
ICMR	Indian Council for Medical Research.
ILI	Indian Law Institute.
IMA	Indian Medical Association.
IMBC	International Medical Commission on Bhopal.
IPC	Indian Penal Code.
IPCS	International Programme on Chemical safety.
IQ	Intelligence Quotient.
ITRC	Industrial Toxicology Research Centre (CSIR- India)
IUPAC	International Union of Pure and Applied Chemistry.
JMPR	Joint Meeting on Pesticide Residues.

JPHN	Junior Public Health Nurse.
KSSP	Kerala Sasthra Sahitya Parishad.
MIC	Methyl Iso Cyanide.
MR	Mental Retardation.
MRL	Maximum Residue Limit.
NGO	Non Governmental Organisation.
NIOH	National Institute of Occupational Health (of India).
NIOSH	National Institute for Occupational Safety and Health (US).
NRCC	National Resource Centre for Cashew (of India).
NYCAP	New York Coalition for Alternatives to Pesticides.
PANAP	Pesticide Action Network Asia and Pacific.
PANI	Pesticide Action Network International.
PCBs	Pesticide Control Boards.
PCK	Plantation Corporation of Kerala.
PHC	Primary Health Centre.
PHSC	Primary Health Sub Centre.
PIL	Public Interest Litigation.
PMFA	Pesticide Manufacturers Association.
POPs	Persistent Organic Pollutants.
PTAC	Pesticide Technical Advisory Committee.
ROHC	Regional Occupational Health Centre (Bangalore).
TV	Television.
UAE	United Arab Emirates.
UCC	Union Carbide Corporation (of America).
UCIL	Union Carbide India Limited.
UNEP	United Nations Environmental Programme.
UOI	Union Of India.
USA	United States of America.
USEPA	United States Environmental Protection Agency.
WHO	World Health Organisation.

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Chapter-1

INTRODUCTION

The concept of a *web of life* is the interrelated *whole* of the plants, organisms, and the environment. Each and every minute constituents of this larger whole has an influence on that larger whole¹. Application of chemical pesticides to the environment creates a negative impact upon the balance of the larger system. Despite these impacts the global usage of pesticides goes on increasing. World Resource Institute estimates a global consumption of 2.6 million metric tons of pesticides in 1995². Rapid industrialisation and agricultural advancement have been responsible to a large extent for this high usage of pesticides and today pesticides constitute an integral part of modern agriculture. However with excess pesticide usage the quality of the natural environment deteriorates and the ecosystem loses its balance with the unprecedented emission of pesticides in the environment. With this high extent use pesticides, the exposure and health impacts upon people started to increase. Rachel Carson (1962) in her book *Silent Spring* pointed out the adverse effects of pesticides upon the environment. Thornton Joe (2000) pointed out another example of pesticide exposure and negative health impacts on people. He explained the tragedy that has happened to the people of the area from Baton Rouge to New Orleans of United states. There are over 100 chemical plants are working in this area and the people of the area manifest severe health problems like cancer and physical deformities. Environmentalists called this geographical area as *cancer valley*³.

Pesticide use in India has also rapidly increased after the introduction of high yielding variety seeds during the mid sixties. This increase in use of pesticides causes many problems. The biggest example of a pesticide disaster that happened in India was the Bhopal tragedy of 1984. Sanjoy Hazarika

¹ Reid, L., (1962) *The Sociology of Nature*, Penguin Books, Harmondsworth, pp. 13-26.

² Chemistry and Industry, (1995) *World Mackenzie Agrochemicals*, 15, November, p. 1.

³ Thorton Joe, (2000), *Pandora's Poison, Chlorine Health and New Environmental Strategy*, MIT Press, Massachusetts, p. 42.

(1987) explained the damage that happened to the health and environment in Bhopal, as a "poisoned world"⁴.

The present study examines the health and socioeconomic impacts that occurred in a village after continuous exposure of a pesticide. The Plantation Corporation of Kerala (PCK)⁵ owned 4696 ha. of cashew plantations, in Kasargode district of Kerala. These plantations were aerially sprayed with a pesticide Endosulfan, to control *tea mosquito bug*⁶, for the past two decades. Now people living in the surrounding area are affected with peculiar and unusual kind of diseases. Padre village, one among the surrounding villages came into high media attention with the manifestation of many such diseases like mental retardation, physical deformities, cancer, epilepsy, cerebral palsy, hydrocephalus and skin diseases. Various Non Governmental Organisations conducted fact-finding missions regarding the problem. Kerala Sasthra Sahitya Parishad (KSSP)⁷, Thanal Conservation Action and Information Network⁸ are some among the fact-finding teams. The problem came to the attention of the National Human Rights Commission (NHRC) and on the basis of their directive National Institute of Occupational Health (NIOH) conducted a study in the area. The NIOH study established the presence of high number of strange diseases and criticised the unprecedented and continuous usage of aerial spraying. The government of Kerala responded to this problem and appointed a committee to study and recommend the future course of action regarding the problem. This committee recommended avoidance of further aerial spraying of any pesticide in the plantation division. However another study conducted by the Pesticide Manufacturers Association (PMFA) exonerated endosulfan. Pesticide Manufacturers Association argues for the continuation of aerial spraying of Endosulfan on the basis of the absence of a dose- response relationship to the health impacts in this case. Risk assessment of pesticide exposure comprises the same problem of establishment of proven dose- response relationship. The

⁴ Sanjoy Hazarika (1987), *Bhopal the Lessons of a Tragedy*, Penguin Books, India, p. 1.

⁵ A Kerala government owned corporation, with the objectives to cultivate, develop, and protect cash crops.

⁶ A pest, which affects the flowers and tender leaves of cashew plantation.

⁷ KSSP is an organisational network, for the scientific and cultural and advancement of the state.

⁸ Thanal Conservation Action and Information Network, is a Non Governmental Organisation, based in Thiruvananthapuram, Kerala.

argument for the establishment of a linear association, of Endosulfan and health problems, seems to be the negation of precautionary principle⁹. The decision to restrict or ban a particular pesticide would be taken after assessing its toxicity, current use patterns and the availability of less toxic and economically comparable substance. The political and economic decisive forces behind this process of decision-making, tends to avoid the voiceless and poorest people, as in the case of Padre village. The economic consideration, which rules the society, has the tendency to avoid the powerless people and their sufferings. In the case of Padre village means the suffering people. Intervention of civil society is expected to guide the policy and the legislature, to provide justice to the sufferers. In Padre village such interventions instigated the State government to ban the aerial spraying.

The study plans to explore the health and socioeconomic consequences of pesticide exposure in Padre village. Kerala government owned Plantation Corporation of Kerala was conducting the aerial spraying for the past two decades till December 2000, and the regulatory mechanism to control the pesticide use were non functional. This exploration is conceptualised, in the context of politics and ethics involved in the process of decision making for pesticide usage. Toxicity of Endosulfan and its associated health hazards are not a subject for this study. The manifestation of peculiar diseases in a village and its social, economic and psychological impacts upon the affected families are the subject for this study.

The study contextualises the issue within peoples right to live in a healthy environment. The scientific studies regarding the inefficiency and hazards of aerial spraying, and the possible health impacts due to this pesticide exposure are traced out for this study. The issues that obstruct the compensation to the sufferers are compared with the Bhopal tragedy and the lengthy judicial process to provide compensation to the Bhopal disaster is

⁹ The scientific principle prevents the risk by avoiding the practice rather than assessing the established risk and then avoiding the practice. The scientific concept, to protect public health and the environment.

analysed in this study. This comparison tries to mark out the gap between compensation and suffering population even with clear evidence.

If we analyse the social distribution of environmental benefits and burden, it can be seen to be an unjust distribution of benefits. The burden is unjustly directed towards the least advantageous group of people. This disproportionate risks faced by the underprivileged, exposed population is the central concern of this study. The study is an attempt to analyse the problems, between the people, society and environment.

Chapterisation

The study is divided into 7 chapters. The introductory chapter contains the problem statement and the explanation of Chapterisation of the report. Chapter 2 is designed to review the literature on the crisis generated by pesticide exposure to human beings at present as well as to the future generations and to the environment. The studies of various country experiences that establish the relationship between the pesticides (particularly Endosulfan) and the health and environmental impacts are reviewed. The history of industrialization and pesticides, historical and political factors behind green revolution, economic and industrial dimension of pesticides etc, are traced out and the subsequent deterioration in the quality of the natural environment are also analysed in this chapter. Studies by different groups on health impacts due to the aerial spraying of Endosulfan in the area are reviewed and presented in this chapter.

Chapter 3 is the conceptualisation and methodology of the study. The conceptual base of the study is formed on the basis of the literature review. The chapter explains, the various dimensions of the problem, the rationale behind the selection of the problem and the objectives of the study. This chapter further explains the location of the research area and the design of the study. It also detects some of the geographical peculiarities of the area and basic demographic profile of the district and the panchayath. The methodology used

in the selection of the sample, the process of data collection and the limitation of the study etc are also explained in this chapter.

Chapter 4 is written on the basis of the objective to analyse the socio-economic profile of the area and study population. The chapter examines the availability of various institutions and the infrastructural facilities of the village. The living conditions of the village, family composition, caste, education, land, livestock, water sources and income etc, are also looked at this chapter. The chapter provides the basic information of the affected families.

Chapter 5 summarises the economic, social and health impacts of diseases due to pesticide exposure in the affected families. The first part of the chapter establishes the peculiar diseases in the affected area. Subsequently this chapter express the impacts of unusual diseases in affected families. The age group, type of diseases, details of treatment, schooling of the affected children and social participation of the affected families and the stigmatisation that has happened to the village etc are examined in this chapter. The general health problems of the villagers are also considered and their multidimensional impacts on their lives are explained.

Chapter 6 reviews the regulatory mechanisms for pesticides and environmental protection in India. The chapter looks at the lengthy judicial process for availing compensation to the victims of Bhopal gas leak tragedy. A comparison of the Padre village to the Bhopal case was done in this chapter. It pointed out the capturing of people's right for a healthy life and environment. The chapter discusses the environmental laws in India and non-functional nature of those laws in the case of Padre village. The disinformation done by the PCK, the violation of the guidelines insecticide rules and contamination of the drinking water sources of the people etc are discussed in this chapter. This chapter further discusses the powerlessness of the people and the necessity for applying the precautionary principle in the case. Chapter seven is the concluding chapter and it summarises the findings of the study within a public health dimension.

Chapter-2

REVIEW OF LITERATURE

Introduction

The literature reviewed for this study includes the history of pesticide use, the health and environmental impacts due to pesticide exposure, and the economic dimensions of pesticide industry. Various studies on the health and environmental problems of Padre village have been reviewed. An attempt is made to analyse the village level situation, in the context of a value-based question, that is the comparison of the economic dimensions of pesticide usage and human health.

In 1962, Rachel Carson described the adverse effects of indiscriminate use of chemical pesticides. In her book *Silent spring*, she pointed out the dangerousness of pesticides to the environment and all forms of life due to the appearance of these chemicals in soil, water, and air and in agricultural products.

“For the first time in the history of the world every human being is now subjected to contact with dangerous chemicals, from the moment of conception until death. In less than two decades of their use the synthetic pesticides have been so thoroughly distributed throughout the animate and inanimate world that they occur virtually everywhere. They have been recovered from most of the river systems and even from streams of ground water flowing unseen through the earth. Residues of these chemicals linger in soil to which they may have been applied for a dozen years before. They have entered and lodged in the bodies of fishes birds reptiles and domestic and wild animals so universally that scientists carrying on animal experiments find it almost impossible to locate subjects free from such contamination. They have been found in fish in remote mountain lakes, in earthworms burrowing in soil, in eggs of birds-and in man himself. For these chemicals are now stored in the bodies of the vast majority of human beings, regardless of age. They occur in the mother’s milk, and probably in the tissues of the unborn child”¹

¹ Rachel Carson, (1962) *Silent Spring*. Other India Press, Mapusa, Goa, India. p. 12
The deadly effects of DDT and other chemicals are highlighted in the book. The continued and indiscriminate use of the pesticides according to Carson would make silent the spring through pollution

The issue raised by the author on the alarming consequences on the environment and destruction of wild life caught the attention of the international arena. The book led to the formation of a Senate Committee for environmental affairs by John F Kennedy in the United States. Despite worldwide attention to '*Silent Spring*' the problems Carson describes in the book and the ethical issues she raised remain almost unaddressed. Today, the controversial administrative negligence of the environmental policies and vested economic interests and irrecoverable damages upon the people and environment are visible all over the world.

In his book '*The Sociology of Nature*' Reid in 1962 outlines the principle of dependence that governs the activities of all the forms of lives and creatures. His views are ecocentric rather than anthropocentric. He outlines that human beings and nature are equal partners and argues that each and every single phenomenon has its own purpose.

He thus explains the pattern and structure of the set of soil, air, water and life. The relationship between plants and animals, between human beings, between human beings and plants, between human beings and animals etc, are explained. This view of *whole complex web of life*, gives the dynamism of give and take, which is mutual dependence.² Reid's views are of mutual cooperation between all living and nonliving things in the environment that binds all lives of earth. That is the harmonious cooperation of web of nature, which has deteriorated highly in the present days. Human beings are living in a world where they extract maximum possible outputs from nature for their existence, distribution and profit. The issues pointed out by Rachel Carson are an outcome of that deterioration.

A Brief History of Pesticide Use

Pesticide use seems to be as old as human recorded history. There are numerous examples in literature regarding the use of chemical substances for the purpose of pest control in early agriculture practices. Homer was considered

and poisoning. The book has profound influence in on the public attitude concerning chemical pollution and environmental protection.

² Reid, L. (1962) *The Sociology of Nature*, Penguin Books, Harmondsworth, pp. 13-26.

the pioneer in the field of pesticide use. He mentioned the value of burning Sulphur as a fumigant and Pliny also refers the use of Arsenic compounds against insects during the first century AD. Available records on pesticide use in India indicates that rat poisons were used even prior to 1000 B.C. Natural products like tobacco decoction, pyrethrine, whale oil, soap and inorganic chemicals such as calcium disulphide, arsenate etc were used in early India for agricultural protection³.

The Chinese experience of pesticide usage to protect plants is recorded from 16th century. They applied Arsenic compounds as insecticides. Literature shows that the Chinese extracted nicotine 300 years ago for the same purpose⁴. In 1774 a Swedish chemist, Scheele who accidentally dropped a few drops of hydrochloric acid on a piece of manganese dioxide, discovered Chlorine. Chlorine gas evolved as greenish yellow gas at that time⁵. During 1850 soap was used against aphids and Sulphur was used as a fungicide. A mixture of copper sulphate, lime and water known as *Bordeaux mixture* was introduced first as a fungicide during 1885. The same mixture was used as a herbicide from the year of 1896. About the same time it was discovered that iron sulphate could kill weeds in cereals and with in the next ten to twenty years other simple substances like sodium nitrate and ammonium sulphate and sulphuric acid came into use as herbicides⁶. The use of pesticide increased by the year of 1920's and 1930's. By this time organic compounds started to outweigh the inorganic compounds and among the organic compounds petroleum and related compounds were the most commonly used.

The period immediately followed by the Second World War was the period for the discovery and production of a new class of pesticides known as organochlorines. Paul Muller discovered DDT in 1939 and that made a shift in the nature of pesticide usage of that time. The most common organochlorine insecticides of that time were DDT, Lindane, Aldrin, Endrin, and

³ Mc Leene, (1993) *Pesticide Regulation Handbook*, Executive Enterprises Publication Company, New York, pp. 14-45.

⁴ Hansen, P.E. and Jorgensen, S.E., (ed.) (1991) *Introduction to Environmental Management*, Elsevier Science Publishers, B.V. Sara Burgerhartstraat, Amsterdam, pp 198-99.

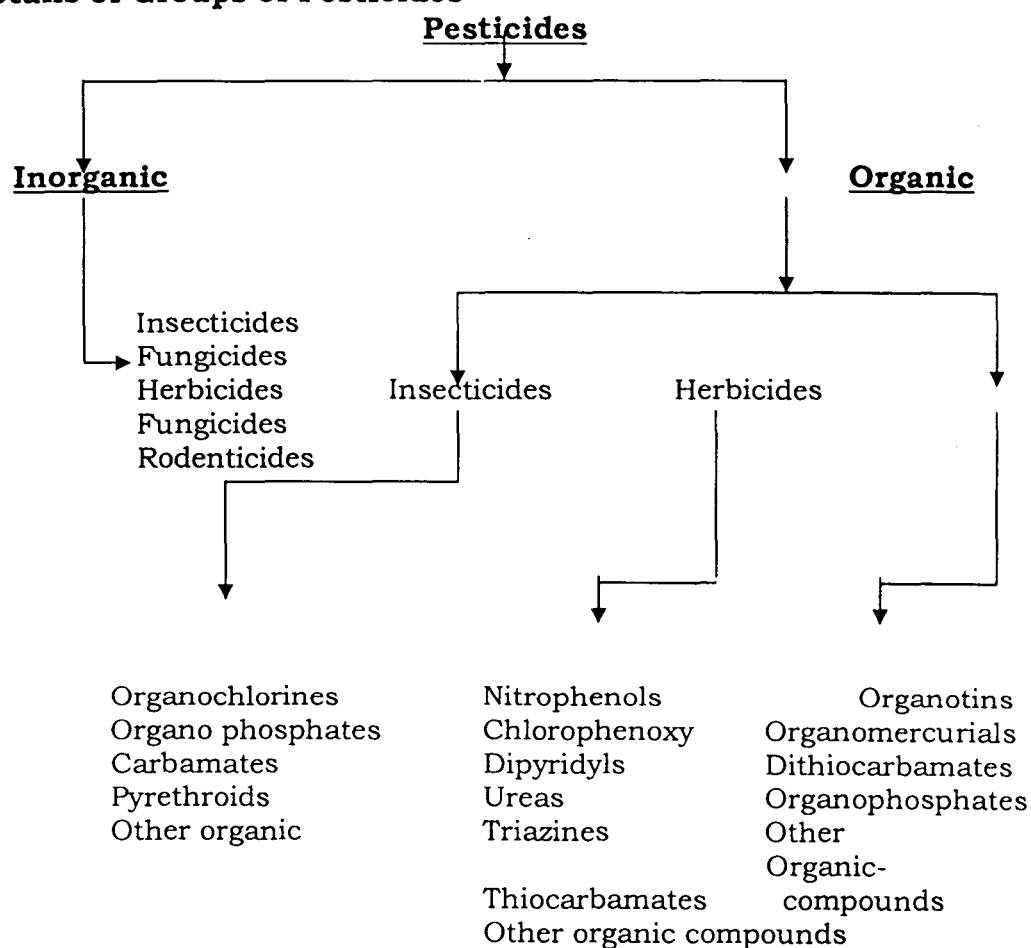
⁵ Bas Wielenga.(1999): *Towards An Eco-Just Society*, Centre for Social Action, Bangalore, pp. 23.

⁶ Hansen, P.E, no. 4, p. 198.

Dieldrin. Endosulfan is an organochlorine pesticide, which was first made available for use as an insecticide in 1950s⁷. The organophosphates were also discovered during that time. This class of pesticide includes parathion, malathion, and diazinon. After 1975 synthetic Pyrethroids emerged as a new class of pesticides. All these pesticides were developed primarily by chemical industry using a high amount of synthesis and test programmes⁸.

Pesticides are broadly classified into five major groups. They are Insecticides, Fungicides, Rodenticides, Herbicides and Fumigants. These broad groups are again classified according to their chemical combination and nature of action.

Figure 1
Details of Groups of Pesticides⁹



⁷ Romeo Quijano., (2000) "Risk Assessment in a Third World Reality an Endosulfan Case History", *International Journal of Occupational and Environmental Health*; Oct-Dec. 6(4), p. 312.

⁸ Ibid.

⁹ Bhatt, M.V., (1985) "Introduction to Pesticide", *Pesticide Information*; October-December, p. 27.

Thus in general the class of pesticides can be classified in three main generations. The first generation includes the 16th century pest control practices using burning sulphur, soap, nicotine and arsenic compounds. Second generation pesticides and their development was actually a product of the Second World War. That is some of the products developed for the warfare were found useful in killing insects also and the industrial production of them started then onwards. With the invention and high use of chlorinated hydrocarbons like DDT organochlorines and organophosphates the dimensions were extended a great extent. Finally the early 1970s were considered as the emergence of a third generation of pesticides.

The Philosophy of Intense Use of Pesticide

Thomas Robert Malthus wrote *An Essay on Principles of Population*, which was published in England in 1798. The essay propounded the view that the natural resources are finite and the population growth is the factor which determines the use and availability of these resources. Malthus stated that if there is no check on birth rates the human population would increase to the extent that people will starve as the natural resources are finite and are insufficient to serve all the population. He propounded that the population has the natural tendency to grow in a faster rate than the growth of the resources. However, actual population growth will be checked by the insufficiency of resources. It can be either by death, disease or starvation or by postponing of marriages or by sexual abstinence¹⁰. His approach was static one because he did not deal with technology. He assumed technology has only a slight role in influencing the level of production.

Laissez faire economics got primus value in the West during the 18th century. The approach asserts the importance of free and competitive market of individual suppliers to the efficient production, distribution and allocation to goods and services. Individual choice is maximized in this approach. The classical theory was the major theory behind any capitalist model of economy.

¹⁰ T.R Malthus. (1817) *An Essay on the Principles of Population*, Murray, London, pp. 1-13.

The classical economists believe in free market and perfectly competent economy. They identified capital accumulation as the key to economic progress. The classicists' *sees profit is an incentive to the investment*¹¹. It completely negated the role of public sector. The theory of Laissez faire economy has its origin from the work of classical economists, such as David Ricardo, Thomas Malthus, and Adam Smith at the end of the eighteenth century and nineteenth century¹². In the twentieth century, economic depression happened during nineteen thirties and the period followed by Keynesian economics. It provided its emphasis on state intervention and public spending as a means to reduce unemployment. As a result followed a period of mixed economy but since by 1970s with increased influence of laissez faire philosophies capitalism again came in to the political forefront. All these economic doctrines were an impact upon the capitalistic mode of production. This reflected in the agricultural practices of the century. Infrastructures in terms of road, railways, ports etc, were developed and the degree of urbanization was increased. The period referred above thus witnessed to many social cultural and economic and political changes. The quality of the natural environment deteriorated simultaneously with the high extent use of pesticides.

Green Revolution as a Technological Solution

The basic objective of all agricultural activity is to increase productivity. Green revolution is the particular term that denotes the change that occurred in the third world agriculture during the 1960s. This change includes the use of improved genetic seeds, fertilizers and chemical pesticides. According to Eric Ross (1991) *Green Revolution was the counter revolutionary modernization of the third world agriculture*¹³. According to the author, green revolution was technocentric and promoted large-scale agricultural production. He called it counter revolutionary in the sense that it decelerated the restructuring of agrarian relations in the third world and it broke the concept of land reforms.

¹¹ M.L Jhingan., (1986) *The Economics of Development and Planning*, Konark Publishers Private Ltd, New Delhi., pp. 92-94.

¹² Gordon Marshal., et al, *Oxford Dictionary of Sociology*, (ed.), Oxford University Press , New York p. 358.

¹³ Eric Ross (1991) *The Malthus Factor*, p. 123.

The central assumption of the green revolution was that increased output was required to forestall the Malthusian pessimist scarcity. Technological growth had helped to establish the expected pre-conditions of green revolution. It was expected that food scarcity would be overcome through introducing high yielding varieties of seeds, substantial use of pesticides, irrigation, and cultivation in large areas of land and the use of chemical fertilizers. But these preconditions of irrigation, chemical fertilizers and pesticides were out of the reach of small farmers. In that sense it aimed at the capitalistic mode agriculture, which expected to promote cultivation of large volume of land with mechanized technology farming. The global usage of chemical pesticides kept on increasing by the onset of Green revolution. The discovery, production and use of pesticides were tremendously increased. By the later half of the 20th century the production and use of the pesticides in the third world countries increased rapidly. The commercialisation and intensification of agriculture due to the difficulty in expanding the area of cultivation due to high density of population, growth in demand for agricultural products and the shift to cash crops and export-oriented agriculture etc, stimulates the pesticide usage.

“ The World Health Organization expert committee on the safe use of pesticides based on the statistics of 19 countries estimates in 1973 that there were as many as 5,00,000 pesticide poisoning cases annually, worldwide. Ten years later Economic and Social Commission of Asia and Pacific suggested that pesticide poisoning incidents could be as high as two million each year out of which 40,000 could be fatalities”¹⁴

If we look at the political factors behind the emergence of the green revolution, some interesting facts come to light. Henry A Wallace was a seed corn businessman who was engaged in plant breeding, hybridisation in the United States. His father was Henry C Wallace was the secretary of agriculture during 1920 in the United States. The son convinced his father for increased

¹⁴Sasi K.P., (2000) *When Birds Stop Singing -A Study of Impacts of Pesticides*, Vikas Adhyayan Kendra, Mumbai- 64, p. 5.

federal funding for hybrid seed corn research¹⁵. By the year 1932 the seed corn researcher Henry A Wallace became Franklin Roosevelt's secretary of agriculture. He became the Vice President of United State during the period 1940-44. He was noted as one of the liberal advocates of modern style of agriculture. Nelson Rockefeller was a close associate of Henry A Wallace. Both these persons were considered the chief proponents and exporters of American style of agriculture. In 1940 Roosevelt appointed Nelson Rockefeller as the head of a newly organized office of Coordination Inter American affairs (CIAA). In 1946 Nelson Rockefeller established The International Association of Economic Social Development (IAESD), which operated with Rockefellers International Basic Economy Corporation (IBEC). Most of the top officials of CIAA appeared in the boards of IBEC and IAESD.

These people exported the American mode of agriculture to the rest of the world in the name of green revolution Today the seed company Wallace family is the world's largest seed company¹⁶.

Environment and Public Health Hazards Due to Pesticide Exposure

Adverse effects of pesticides to public health and environment are due to their toxic nature, persistence and bioaccumulation. There is a terminological difference between toxicity and hazard. Toxicity is an innate capacity to create damage to body and hazard is the risk of poisoning arising by practice. Hazard is a function of two major functions, contamination and time¹⁷. Some technical terms associated with pesticide exposure are as follows:

- Hazard identification

It is the determination of the causal relationship between the chemical product and the demonstrated injury to the exposed people. It is done on the basis of verification of the available scientific data.

¹⁵ Eric Ross., (1991) *The Malthus Factor*, p. 123.

¹⁶ *Ibid.*, p. 124.

¹⁷ Kalra, R.L., (1996) "Pesticide Management in India-a Critique on the Current Situation" in *Pesticides Crop Protection and Environment*: Ed: Walia, Parmar, B.S., Oxford & IBH Publishing Company, New Delhi India, pp, 216-217.

- Dose response relationship

It is the way of establishing the quantitative relationship between exposure and response where adverse health or environment effects have been observed.

- Exposure analysis

Identifying and characterizing the exposure in potentially exposed populations.

- Risk characterization

To fully describe expected risks by examining the exposure predictions taking into account the dose – response and other relevant information.¹⁸

In general pesticides are hazardous as well as toxic by their very nature. Today the use of pesticide for crop protection is unavoidable. The chemical property of pesticides provides them to persist for certain time in the crops. It may also decompose to another compound and remain for a long time. This chemical property is known as persistence. The massive expansion in the availability and use of chemicals in the agricultural and industrial fields has led to the continuous exposure of people to these chemicals. Most of the countries regulate the level of pesticide residues in their food supply by setting their maximum residue limits (MRLs). Maximum Residue Limit is the allowable maximum concentration of a pesticide in milligram per kilogram of food commodity resulting from the use of pesticides¹⁹.

Generally people receive only low dose, but they may receive much higher dose if they are continuously exposed to persistent and bioaccumulating pesticides for at least a year²⁰. Persistent pesticides can prevail in the soil, air, and water and can reach the food chain also. So habitual takers of fish, livestock and diary products, predators and pesticide exposed crop eaters can have high dose of pesticide in their body. Mainly the exposure to human beings is taking place through the pollutants of water food and air. It can enter human body in different ways through lungs, digestive systems, skin, etc. “Depending

¹⁸ Romeo Quijano, F.R, (2000), no. 7, p. 312.

¹⁹ Kalra R,L. (1996), no. 25, p. 217.

²⁰ Ibid., p. 217.

on the level of exposure and toxicity of the chemical the health effects can be immediate or long term. Pesticides can affect reproduction, causing miscarriage, birth defects, or by altering genetic material so that mutation is carried on to the next generation.”²¹ Endosulfan is an organochlorine pesticide (see figure 1). This group of pesticides is considered as highly hazardous. This class of pesticides can accumulate in the living organisms. It has the property of bio concentration, attraction to fat tissues of living organisms and gradually can build up in the body and remain there for a long time. “Organochlorines are passed to one generation to another in extraordinary concentration through mother’s milk and across the placenta”²²

Once an Organochlorine has taken up residence in a persons fatty tissues there is no way to get rid of it. Organochlorines degrade very slowly. The Chlorine industry makes about 40 million tones of chlorine to make chlorinated organic chemicals. Virtually all these chemicals remain unchanged in the environment due to their slow degradation²³. According to the International Agency for Research on Cancer (IARC), a division of World Health Organization, there is limited evidence of carcinogenicity for over hundreds of organochlorines. However, a majority of them are mutagenic and damage the DNA the genetic material that constitutes the basic hereditary information of all organisms. A large number of them are neurotoxic, causing permanent or temporary damage to the function of brain and nervous system²⁴. Sudden and excessive exposure to organochlorine can therefore create tremor, slurred speech, euphoria, nervousness, depression, anxiety, memory disorders and excitement. Birth defects are happening mainly due to the chronic exposure that creates damages of the DNA in the germ cells.

“Pesticides such as Endosulfan, and atrazine, disrupt the body’s natural control over the reproductive system by mimicking or blocking the activity of the steroid hormones that regulate the reproductive

²¹ CONCERN, Pesticides: A Community Action Guide, Washington. D.C.: USA, 1985.

²² Thorton Joe., (2000): *Chlorine Health and New Environmental Strategy*, MIT Press, Manchester Institute of Technology, p, 41.

²³ Ibid., p. 41.

²⁴ Ibid., p. 59.

function and behavior or by changing the quantities of hormones that circulate in the body. Organochlorines acting through these mechanisms have been shown to reduce sperm count, prevent proper menstrual cycling, increase or reduce the size of uterus and cause structural changes in reproductive tract of both males and females."²⁵

There are many studies which points out the persistent nature of organochlorines. In Michigan people are consuming more than twenty-four pounds of fish from the highly polluted Great Lakes. Their blood samples of them showed DDT levels more than 2.3 times that of a non-exposed control group. These levels occur even though the pesticide was banned in the United States decades ago (Hovinga, 1993). Other studies from the Great Lakes area also confirm these findings (Asplund, 1994; Fiore, 1989; Davies, 1988; Hallet, 1988).²⁶

Similarly a study in New Delhi also found DDT and HCH residues in urban water, soil and fauna, even though DDT has been banned from agricultural use from long back. Human breast milk samples also showed high levels of these pesticides. These levels had not declined substantially over the past decades. An infant ingesting breast milk in Delhi received roughly 12 times the allowable daily intake of DDT (Nair, 1992)²⁷.

Endosulfan and its Toxicity

Endosulfan comes under the hazardous and toxic organochlorine group of pesticide. It was originally classified under cyclodienes. The other groups of pesticide of this group are aldrin, dieldrin, chlordane, heptachlor, and endrin. All these other pesticides are banned in India due to their high toxicity and long persistence. The molecular formula for it is C₉ H₆ Cl₆ O₃ S.

²⁵ Ibid., p. 61.

²⁶ Robert Repeto, Sunjay, B.S., (1996) Pesticide and Income Systems, the Public Health Risks, World Resource Institute, p. 14.

²⁷ Ibid., p. 15.

The chemical name for Endosulfan is 6, 7, 8, 9, 10,10- hexachloro-1, 5, 5a, 6, 9, 9a hexahydro-69-methano2, 4, 3- benzodioxathiepin-3 oxide.

The half-life period for the compound is 7 to 50 days. Two types of isomers of the compound are alpha Endosulfan and beta Endosulfan and they exist in the ratio 70 to 30. Alpha isomer is more toxic but beta isomer is more persistent and stable The compound has different trade names, Beosit, Malix, Thiodan, Thiofor, Thiomol, Thionex, are some of the main trade names. It is brown crystalline substance and it smells like turpentine. Solubility in water is very less or virtually it is insoluble in water²⁸.

New York Coalition for Alternatives to Pesticides (NYCAP) ²⁹ has reported Endosulfan as an insecticide that can cause endocrinological and reproductive disruptions. Endosulfan is a highly toxic substance. The World Health Organization (WHO) classifies it in category two, along with 118 other moderately hazardous chemicals³⁰. The United States Environmental Protection Agency (USEPA) classifies it as a category 1b, that is as highly hazardous pesticide.³¹ Direct exposure to Endosulfan also taking place through breathing air where it has been sprayed, drinking water contaminated with it, eating contaminated food and touching contaminated soil.

Endosulfan is extremely toxic to aquatic life, particularly to fish. It can cause fish killing even in the recommended level of application. "In August 1995, runoff from cotton fields contaminated with Endosulfan resulted in the death of more than 240,000 fish along 25-kilometer stretch of a river, in Alabama. Investigations showed that the pesticide had been sprayed according to the label instructions."³² The national wild life federation (US) states that Endosulfan is extremely toxic to wild life and acutely toxic to honey bees. It also warns that birds feeding in the sprayed area can be killed.

²⁸ International Programme on Chemical Safety - Convention for Hazardous Chemicals Health and Safety Guide, no. 17, Geneva, Switzerland, WHO,1988. See also IPCS Environmental Health Criteria-Endosulfan, no. 40, Geneva, Switzerland, WHO,1984.

²⁹New York Coalition for Alternatives to Pesticides, 353 Hamilton St. Albany, NY 12210. (518) 426-8246, *Pesticides Reported to have Reproductive and Endocrine Disrupting Effects* (1993).

³⁰ Endosulfan Fact Sheet by Pesticide Action Network- Asia and Pacific, Penang, Malaysia. June 1996,p. 6.

³¹ Ibid., p. 6.

³² Romeo Quijano, (2000), no. 7, p. 312.

“Endosulfan is also highly persistent in soil. In one study, it was found that the half life of alpha Endosulfan was about 60 days and that of beta Endosulfan was about 800 days after incorporation of technical Endosulfan into soil at 6.7 kilo gram per hectare. In another study when 0.38 particle per million of Endosulfan was applied to Colorado soil, it was found that 0.04 particle per million remained after three years. Other study done under varying soil conditions showed persistence profiles ranging from 42 to 100 days.”³³

Residue surveys in various type of food also revealed significant contamination of Endosulfan “For example monitoring pesticide residue level from July 1 1969 to June 30, 1970 by the United States FDA, showed that 17 to 240 food composites contain Endosulfan concentration ranges from .001 ppm to .006 ppm”³⁴. Despite these studies the pesticide industry argues that Endosulfan is chemically unique due to the presence of a sulphorus acid bridge attached to the hexachloro atomic ring. According to them the presence of this bridge help the compound for easy degradation compared to other similar compounds. On the basis of this argument the WHO classifies Endosulfan under the moderately hazardous group. However with the presence of oxygen, the compound would oxidize to form Endosulfan sulphate. This oxidization product is more persistent than the parent compound³⁵.

Studies in animals revealed that alpha Endosulfan is highly toxic to animals exposed to it. Alpha Endosulfan residues had been detected in liver and brain tissues in rabbits, which died due to active exposure³⁶. The committee appointed by the Government of Kerala to report on the effect of aerial spraying of Endosulfan in Kasargode reported that there are very few studies to link the long-term toxic effect of Endosulfan in human beings. Studies in animal reveals that the compound may cause adverse effect on the immune system, even at low level of exposure. The report says

³³ Ibid., pp. 314-15.

³⁴ Ibid., p. 315.

³⁵ Extension Toxicology Network (EXTOXNET), Endosulfan Data Sheet, Extoxnet, Ithaca, New York, USA, Oct 1992, p, 4.

³⁶ Romeo Quijano, F.R, (2000), no. 7, p. 312.

Endosulfan can cause chronic health problems and genotoxic effects at least in animals, as there are reports on mutagenic impacts upon animals. Information on effects of Endosulfan on human immune system are very limited and study on rats indicates that hormonal and immune responses are suppressed by ingested Endosulfan at doses that do not induce any overt signs of toxicity. The report says that it is possible to assume from these studies that Endosulfan can cause adverse risks to immune system of human beings. "Endosulfan has been shown to have hormone disrupting action on diverse animals ranging from newts, zebra fish and rats³⁷

No reliable data exist to establish the genotoxic, reproductive toxic, carcinogenic, and endocrine disrupting impacts of Endosulfan on human beings. However the study on animals and various fact sheets of international agencies like New York coalition for alternatives to pesticides, which analyses the chemical safety of pesticides states that Endosulfan can cause reproductive and endocrine disruption in human beings.

Lethality of Pesticides

While pesticides can be used as one of the means of increased agricultural production their lethality cannot be forgotten. In history there are a good number of examples that pesticides had been used as war weapons. Pesticides are intended to kill insects through contact. So with the mode of operation of killing organisms through poisoning, none of them are purely harmless to human beings. During the Vietnam War a chemical namely 'Agent Orange' was sprayed to clear the jungle vegetation. "The United States service men exposed to those chemical subsequently fathered deformed babies years after they had got back home."³⁸ This indicates how a pesticide can be lethal and fatal to generations.

³⁷ Report of the committee to study and analyse the effects of aerial spray of Endosulfan in the cashew plantations of PCK ltd in Kasargode district under the head of Dr Achyuthan. The Committee was appointed by the Government of Kerala and it submitted the report in November 2001.

³⁸Sahabat Alam., (1984): *Pesticide Dilemma in a Third World a Case Study of Malaysia*, Friends of Earth Malaysia, 37 p. 6.

On the night of 2nd December in 1984 about 40 tones of deadly poisonous Methyl Iso Cyanide gas leaked from the pesticide plant of Union Carbide India, in Bhopal spreading death and diseases in to the crowded city³⁹ According to the final report of the International Medical Commission on Bhopal (IMCB) headed by Dr. Rosalie Berthell, there are serious medical, social and economic problems among the survivors and their children even twelve years after the disaster.⁴⁰

Pesticide Market in World and India

The top ten multinational pesticide companies are Ciba-Geigi, DuPont, Monsanto, Zeneca, Bayer, Dow Elanco, Rhone-Poulenc, Hoechst, American Cyanamid and BASF⁴¹. However, data on worldwide pesticide market and use are very difficult to find. According to Curti (1994) as quoted by Robert Repeto "The United Nations and Food and Agricultural Organization surveyed ministries in each country regarding pesticide use in each year but the responses are not reliable." ⁴² In dollar terms, pesticide sales increased by 11.2 percent, annually between 1960 and 1992. Most of the growth of the pesticide market is in developing countries. Growth between 1987 and 1993 in Latin America and Asia excluding Japan was more than twice the average. In large developing country markets, including China, Brazil, Mexico, and India is expected to range from 2.5 to 3.5 percent per year through 1998, two times the world average⁴³.

Production of Pesticides in India

The pesticide industry in India was very small; during the late 1940s it was simply the use of DDT and HCH. It has developed to a stage of developing and

³⁹ Bas Wielenga., (1999), no. 5, p. 89.

⁴⁰ Sasi K.P., (2000), no. 14, p. 8.

⁴¹ Robert Repeto, Sunjay, B.S., (1996): *Pesticide and Income Systems, the Public Health Risks*, World Resource Institute, p. 14.

⁴² *Ibid.*, p. 3.

⁴³ *Ibid.*, p. 4.

using nearly 75,000 tonnes of technical grade pesticides by the early 1990s. This group includes 133 registered products.

The following table shows the annual production of pesticides in India

1997-98	82500 tonnes
1998-99	90100 tonnes
1999-2000	105417 tonnes

TERI energy data directory yearbook 1996-97 tabulates the comparison of pesticide consumption in India as follows:

Group	1971	1994-95
Insecticides	22013 tonnes	51755 tonnes
Fungicides	2067 tonnes	22895 tonnes
Herbicides	30 tonnes	7620 tonnes
Rodenticides	195 tonnes	1860 tonnes
Others	N.A	900 tonnes
Total	24305 tonnes	85030 tonnes⁴⁴

Crop protection with synthetic pesticides commenced in India by the use of DDT and HCH in 1947-48 ⁴⁵. Till 1970, India was mostly dependent on imported pesticides. But the picture changed rapidly after that. "The annual consumption of synthetic pesticides in India shot up from 2350 tonnes during first Five Year Plan to 75,000 in the Seventh Five Year Plan. Pesticide industry has a current turnover of Rs.1200 crores. The country is nearly self-sufficient today and exported Rs.232 crores worth pesticides during 1991-92. Nearly 50 major pesticides are used in agriculture. There are about 35 major manufacturers of technical grade pesticides and about 500 manufacturing units with 1,00,000 commercial outlets.⁴⁶ Early remarks, on various trade names of Endosulfan shows that, a pesticide in India could be marketed in different trade names.

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⁴⁴GOI, *Compendium of Environmental Statistics* (2000), ISO, Ministry of Statistics and Programme Implementation, New Delhi. p. 4.

⁴⁵ Bami, H.L., (1999): "Pesticide Regulations in India an Overview" in *Pesticide Crop Protection and Environment* Ed: Walia, S., Parmas. B.S., Oxford, New Delhi, pp. 212-83.

⁴⁶ Ibid., p. 284.

Indian Situation

Any pesticide, to be sold in India, has to get the registration of technical grade material manufacture and formulations. Registration is the process of assessment and acceptance by a statutory authority. The authority may analyse the documentary support and claims of safety and efficiency proposed by the manufacturers. The decision to restrict or ban a product will be on the basis of toxicity assessment, and verifying the availability of other economically viable and less toxic substitute products. The Insecticide act of 1968 along with rules framed under this act is the major regulatory act for pesticide management in India. The act makes compulsory registration of pesticides at the central level for its use in India, constituted authorities for issuing license for manufacturing or formulation and sale, and established the enforcement authorities like insecticide inspectors etc.⁴⁷

Two statutory bodies namely Central Insecticide Board (CIB) and the Registration Committee have been constituted. The CIB is headed by the Director General Health Services and comprises 28 other members from various disciplines including agriculture health, forest, transport, industry, plant protection etc. They perform an advisory function on health and environmental impacts of the insecticides.⁴⁸ The Registration Committee constitutes a chairman and not more than five members including the drug controller of India and plant protection adviser to Government of India. Further a licensing procedure also exists in this case. Any people who want to sell, store and manufacture the chemical require a license, which has to be renewed periodically. These legal provisions are enforced through the licensing officers of the states and through the insecticide inspectors and analysts of either central or state government. The state and central

⁴⁷Srivasthava K.U (1990): *Pesticide Industry in India Issues and Constrains in its Growth*; Oxford and IBH Publishing Company, New Delhi, pp. 80-81.

⁴⁸ Ibid., p. 82.

government have the power to prohibit sale distribution or use of an insecticide for reasons of public safety.

The registration of Endosulfan in India was done in 1965 on the basis of the data gathered by the Codex Alimentarius Commission of the FAO/WHO. The commission was responsible for assessing the toxicological and environmental behaviour of the compound. Assessment of the data and its reviewing was done by the joint meeting of the expert panel of FAO and WHO during 1989 and 1998⁴⁹. The toxicological reports were based on studies conducted on mice, rats and dogs. After analysing data the expert panel recommended, an Acceptable Daily Intake (ADI), of .006-mille gram per kilogram body weight for human beings.

Under the chairmanship of Dr. S.N. Banerji, the Government of India constituted a high power committee in 1991 to review the use of Endosulfan. The committee analysed the data on chemistry, carcinogenicity, mutagenicity, epidemiological studies and reports from WHO/FAO environmental impact persistence in soil etc. The committee recommended continued use of the chemical in the country, but they strictly specified that Endosulfan should not used near water bodies and this should be used as a condition while issuing the registration for this chemical.

Another committee appointed under the chairmanship of Dr. R.B. Singh committee in 1999 also insisted avoidance of Endosulfan near water bodies.⁵⁰ Endosulfan residue data created by the All India Coordinated Research Project summarised that, the waiting period between spraying of Endosulfan and harvesting was 3 to 7 days and there were no residues in the case of cereals, pulses and oil seeds⁵¹. In India there are three manufacturers for Endosulfan they are Excel industries, Hindustan Insecticide Limited and EID Parry. The Annual Report of Department of Chemicals and Petrochemicals by the Ministry

⁴⁹ Committee Report, no. 37, p. 18.

⁵⁰ *ibid.*, p. 19.

⁵¹ Annual report of the all India Coordinated Research Project on Pesticide Residues, 1999, ICAR, New Delhi, p. 3.

of Chemicals and Fertilizer, GOI, 2000 states that the annual production capacity of Endosulfan in 1995-1996 was 7.8 million tons and in 1999-2000 it was 10.1 million tons⁵². The state wise consumption of pesticides indicates that Kerala state consumed 1384 thousand tones of pesticide in 1995 but by 1999 it had decreased to 1161 thousand tones.

Chemical pesticide usage in agriculture started in India by 1948 and its associated problems also grew simultaneously. For the first time DDT was imported for malaria control programme. The first Factory of DDT and BHC were established just outside Delhi during 1954 .By the same year Second factory was established in the southern state Kerala. This was a public sector company called Hindustan Insecticide Limited (HIL) with an established capacity of 10000 metric tones of DDT. Now India is one of the manufacturer and exporter of chemical pesticides⁵³. India now manufacturing several POPs pesticides and is exporting to Bangladesh and Nepal.

Between 1997 and 1998 India illegally exported 175,795 kg of DDT to Bangladesh, Japan, Nepal, New Zealand, Sri Lanka, Switzerland and UAE. Export of Aldrin was 259,952 kg to 20 countries. This includes developed countries like Australia USA and Netherlands. Besides these acknowledged POPs pesticides, India also known to export other pesticides which either has potentially harmful to POPs such as Dioxins, 2-4D, Endosulfan, Sodium Pentachloro Phenate, Lindane etc. Indian export of these chemicals was 2.02 million kilograms during April 1997- January 1998⁵⁴.The annual production of pesticides in India has increased from 82500 tones in 1997-1998 to 105,417 tones in 2000. Consumption pattern of pesticide in India shows that 40% of the consumption is Organochlorines, 30% is Organophosphorus, 15% Carbamates, 10% Synthetic Prethorides and 5% others.⁵⁵

⁵² Ministry of Chemicals and Fertilizer, *Annual Report-2000 (Department of Chemicals and Petrochemicals)* Government of India, New Delhi, pp.175-77.

⁵³ Green Peace International, Amsterdam, Keizergarcht, *Report of Persistent Organic Pollutants in Asia*, 1998, November, p. 37.

⁵⁴ *Ibid.*, p. 38.

⁵⁵ SRISTI, Toxic Link Report, November, 2000, p. 4.

National and International Regulatory Status of Endosulfan

United Nation's Environment Programme (UNEP), Food and Agricultural Organisation (FAO), WHO, International Labour Organisation (ILO) and International Programme on Chemical Safety (IPCS) are the international bodies regulating the use of hazardous chemicals. In line with the direction of these agencies various countries have their own regulatory status of pesticides. There has also been international guidance from the FAO/WHO, Joint Meeting On Pesticide Residues (JMPR), and International Union of Pure And Applied Chemistry (IUPAC) to supplement the various national efforts to regulate pesticide use in India. Most countries regulate the level of pesticide residues in their food supply by setting the Maximum Residue Limit (MRL). This is the maximum concentration of a pesticide in mg/kg of food commodity resulting from the use of pesticides.

With regard to this various countries have regulations against Endosulfan. Production, storing, export and use of this chemical is banned in Sweden, Germany, Tonga, Syria, and Brazilian State of Rondonia, Denmark, Singapore and Netherlands. In Bangladesh Endosulfan is not allowed to use in rice fields, It is severely restricted in Indonesia, Korea, Thailand. In Philippines It is allowed only for spraying pineapples. Other countries where it is severely restricted are United Kingdom, Japan, Khaskistan, Kuwait, Lithuania, Sri Lanka, Taiwan, Norway, Finland, Canada, Kenezuela and in Russia⁵⁶. During 1991 in India a high power committee recommended to restrict the use of Endosulfan near water bodies. However this was not enforced as a law in India.

⁵⁶ PANUK, *Fact Sheet on Endosulfan*, Pesticide Action Network of United Kingdom, Pesticide News, no. 47 March 2000, pp, 20-21.

UN, Dept of Economics and Social Affairs, New York, *Consolidated List of Products Whose Consumption and Sale have been Banned, Withdrawn, Severely Restricted or Not Approved by Governments*; 1994 (4th edition), pp. 217-18.

Economic and Political Dimensions of Pesticide Industry

Hoechst of Germany, one of the major manufacturers of the pesticide Endosulfan had a rigorous legal fight with the Philippines authorities. Philippines created Fertilizer and Pesticide Authority (FPA) in 1977. Endosulfan was registered under this body without any major evaluation at that time. In early 1980s another body termed the Pesticide Technical Advisory Committee (PTAC) was constituted. Pesticide Action Network International (PNAI) internationally started campaign against 'Dirty Dozen' and a rigorous risk assessment was done in Philippines. In 1990s a review of Endosulfan was undertaken by sub committee of PTAC. As result FPA ordered a ban on 35% Endosulfan and severely restricted the formulation and use of 5% Endosulfan. Immediately Hoechst the major manufacturer of Endosulfan took the FPA to court and the ban was lifted on procedural grounds. Finally by 1994 the ban came into effect⁵⁷.

The first meeting of experts on Persistent Organic Pollutants (POPs) occurred in Vancouver, Canada, in 1994. The governments of Canada and Philippines convened it jointly. The Philippine delegation strongly argued for the inclusion of Endosulfan in the initial list of POPs. This position got support from many country delegates. The pesticide manufacturers, mainly Hoechst, vigorously opposed this position. Different scientists delegated further meetings on this issue. Later the initial list of pesticides to be decided as POPs was trimmed in to only 12 from a list of 40. The list includes aldrin, chlordane, dieldrin, endrin, DDT, heptachlor, hexachloro benzene, mirex, toxaphene, PCBs, dioxins, and furans.

"It is significant to note that all the POPs that are not byproducts have already been banned or severely restricted in most countries and not one is still being manufactured any major chemical company based in developed

⁵⁷ Romeo Quijano, F., (2000), no. 7, p. 312.

countries. No major chemical company from the developed countries, therefore, stands to lose profits from a world wide ban of these chemicals.”⁵⁸

The Situation in Padre Village in Kerala

By the year 1963 the Agricultural department planted cashew plants in the hills of Padre village in Kasargode district. In 1978 Plantation Corporation of Kerala (PCK) took over these estates. This cashew estate of PCK under Kasargode division is of 2190 hectors. Endrine Ekalux etc were used till 1981 for pest control. Trial spraying of Endosulfan was done here during 1977-1978 and aerial spraying of Endosulfan carried out from 1981⁵⁹. Thus for the past two decades the cashew plantations owned by the Plantation Corporation of Kerala (PCK) has been aerielly sprayed by endosulafan. People of the surrounding villages are reportedly manifesting unusual diseases allegedly caused by Endosulfan exposure. A village called Padre came to high media attention with regard to the aerial spraying and manifestation of a wide range of peculiar diseases. Local media and activists expressed their concern from 1979 about this. By 1984 two nearby panchayaths of this village passed resolutions not to allow spraying of pesticide by air. In some areas of the plantations there was a suspension for spraying nearly two years after this. Again by 1988 the PCK started spraying Endosulfan. Then with the emergence of more health problems local organizations extended their protest. Dr. Mohankumar, a doctor practicing in the near by village Vaninagar recorded the unusual disease pattern of the area and wrote to the Indian Medical Association (IMA), for a detailed research in the area. In 1998 people of a neighboring area Periya gave a memorandum to the munsiffs court of Hosdurg asking for a ban of aerial spraying of Endosulfan. The court temporarily suspended the spraying and PCK could not spray in 1999 in Periya division of the plantation. They forcefully conducted aerial spraying in the other divisions and many people were arrested during that time. Then PCK moved to the high court of Kerala, asking for permission for conducting aerial spraying. By the end of 1999 various

⁵⁸ Ibid., p. 315.

⁵⁹ Committee Report, no. 37, p. 22.

environmental agencies started their study in the area and the issue got statewide attention. By the year 2000, the government of Kerala appointed a committee to study and report problem. After the continuous efforts taken by the various groups, like Endosulfan Spraying Prevention Action Council, Thanal Conservation and Action Network, Local Arts and Sports Clubs, and KSSP, the Kerala Government totally banned sale, use and distribution of Endosulfan in the state on July 25, 2001. This order was questioned in the High Court of Kerala by the PMFA. They asked the government to reconsider the decision on the basis of the report of Dr. Achyuthan committee. The government lifted the total ban of endosulfan but prohibited the aerial spraying of Endosulfan in Kasrgode plantation division. The High court of Kerala left the final decision to the pesticide Registration committee's expert panel. Later a panel of experts set up by the registration committee in April 2002 by the Central Insecticide Board, the eight- member expert panel headed by O P. Dubey reported that Endosulfan is not responsible for the health problems of Kasargode. The possibility to continue the aerial spraying became higher with this report. Subsequently the Pesticide Manufacturers Association (PMFA), PCK, and National Resource Centre for Cashew (NRCC) etc have been requesting the Government for lifting the ban. Report of newspapers and periodicals says that even the ministry of agriculture of Kerala favors the spraying of Endosulfan⁶⁰.

Reports of unusual diseases in Padre village were published in *Down to Earth* (2001)⁶¹, local newspapers and TV channels. The National Human Rights Commission (NHRC) asked the National Institute Of Occupational Health (NIOH) and the Indian Council Of Medical Research (ICMR) to submit a report on the unusual diseases of the area and their association with Endosulfan. On the directive of the ICMR, a team from NIOH visited the area and conducted their study. The study was designed as an exposure control group analysis to establish the higher prevalence of any kind of unusual diseases. This study has

⁶⁰ Madhyamam, July 19, 2002.

Mathrubhoomi, August 4, 2002.

⁶¹ Sopan Joshi., "Children of Endosulfan", *Down to Earth*, vol 9, February 28,2001, , Society for Environmental Communications, New Delhi, pp. 28-35.

the objectives to evaluate the magnitude of the problem, and to confirm whether there are any residues in the environmental and biological samples.

The study was conducted by ICMR/NIOH in two phases. It was started from 24th September 2001 and ended in 7th October 2001. The first phase was to study the school children of the Padre village and to compare them with another set of children. The exposed population of children who were subjected to the study was from the government higher secondary school, Vaninagar. 619 children were selected for this. The control group of children were of 416 in number, and are taken from a near by panchayath. The study says that these children were of similar socio economic background and the control group was never exposed to Endosulfan. Three organizations involved in conducting this study. They are NIOH, Regional Occupational Health Centre, Bangalore (ROHC), Department of Pediatrics, Kasthurba Medical College, Mangalore.⁶² All children were requested to bring their parents to school. Major diseases of the family, sexual maturity of rates of the children, causes of death, etc were collected from exposed and control populations. Cases showing any kind of abnormality were referred to the senior pediatrician of Mangalore Medical College.

The second phase of analysis was the analysis of Endosulfan residues from various samples collected from the area. Water samples from the area as well as blood samples of peoples from the area were collected and analysed. Blood samples from 170 exposed children and 92 non-exposed children were taken for the study. The analysis of blood samples had the objective to check the Endosulfan residues, hormonal analysis, and to study the chromosomal aberrations⁶³.

Maximum Residue Limit (MRL)² of Endosulfan is 74 particle per million for water.⁶⁴ Endosulfan levels were found from the water and blood samples collected from different parts of Padre village. The analysis revealed, .0209

⁶² NIOH, ICMR, Ahemadabad-38006, *Report of the Investigation of Unusual Illnesses Allegedly Produced by Endosulfan Exposure in Padre Village of Kasargode District of Northern Kerala*; pp. 1-8.

⁶³ *ibid.*, p. 9.

⁶⁴ *Ibid.*, p. 11

particle per billion (ppb) of Endosulfan in the primary school's well, and, .0085 ppb in the water sample from a stream passing about fifty meters away through the plantations. Water sample from a pond in the course of the stream from the plantation showed, .0667ppb endosulafan level. Even with an average annual rain fall of 3500mm in the district, and about ten months after the aerial spray of endosulafan the presence of Endosulfan in the samples signifies the continuous exposure to the population.⁶⁵

World Health Organisation approved the Maximum Residue Limit of Endosulfan as .02- 30 mg/ Kg weight of body.⁶⁶ The human blood sample analysis of CSE showed a residue of 150 particles per billion. The study reveals that Endosulfan could be detected in 18 out of 22 samples. "The presence of Endosulfan therefore signifies the exposure which could be through water, food or soil. Moreover, the intake of food, water, and air per kg of body weight would result in greater intake of the chemical"⁶⁷. The study also established the presence of very high occurrence of peculiar diseases among the exposed population. It reported that, Endosulfan is responsible for the manifestation of the health problems of the village. Further the study analysed the scholastic performance of both the populations. They adopted the methodology of 'draw a man test' and it showed the significantly high prevalence of learning disability and incidence of detaining to the same class among the exposed children. The study conducted a simple exercise to check the intelligence quotient (IQ), of children between the age group of 3-15, and it also revealed the exposed children had a significantly low IQ.

The study conducted by NIOH reveals that the cashew plantations are a continuous source of Endosulfan for the exposed population. It also explained the significantly higher prevalence of congenital malformations in the exposed population. In the concluding part the study clearly says the malformations and functional abnormalities in the exposed population points, the exposure of this

⁶⁵ Ibid., p. 10.

⁶⁶ WHO (1984), *Environmental Health Criteria*, no. 40, Geneva, p. 82.

⁶⁷ NIOH, ICMR, no. 62, pp. 1-8.

group to a genotoxic agent and a neurotoxic, which in the present study could be Endosulfan.

Similarly another study was conducted in the area by Professor Romeo F. Quijano, from the Department of Pharmacology and Toxicology, College of Medicine, University of Philippines, in this area during January 19-22, 2002. The objective of his study was to determine the veracity of the health problems in the area and adverse environmental impacts and its association to aerial spraying of Endosulfan in the area. The study confirmed the unusually large number of illness occurring people in the villages of Kasargode within the cashew plantations where aerial spraying of Endosulfan was taking place. And it confirms the occurrences of these diseases are probably due to Endosulfan.⁶⁸

Kasargode district committee of Kerala Shastra Sahitya Parishad (KSSP) conducted a house-to-house survey during August 2001, in seven villages neighboring to cashew plantation. Total 747 houses comprising a population of 4102 were surveyed in this study. The study objectives were to assess the impact of pesticide spraying in the environment, impacts of human health particularly in relation to the rates of disability and to assess the safety precautions done during aerial spraying⁶⁹. The study says the rate of childless couple to the exposed area is 18.6 per thousand and for the non-exposed area it is 6.6 per thousand. Disability rate in the Enmakaje area is 73% higher than the rate of Kerala. If the locomotor and mental retardation alone are considered the rate is higher by 107% to the rate of Kerala state⁷⁰. This study also confirmed the significantly high amount of environmental disruption in the form of absence of fishes, honeybees and other small animals, that has occurred in the area. Further the study pointed out the administrative negligence in informing the people about precautions and providing them safety measures. Majority of the above said studies analysed and confirmed the

⁶⁸ Quijano, F.R, (2002); *Endosulfan Poisoning in Kasargode, Kerala, India –Report of the Fact-finding Mission*; Pesticide Action Network Asia and Pacific, Malaysia.

⁶⁹ Kerala Shastra Sahitya Parishad, Kasargode District Committee, *Household Survey to Assess the Health and Environmental Impacts of Aerial Spraying of Endosulfan in PCK Plantations of Kasargode District*, August 2001, pp. 1-8.

⁷⁰ *Ibid.*, pp. 6.

environmental disruption in this area and a significant amount of political and administrative negligence occurred in this issue. But the social isolation and stigma happened to the village due to the presence of unusual diseases like mental retardation, physical deformities, and other non curable diseases are not at all revealed by these studies.

Chapter-3

CONCEPTUALISATION AND METHODOLOGY

Introduction

Nobody can deny the advantage pesticides have provided either to the green revolution or to the control of the vector of malaria. However, all chemical pesticides are potentially dangerous, to all forms of life and the more lethal pesticides are considered to be more effective. The review of literature done for this study shows that the pesticide industry produces highly harmful and toxic substances to overcome pest resistance. The persistent and toxic natures of these pesticides are harmful to the environment and human beings. Therefore, despite the advantage they have provided in increasing agriculture productivity and vector control in public health, the persistence of pesticides, their residues in food and their properties like bioaccumulation and carcinogenicity are highly dangerous to human beings and animals. Persistent pesticides such as organochlorines retain their toxicity even after a lapse of many years; thus they are of great danger to human and animals. The biggest example of harm to humans as well as of political irresponsibility related to pesticide exposure in India is the 'Bhopal tragedy', mentioned earlier. People who survived from that fateful night have been struggling since then for more than 17 years for compensation, medical care and rehabilitation. They have not yet received justice¹.

Endosulfan is an Organochlorine insecticide; it is sold in India under different trade names such as Agrosulphane, Endocel, Endoson, and E-Sulphane etc. This chemical is not only toxic to insects but also to fishes, animals etc. Interestingly while ITRC (Industrial Toxicological Research Centre) has classified Endosulfan as an extremely hazardous pesticide, WHO has classified it as class II category, that is as moderately hazardous. Pesticide news (47), March 2000 says, "Stimulation of central nervous system is the main characteristic of Endosulfan poisoning. Symptoms of acute exposure include hyper activity, tremors, decreased respiration, salivation, anemia, and loss of ability to stand. Studies in animals proved that this pesticide could affect the

¹ Wielenga Bas (1999): *Towards an Eco-Just Society*, centre for social action, Bangalore, p. 89.

kidneys, developing fetus, and liver etc. It can cause decrease in semen, increase in defects on sex organs, cancer and gene mutations etc. People with low protein diets may be more sensitive to these effects”².

Conceptualisation of the Problem

The literature review has shown that aerial spraying of the pesticide Endosulfan was taking place in Kasargode district from 1981 onwards. The spraying was intended to prevent tea mosquito in cashew flowers. Spray with helicopter was done two to three times during November to March every year, the flowering season for cashew plants. Today after persistent exposure of about two decades to toxic chemical pesticides, people of at least fifteen surrounding villages are suffering from many unusual diseases³. However the village Padre has the maximum number of affected. Children are living with congenital anomalies, physical deformities, mental retardation, hydrocephalus and cerebral palsy etc. Families are suffering economically compared to the other parts of the panchayath. The village is stigmatised with the manifestation of many such diseases.

Local farmers and local media had expressed their concern from 1979 onwards. They noticed cattle with physical ailments and said that this may be due to the aerial spray of pesticide. Later by 1992 larger number of people were suffering from health problems like mental retardation, physical deformities, skin disorders and physical weakness. The local sports clubs and cultural organisations passed resolutions and extended their protests. In 1994 Kerala Sasthra Sahitya Parishad (KSSP) alleged that the problem is due to aerial spraying and asked the government for strict regulations for of pesticide use. Due to appeals from people, the courts issued a stay order in 1999, to prevent the PCK from spraying in Periya division. But the PCK conducted aerial spraying in other divisions. Many local people conducted massive protests and hundreds of people were arrested at that time. All they were asking was for covering of the wells and water bodies as per the Insecticide act and District Collectors directive. The issue got state level significance and attention by this time, with the joining of various environment and social groups. Simultaneously the PCK reported a loss in cashew output in the last season because of not

² Pesticide News 47, March 2000, Pesticide Action Network UK.

³ Karaval evening daily (Kasargode) dated from July 21 to 27, 2001.

spraying in Periya division of plantations. However, the procedure of cashew collection for the PCK is a complex one. Hence the advantage to the cashew plantations due to aerial spraying cannot be easily assessed⁴.

By 1999 various environmental agencies started their study in the area. Centre for Science and Environment, Thanal, National Alliance for Peoples Movements, Earth Society, National Resource Centre for Cashew, Kerala Agricultural University, are some among them. Then by 2000 Government of Kerala responded to the issue and suspended the use of Endosulfan for all crops in the State. On the basis of this suspension PCK stopped aerial spraying in all its plantations by December 2000. The Government of Kerala appointed a Committee Headed by Dr. Achyuthan, to make recommendations on the issue of pesticide pollution and health disorders in the area. This time the National Human Rights Commission took a *Sue Moto* case against the Kerala government and ordered the Indian Council of Medical Research (ICMR) to study the issue and report to them and the spraying of the pesticide was banned in effect from December 2001. Then onwards the PCK, National Resource Centre for Cashew (NRCC), Pesticide Manufacturers Associations are asking the government to lift the ban,⁵ despite the consequences to the people. The literature review done for this study is in such a way so as to conceptualise and analyse the problem as an environmental ethical issue. Endosulfan is both hazardous and toxic and studies have demonstrated its carcinogenic, mutagenic, neurotoxic, endocrine disruptive effects. Studies in Padre village in Kerala have shown a range of diseases occurring in human and animals over two decades of Endosulfan spraying in cashew plantations. However economic, social and ethical dimensions of the problems of the critically affected lives of the area remain unaddressed.

Chronic health problems due to pesticide exposure can affect the working capacity, productivity and income of the people. Additionally medical treatment for both adults and children increase the cost of medical care. Money for medical care is often raised in poor families by taking loans or selling property.

⁴ The harvest and its profit or loss cannot be easily assessed. "The right to collect the cashew nut auctioned every year. The product is not assessed and the actual crop is not quantified by the PCK. The productivity is only based on the auction amounts. Since there is no means to verify the yield (Achyuthan committee report- pp. 24). The logical analysis of the advantages happened due to the aerial spraying is difficult to assess as the auction amount depends highly on the market prices.

⁵ Surendranath, C., (2002), Mathrubhoomi weekly, August 4, No. 24 (80), pp. 14-17.

The houses loose additional amount of money for the treatment, and this may make them bankrupt or without any savings. General health loss off all people has placed them in a situation of loosing their entitlements, as majority of them are coolie workers. This would also have an impact on the lives of the people. Similarly dropping out from school and decreased social participation would mean isolation for the affected population. Futures of the affected generations are uncertain today. The people are stigmatised, but it need to be explored, whether the village itself suffers from same stigmatisation due to the presence of many people with physical and mental effects of endosulfan exposure.

Not only is people's health status important it is equally important to understand how they are dealing with their health problems. Not only in terms of safety medical care but also in terms of preventive health behaviour. For this, we need to explore the linkages between health and the health behaviour of people affected by pesticide exposure and the risk factors special to this area. People's preventive behaviour on taking self-precautionary measures at the time of aerial spraying is often determined by the availability of information regarding the precaution to be taken and in this case availability of material to cover their drinking water sources. The PCK is responsible to inform the people about the health consequences of pesticide spraying. They are also supposed to give the covering material for all the drinking water sources during aerial spraying. The study also aims to look at the role of PCK in spreading information and following the principles of aerial spraying.

Environmental problems generated by the application of pesticide involve the technical issues of risk assessment. The problems related to such technological application involve the cost benefit analysis, which mainly tends to neglect the poor and suffering population, which pays the cost of development. The policy framework for the manufacturing a pesticide, its optimal use, examining of the environmental impact, residues in food, public health risks etc, is very crucial to the peoples health. The sum total of this is the pesticide management. Smith (1976) defined pesticide management as the technology concerned with safe, efficient and economic use and the handling of pesticide from the time of manufacturing to the final utilisation and disposal. It includes the process of formulation, packaging, transfer, storage, official registration, labelling for use and safety, selection of the area, application and

disposal of unwanted materials⁶. However, the assessment of the problems of residues in food and the environment and its total impact upon human and other living organisms should be included in pesticide management.

The political factors explored in this study include an understanding for the continuous spraying of this pesticide for more than two decades even with various protests. The legal provisions to control the management of pesticides in India are also reviewed and the issues involved in providing compensation to the suffering people are also examined in this study. The Bhopal tragedy is used in this study to compare the justice received by the poor people suffering from industrial accidents or ongoing exposure of pesticides.

This will be an exploratory study, in a village of Northern Kerala, where people are continuously exposed to a hazardous pesticide and manifesting unusual disease patterns. This study examines the socio-economic and health consequences of pesticide exposure in the area. It also aims to review the social economics of the pesticide management and how far the regulatory mechanisms are functional. Thus the study tries to look at the social justice and public policy, with the help of a case study of a village.

Objectives of the Study

1. To study the socio-economic profile of the affected people and geographical nature of the area.
2. To verify the study reports regarding the harmful effects and public health risks caused by spraying chemical pesticide Endosulfan.
3. To understand the perception of the exposed population regarding the abnormalities and precautionary measures done by them and by the government during aerial spraying.
4. To study the economic and social impact upon the families due to the occurrence of unusual disease in their families.
5. To locate the reasons why regulatory mechanisms for India's pesticide control are not functional in this case.

⁶ Smith F.R.(1976): *The agrochemical approach to pesticide management*, USAID Pest Management and Related Environmental Project, University of California, p. 1.

6. To examine the economic and political dimensions of the pesticide industry.

Methodology

Sampling Procedure

Plantation Corporation of Kerala (PCK) is a public sector initiative to cultivate, protect and reap agricultural plantations. The crops coming under plantations are Rubber, Tea, Cashew, Coffee, Coconut, and Spices etc. The plantation Corporation has 4696 hectare of Cashew plantations in Kasargode district. This area is divided in to three sectors, distributed in about twenty villages. In details

Sector 1.

Kasargode Cashew Plantation Division

a) Muliya Division	367.86 ha.
b) Perla Division	783.14 ha.
c) Adhur Division	749.00 ha.
d) Periya Division	<u>290.00 ha.</u>
Total	2190 ha.
Rajapuram Plantation division	1526 ha.
Cheemany Plantation <u>Division</u>	<u>980 ha.</u>
Total	<u>4696 ha.</u>

The Cashew plants were planted in the area by the department of agriculture and it is taken over by PCK during 1979. Pest control for the plants mainly done by spraying Endrine, Ekalux till 1981. By 1978 trial spraying of Endosulfan was began and by the year 1981 aerial spraying of Endosulfan was started and continued till 2000 December. District collector was the permitting authority for conducting each aerial spraying⁷.

⁷ Dr. Achyuthan Committee report, Govt. Of Kerala, 2001, p. 22.

The committee to study and analyse the effects of aerial spray of Endosulfan in the cashew plantations of PCK Ltd., in Kasargode district, Kerala under the head of Dr., Achyuthan. The committee submitted the report in November 2001.

According to the long term monitoring report of the impact of pesticide on people in this area and eco system by 'Thanal', about 15 villages surrounding Cashew Plantations are complaining from complex and peculiar variety of diseases. Compared to the other village highest number of unusual diseases and general health problems are reported in Padre village. Compared to the other villages, in Padre village health problems reported and people responded to the authorities long back.

Map 1

Map of south India including Kerala

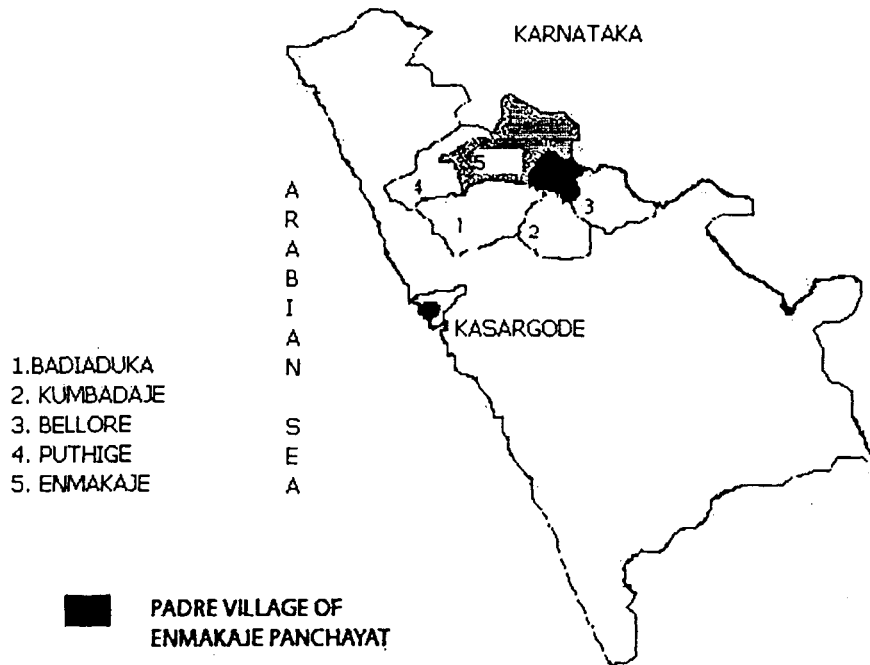


* Source: Microsoft Encarta, Reference Library, 2003

Studies conducted by different groups established the highest number of health problems in the area. These studies were reviewed in the literature review and the present study decided to select Padre village of Enmakaje panchayath, Kasargode district.

Map 2.

Map of Kasargode district



* Source: District Panchayath Office Documents, Kasargode

Kerala the southern state of India's West coast has a district namely Kasargode. Kasargode district came into existence on 24th of May 1984. It lies in the northwest boundary of Kerala. Average rainfall for Kasargode is about 3500 mm per year and the district has many streams, rivers and backwater. There are mainly 4 rivers passing through the district, Chandragiri, Kariyangod, Uppala and Shiri. It has also a set of beautiful backwaters. Thus in general the district has no scarcity of water. Most of the land of the district is divided as low and midland. The geography of the district is mixed with hills, midlands and paddy fields. Paddy, coconut, areca nut, cashew, pepper, rubber and tapioca are the main crops of the district. Tobacco is also cultivated in some parts of

the district. The district has the monopoly of the cultivation of areca nut. Hilly villages are on the eastern side of the district and are with green vegetation and cashew plantations. The district is blessed with forest area of 115.09 sq. Km. The district consist of 2 Taluks, vis. Hosdurg and Kasargode. It includes 75 revenue villages, 4 block panchayaths and 2 municipalities. The district has its boundaries, South Canara district in the north, Coorg in the east, Cannanore district in the south and Arabian Sea in the west. (Govt of Kerala, Panchayath level statistics, 2001, Kasargode district).

Table 3.1

Demographic Profile of Kasargode District

1	Area	1992 sq km
2	Number of taluks	2
3	Number of blocks	4
4	Panchayaths	39
5	Revenue villages	75
6	Municipalities	2
7	Households (as per 1991 census)	181667
8	Population as per 2001 census	1203342
	Males	587763
	Females	615579
9	Density	604/sq km
10	PDS shops	372
11	Primary health centres	45
	Number of beds	133
	Number of doctors	53
12	Community health centres	5
13	Family welfare centres	244

* Source: Panchayath level statistics, 2001, Kasargode district.

Enmakaje panchayath is one among the 39 panchayaths of Kasargode district. The panchayath shares its border with Karnataka state. There are thirteen wards in this panchayath. The panchayaths is of 78.23 sq km area with a

population of 28835 and occupied household of 4305. As per PHC data there are 3170 eligible couples. Further there are 9 family welfare centres and 16 schools, which includes 4 high schools, 6 upper primary schools and 6 lower primary schools. As per the PHC records, there were 2385 Children belonging to the age group of 0-5.

Table 3.2

Ward Wise Population of Enmakaje Panchayath

Ward no.	Males	Females	Total
1	1217	1141	2418
2	1119	993	2112
3	1452	1291	2743
4	1033	934	1967
5	1226	1090	2316
6	952	846	1778
7	989	879	1868
8	1288	1144	2432
9	1122	997	2119
10	1340	1191	2531
11	1423	1264	2687
12	1085	963	2048
13	951	845	1796
Total	15257	13578	28835

* Source: Enmakaje Panchayath Office Documents

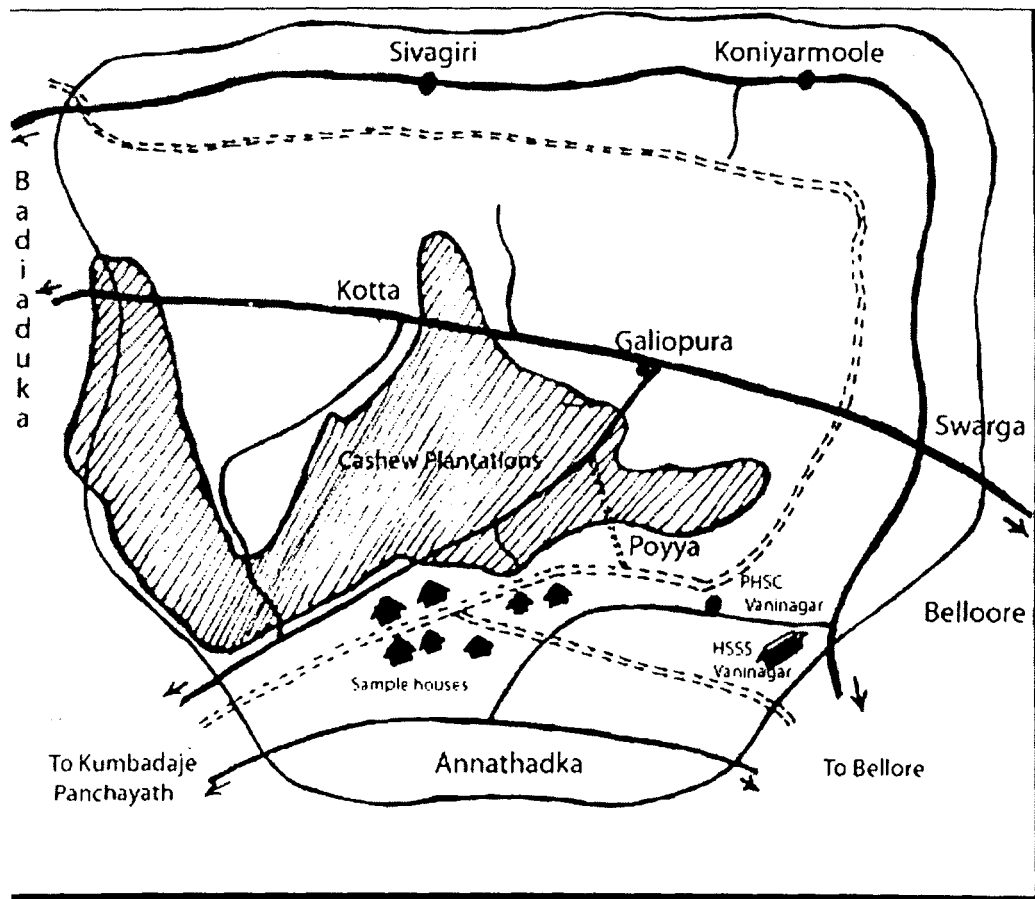
Padre Village

Padre village comes under 6th and 7th wards of Enmakaje Panchayaths. The cashew Plantations are mostly on the hills and the valleys are inhabited by the local people. There are some houses inside the plantations and a large number of houses in the adjoining areas. The plantations surround several of the

inhabited areas by 2 or 3 sides. Similarly there is good number of wells inside the plantations (Achyuthan committee report, Government of Kerala, 2001). People collect drinking water by creating small holes in the hillsides. The selection of the particular area is on the basis of the media information about its excessive exposure and peculiar disease pattern of the population.

Map 3.

Map of Padre village



Legend

- Road
- - - - - Water

* Source: PHC records, Perla

Selection of the Households

PHC of Perla carried out a survey by covering all the population of Padre village in July 2002. 852 households comprising a population of about 5696 people of Padre village were covered by this survey. List of all the people affected

with diseases were collected in this survey. The selection of the sample households for the interview was done in a two stage sampling process. In the first stage the address and location of the affected families were taken from the local Primary Health Centre. In the second stage the diseases that are probably caused by Endosulfan exposure are identified from this list. The literature reviewed regarding toxicological impacts of Endosulfan, helped in making this categorisation. 30 households were randomly selected from this list for conducting in depth interviews. Mainly Orthopedically handicapped, mentally retarded and cases of cerebral palsy etc were taken from the list. These houses were located with the help of the 6th ward panchayath member and the total literacy programme volunteer. This locally familiar people introduced the researcher in the village.

Selection of the Key Informants

For the selection of the key informants, people who could provide the most information about the issue were taken. Words of mouth and media were used to select and locate these people. They were experts in local history, physical and geographical environment. There are mainly three types of key informants in this study. Type one key informants were the panchayath representatives, leaders and activists. This group includes three panchayath members, two NGO coordinators, and one journalist (6 in number). Type two key informants were medical practitioners from the local area. This group includes one PHC doctor, one private community doctor, two health inspectors and one junior public health nurse (4 in number). Type three key informants are members living in the nearby area or people working with the area. This group includes one Nehru yuva Kendra health volunteer and one continuous education programme coordinator (2 in number). Thus the total number of key informants is 12 for this study and the total sample size of the study is 42, which includes 30 head of the households and 12 key informants.

Data Required for the Study and Process of Data Collection.

The study demands both primary and secondary data for its exploration and it contains qualitative and quantitative information.

Secondary Information Collected

This set of data includes the demographic particulars about the area, the PHC survey on diseases in the village, various study reports about the area by different groups, committee reports submitted to the government of Kerala, court orders, literature on pesticide industry, national and international regulatory status of pesticides, toxicological studies regarding pesticides and economic dimensions of the pesticide industry. This secondary information was collected from the literature of different libraries, documents from the panchayath offices, primary health centres, local news paper office and from the offices of different non government organisations⁸.

Primary Information Collected

Primary information collected includes socio economic and demographic profile of the affected families. It contains land ownership, employment and income of the families, housing pattern, source of drinking water, money spend for treatment process, peoples perceptions regarding the diseased persons, their health seeking behaviour, reoccurring diseases, social participation of the family and affected persons, public behaviour towards the affected, general information regarding the immediate effects followed by aerial spraying and the precaution done by themselves and by the authorities during spraying.

Tools of Data Collection

Primary data collection was done through (1) Semistructured personal interview (2) Interview schedule (3) Observation method (4) informal discussion.

Semistructured personal interviews were carried out to collect information about the problem. Personal interviews were carried out with Enmakaje panchayath authorities, Information mission Kerala authorities, public health professionals of Perla PHC and Muliyar Block PHC (neighbouring

⁸ Demographic particulars of the Kasargode were collected from the Information Kerala Mission office and from the District Panchayath office Kasargode. Panchayath level information was collected from the Enmakaje Panchayath tax register. Study reports on the area by different fact-finding missions were collected from different libraries and from the NGO involved with the issue. Health and demographic particulars like population details, disease patterns, medical care facilities available in the area and its utilisation pattern by the people, survey report on the peculiar health problems of the village by the PHC etc were collected from the Perla PHC. Literature on pesticide industry, national and international regulatory mechanisms, toxicological studies and the economic dimensions of the pesticides were collected from different libraries. Particularly the legal documents in this regard are collected from Indian Law Institutes. International regulatory mechanisms and study reports were collected from the country offices of UNEP, ILO and FAO.

to Padre), official of Hindustan Insecticide Limited, and to the NGO coordinators. On the basis of this discussions and conceptualisation of the problem interview guides were prepared separately. The interview guide was tested with the local doctor and health inspector to make necessary modifications.

In-depth interviews carried out to collect majority of the Primary data collection. This was done mainly with priorly prepared interview schedules. Interview schedules were separately prepared for the affected families (appendix 1), for the key informants (Appendix 2) and to the medical practitioners of the area (Appendix 3).

The first part of the interview schedule (for the houses affected with peculiar diseases) deals with general information about the ward number, details of their staying in the area. Socio-economic information and demographic profile of the people are collected by close-ended questions. Data on money spend for treatment process their perception towards the affected people; social participation and public behaviour etc were collected with open-ended questions. These questions were asked during the second or third visit to the area that is after making some kind of rapport with the families. Data on health seeking behaviour, recurring diseases, precaution taken against endosulfan etc, were collected with open-ended questions.

Medical care practitioners were asked about the morbidity pattern, health-seeking pattern of the people, disease distribution to various cast and class, mortality pattern, sexual health of the people and the environmental hazards happened to the village. Later the information provided by them is crosschecked with the people's responses.

Observation was another major tool to collect first hand information regarding type of housing, drinking water source, physical nature of the people etc. proximity to the plantations, the geographical peculiarities etc are also observed during the data collection.

Limitations and Problems of the Study

The area of the study was a highly interior and remote village. Even though the village is officially a part of Kerala, people speak another language called 'Thulu'. People identify themselves more as Kannadiga people than Keralites due to this language difference. Initially this language difference

caused serious problems to the process of data collection. Later with the help of local volunteers of continuous education programme, Nehru yuva Kendra health volunteer and a local panchayath member, interviews were done. However some data would have lost due to the language difference. Another major problem aroused during the data collection was the apathy of the people. This was due to the excessive amount of media attention, visits of different NGOs, politicians and journalists to the area. Frequent visits and interviews made by these people made the villagers to state that, they were getting nothing out of these studies. People say that the damage and disability they have suffered are irreversible and they feel the researchers are making them study objects. This apathy from the sample population made problems to the researcher in collecting the primary information. In the conceptualisation stage of the study, the researcher planned to interview the affected children also. However the key informants, the accompanying people and the action council to prevent aerial spraying were seriously restricted the researcher from asking questions to the affected children. Therefore the parents of the affected children were answered to all the questions. This problems were overcome to some extent by accompanying the local panchayath member, Continuous education programme volunteer, and Nehru Yuva Kendra (NYK) health coordinator. The problems of language also overcome through this.

Chapter- 4

PROFILE OF THE AREA AND PEOPLE

General Profile of the Area

Kasargode district is the northern most district of Kerala. The PCK owned 2190 hectares of cashew plantations under Kasargode division of plantations. The cashew plantations may surround some of the houses and its premises, on two or three sides. These houses, which are surrounded by three or two sides by the plantations, are said to be the houses inside the plantations. As per the report to the Government of Kerala by Dr. Achyuthan there are 210 houses inside and 1593 houses just outside the plantation division of Kasargode (2190 ha). Moreover there are 174 wells inside and 1333 wells just outside this plantation division. Households nearer to the stream, use this water for washing, bathing, draining agriculture and for washing livestock. Some of the families take drinking water by making open wells or holes in the rocky side of the hills. They get constant water throughout the year from this water source.

Enmakaje panchayath is one among the 39 panchayaths of Kasrgode district. The panchayath shares its border with Karnataka state. Kodenkeri stream is the major stream passing through the plantations passing through the plantation and makes small ponds and drains into the Chandragiri River. The northeast boundary of the panchayath is Coorg district of Karnataka state. The southern boundary of the panchayath is common with Bellore, Kumbadaje and Badiaduka Panchayaths of Kasargode district. Badiaduka and Puthige panchayaths share the western boundary of the panchayath (see map.2, page 42). There are 13 wards in Enmakaje panchayath and Padre village comprises a portion of the 6th and 7th wards of the panchayath. As per the 1991 census, Enmakaje panchayath is of 78 sq km in area, total population of the area is 24166 out of which 1978 Scheduled caste people and 6501-scheduled tribe people. As per the 1991 census report, population density of Enmakaje panchayath is 309 /sq km which is about half of the population density of

Kasargode district which is 604 / sq km. According to the more updated PHC data, average size of the family of the panchayath was 6 to 7, as the total people in the area is 28,835 and occupied households are of 4305 in number¹.

General Housing Pattern of Enmakaje Panchayath.

According to the 1991 census there are 4944 occupied households in this panchayath². Out of which, 2180 are electrified and 2764 are not electrified. Thus the more than half of the total number of houses of the panchayath was not electrified during 1991. Present panchayath level census report of this panchayath was not available at the time of this study to check the development occurred in this regard.

Table 4.01

Table Showing Housing Pattern of Enmakaje panchayath

Panchayath	Concrete	Roof Tiles/ Asbestos	Thatched / others	Total	Electrified	Not electrified
Enmakaje	285	3769	890	4944	2180	2764

* Source: Department of Economics & Statistics, Kerala, Panchayath level
 2001, Kasargode District, Statistics

Being a place of heavy raining, people prefer to have tiled houses. Only those who are not able to afford the high investment for tiled houses would make

¹ As per the PHC records (as on June 30, 2002), the total population of the Enmakaje Panchayath was 28835 and number of occupied houses are 4305.

² Area of the panchayath was reorganized and some portion of the panchayath gone to other panchayaths. Therefore the number of households decreased in the more updated PHC and Panchayath records.

thatched houses, as these require frequent maintenance. Thus thatched houses indicate the poor economic status of the families.

Institutions in the Panchayath

There is one Primary Health Centre and one Sub Centre in the panchayath. There are nine family welfare centres under the PHC. The PHC is located at Perla, near the Enmakaje panchayath office and is about six kilometres away from Padre village. There is no facility for inpatient treatment and there are no beds in the PHC or the Sub Centre. The doctor is residing near the PHC. There are 3170 eligible couples registered in this PHC as on June 30, 2002. As per the PHC documents there are 2385 children in the age group of 0-5, including 1209 male children and 1176 female children as on June 30, 2002. The Sub Centre is located at Vaninagar and is about three kilometres away from Perla and Padre village. There are 14 schools including 4 high schools, 6 upper primary schools, and 6 lower primary schools in the panchayath.

Padre Village – A Description

Padre village was famous for its production of Areca nut, and its remoteness. Limited transportation facilities are available to the village that lies almost 6 kilometres east from Perla town. Industrial growth and similar technological advancement are almost unknown to this village. The people consider themselves as Kannadiga people although the village officially belongs to Kerala. Apart from Malayalam they speak 'Thulu' as their language and for writing purpose they use Kannada letters. Schools are of Thulu medium. Therefore it is difficult to identify them clearly as Keralites. Scheduled Caste people of the village belongs to a caste called 'Moojira', Scheduled Tribes are 'Marathy' and 'Kuragas' and other backward classes of the area are from 'Rai' caste. 'Sastry', 'Shetty' are the castes of the general category of people.

The village is one of the eastern most villages of the district and is hilly in nature and full of green vegetation. The area is blessed with good rainfall (3500

mm) and average temperature (27 degree C). Paddy Coconut, Arecanut, Cashew, Tapioca are the main crops grown in the area. The Plantation Corporation of Kerala has 783.14 hectors of Cashew plantation under the Perla division of Kasargode division. Padre village is closer to the Perla division of Plantations. Nobody from the village was working in the PCK plantations. People migrate mainly to Karnataka for work and in such cases they will continue their work in the workplace for one week to a month.

People of the village are mainly coolie workers and agriculture labourers. They often go to Karnataka and other surrounding areas for their work. Agriculture coolie work, firewood splitting for the hotels and head load working in the town, are the major occupations of the male heads of the families. Small income families owned cultivable land of small size (between 20 to 50 cents³ of land). They cultivate vegetables, coconut etc, for their own use and for sale in some cases.

People of Padre village are considered poor compared to the other part of the panchayath. However, almost every house owns cow goat and poultry as their livestock. Women in the family care for these livestock. The advantages of having these livestock are directed towards the supplementary nutrition and income to the families. Women generally don't go out for work, but in some cases they would go for agriculture work if it is available closely. Out of the thirty families interviewed, only two women are doing coolie work and earning income for their family. They are doing agricultural coolie work for the people of near by villages.

Caste Groups of the Sample Families

The diseases distributed throughout the people of Padre, irrespective of caste and economic background of the families. The sample of affected families includes all the castes of the area. The key informants and the accompanying local people reported that any analysis of the sample, on the basis of caste would be a pointless one, as there is no significant association of caste and

³ A unit to denote land area. One acre is equal to 100 cents.

distribution of diseases. However the affected families are analysed on the basis of their castes. It was found that the sample families belong to caste groups of 'Rais', 'Naiks', 'Marathys', 'Moojira' 'Kuragas' 'Sastries' and 'Shetties'.

Table 4.02

Table Showing the Caste Groups of the Sample Families

Caste of the affected families	Number of families	Percentage to the sample
Moojira (SC)	8	26.7
Marathy (ST)	4	13.3
Kuragas (ST)	1	3.3
Naiks (ST)	3	10.0
Rais (OBC)	5	16.7
Sastries / Shetties (General Category)	9	30.0

The sample shows no significant variation of disease distribution on the basis of different caste groups. Hence the opinion of the key informants found to be true for the village.

Family Size of the Sample

According to the PHC data, Average family size of the area is 6 to 7, however, the sample houses taken for this study shows less number of people than this average family size. Majority of the families have 4 to 6 number of people. In the sample, only one house contains 7 people and one contains 8 people. Among the 30 sample families there are 79 children, between the age of 0 and 15. A generalization on the basis of this average size of the families can only be applicable to the particular village hamlet. In Padre village it is found

that the average size of a family is 4 to 6 and there are only minimal number of houses having more than 7 people.

Table 4.03

Table Showing the Family Size of the Sample

Number of people in the family	Number of families	Percentage to the sample
3	5	16.7
4	11	36.7
5	8	26.7
6	3	10.0
7	1	3.3
8	1	3.3
9	1	3.3
Total	30	100.0

Education of the Respondents

Compared to other states of India, Kerala has a higher literacy rate of 90%. Panchayath level statistics, 2001, Kasargode districts says the district has a literacy rate of 85.17 %, out of which the scheduled caste and scheduled tribes population has literacy rates 63.61 and 66.38 respectively. The district is considered as the poorer one in Kerala as far as such human development indicators are concerned. Even if the Enmakaje panchayath is one of the remotest one in Kasargode, it has an effective literacy rate of 75.99, out of which the female population and male population has literacy rates 67.35 and 84.39 respectively. The sample population also has a comparatively good rate of education almost all of the respondents are from the age group of 20 to 45 and majority of them has primary to upper primary level of education. Almost the entire sample has an effective literacy level, that is to read and write.

Table 4.04

Table Showing Education Level of the Male Heads

Education	Number of males	Percent
Illiterate	1	3.3
1-4	6	20.0
5-7	20	66.7
8-10	3	10.0
Total	30	100.0

None of the female respondents from the affected families are illiterates. 12 female heads out of 30 families in the sample, has up to 5th standard education, 17 have between 5th and 8th and 1 has her education in between 8th and 10th standard. The families have a relatively good level of education even though the village is one among the poorest of the Enmakaje panchayath and Kasargode district.

Types of Houses of the Sample

Some of the houses of the area are constructed with mud walls and mud floors. Roof may either be constructed with wooden bars and tiles or thatched with weaved coconut leaves. Some of the houses were well constructed with tiled roof and cement plastered walls and floors. They owned one cot and one or two stools as their furniture. Most of the houses have only one or two small rooms and a kitchen. People of the area stated that they could afford two square meals every day to all of their family members. These people are above the level of subsistence. But the housing pattern of the area and the furniture they owned etc shows their poor standard of living. The high-income people of the area owned terrace building with land ownership of few acres of land with cash crops like areca nut, cashew and paddy fields.

Table 4.05

Table Showing Housing Pattern of the Sample

Type of housing	Number of houses	Percentage to the sample
Thatched roof and with mud walls and floor	5	16.7
Thatched roof and with Plastered walls and floor	2	6.7
Tiled roof and with mud walls and floor	11	36.7
Tiled roof and with plastered walls and floor	12	40.0

Generally in Kerala rainfall is high and is getting throughout the year except two or three months. So the houses are to be constructed in such a way to withstand this rainfall. Thatched houses required annual maintenance and it cost some amount of money. To avoid this frequent maintenance, people prefer to make tiled houses, even if it demands comparatively high investment of money. Thus in Kerala, people from the lower economic strata also prefer to construct tiled houses and that is not necessarily a measure for their poverty. Considering these factors, thatched houses in the area might belong to the poorer people of the area who couldn't find any source for making good houses.

Land Owned by the Sample Families

Land ownership is one of the key factors to assess the economic standard of any family in a village. People may be living in the area for long years and can have hereditary ownership of land and house. The land

ownership pattern of the affected households shows that the families are relatively poor.

Table 4.06

Land Ownership of the Sample

Land owned	Number of house holds	Percent
5-10 cents	1	3.3
11-15 cents	6	20.0
16-20 cents	18	60.0
21-25 cents	5	16.7

Most of the families owned small size of landownership. 23 families out of 30, have more than 15 cents of land ownership. Thus these people are able to have a kitchen garden and some coconut trees. People reported that, they are not selling any of such vegetables, but consumes themselves such products. People are above the level of subsistence

Livestock Owned to the Sample Population

Livestock are another decisive factor for the family income. People stated that, they are not selling livestock produce but the contributive income in the form of their own food didn't calculated in this study. However the presence of livestock and its management indicates the income level of the families. The following table indicates the ownership of livestock to the families. The economic losses for the families were taken place in the form of the loss of their livestock. One panchayath member told there were about five to ten cattle deaths were taking place every year in Padre village when the aerial spraying was taking place. Another key informant informed that many of the cows were miscarrying and dying at that time. He told similar incidents were found in Cheemany plantation area also. They commonly opined that, such incidents were more if the cows were grazing in the plantation area.

Table 4.07

Livestock Ownership of the Sample

Livestock	Number of families	Percentage
No livestock	2	6.7
Cow	6	20.0
Goat	5	16.7
Poultry	7	23.3
Goat & cow	3	10.0
Goat & Poultry	7	23.3
Total	30	100.0

Twenty-eight out of thirty families have any kind of livestock. This is typical to a village level situation. The presence of livestock in the family is a factor determines the supplementary nutrition to these families. None of families owned more than one cow. If they owned goats, it may be two or three in number and if it is poultry, the number may extend up to ten.

Income Status of the Families

The respondents for this study are the head of the households. Even if women were present in the families at the time of the interviews, they insisted to place their husbands as the head of the family and provided answer about their income. Major income sources of the affected families are from, the occupation of the male head and from the livestock and agriculture products and in some cases from the occupation of the female workers. People from the sample families are not selling their agricultural or livestock produce but they consume it. So it contributes indirectly to their income, as they purchase fewer provisions. Further it provides supplementary nutrition to the families. Out of

the thirty families, twenty-eight people are coolie workers and two are auto rickshaw drivers. Personal income is calculated on the basis of the reported availability of employment days per month and from the average wage of the occupation. Calculation of the income from agriculture and livestock are not done in this study as majority of the people said that they are not selling these products and consuming for themselves.

People usually get work for about twenty days a month. Income level is calculated on this basis and it is important to keep in mind that they may not have employment for all the month of the year. Their income for that months may be less.

The following table shows the average income of the male heads of the family.

Table 4.08

Income of the Respondents

Income per month	Number of male heads having the income	Percent
1001-1500	1	3.3
1501-2000	7	23.3
2001-2500	22	73.3

Twenty-five women out of the sample were housewives and are mainly doing, cooking, caring the children and livestock management. These women reported that they have no income. The contributory income, to the family in terms of their unpaid labor was not assessed in this study. Two of the women are earning through coolie work and 3 from handicrafts. This three women reported that they are making baskets as a part time occupation and sell it in the town every month. They reported they could earn less than Rs.500 from this occupation. One women, who is doing coolie work reported that the wage for women is less compared to men and she can earn less than Rs.1500 per month, if she get fifteen or twenty working days.

Table 4.09

Income of the Housewives

Income	Number of women	Percent
No income	25	83.3
0-500	3	10.0
501-1000	1	3.3
1001-1500	1	3.3
Total	30	100

Source of Drinking Water to the Villagers

Panchayath level statistics of Kasargode district says the district gets an annual rainfall of about 3500 mm and the district is blessed with streams, rivers and backwater. The geography of the district is mixed with hills, midlands and paddy fields. Therefore the district in general has no scarcity of water. The village also shows similar trend for water availability. All the lands except some rocky hillsides are fertile in nature. This help the people to cultivate vegetables for their families in their of land. Kodenkery stream is a good water source for the families of Padre village. Majority of the families uses the stream water for washing, bathing, irrigating vegetables and washing livestock. They are not using the stream water directly for drinking but livestock drinks the Stream water. In Enmakaje panchayath there are only 42 public taps, and two public tanks. In Padre village there were no public tanks and none of the affected families has the luxury of public water connection.

Table 4.10

Sources of Drinking Water to the Sample Households

Source of water	Number of houses	Percent
Own well	17	56.7
Neighbour's well	4	13.3
Suranga (Small channel in hillside)	9	30.0

Almost all of respondent families said that they are using the stream water either for washing, bathing or washing livestock, irrigating vegetables and drinking livestock.

Table 4.11

People Using Stream Water

Purpose of use	Number of households	Percentage
For washing & bathing and irrigating the vegetables	18	60.0
For washing & washing livestock	7	23.3
Only for washing	2	6.7
Only for Washing livestock	2	6.7
Not using stream water	1	3.3

According to the study conducted by Centre for Science and Environment (CSE), this water source is the constant source for the Endosulfan exposure to the families. The sample analysis of CSE, pointed out that the blood sample of lady residing nearby the Kodenkery stream had a residue density of 196.47 ppm. It was more than 900 times the accepted level of residue in water. People

use of this stream water for their day to day activities and they irrigate their vegetables with this water.

Summary

The peculiar diseases were distributed to all caste groups of the village. The people of the area are able to have two square meals every day, to all of the family members. The prevalence of diseases like mental retardation cannot be because of malnutrition. Almost all of the families owned same kind of livestock. It indicates the availability of added nutrition to the families. Land ownership and fertility of the land provided the people to cultivate vegetables for their use and this also indicates the availability of additional nutrition to the families. However the people of this village looks physically weak, children looks stunted and diseases like fever and cough, skin diseases chest pain and body pain etc, are very common. The villagers and the affected families are functionally literate. None of the families have public water connection. People use the stream water for other purposes than cooking and drinking. This water sources may be the constant sources for pesticide exposure to the people. Average income of the affected families ranges from 1500 to 2500 excluding the supplementary income from agriculture and livestock. The geography of the area is risky for aerial spraying.

With all the said characteristics the sample families are poor. The district itself is relatively poor compared to other districts of Kerala. Transportation facilities are limited. More than half of the houses are not electrified. The village is an isolated one in the panchayath and is away from the ruling centres of the state. The area is least developed as far the industrial and civic developments are concerned. People of the area speak another language. So it is difficult to identify them as Keralites. All these factors indicate the powerlessness of the people of the area, which permits the aerial spraying for a long time even with the suffering of the people. The presence of the plantation has not provided any job opportunity to these people. Thus the advantages of the plantation do not reach these people.

Chapter 5

IMPACTS OF UNUSUAL DISEASES IN THE AFFECTED FAMILIES

Introduction

In the previous chapters the geography and social and economic situation of Padre village was considered and the occurrence of many unusual diseases is noted. The primary research question of the researcher for this study is the social and economic impacts created in the families due to the occurrence of these unusual diseases. These impacts can be of either tangible or intangible in nature. The economic impacts such as treatment cost, income loss includes tangible impact. Stigmatization of the village, irreversible physical damage happened by means of occurring peculiar diseases, miscarriages, deaths, other forms of deformities and social participation of the affected families are some examples of intangible impacts. Along with economic and social impacts people are suffering from the emotional and psychological damage because their children are born with congenital abnormalities, mental retardation and epilepsy. Higher incidence of cancer deaths and cancer cases also creates the same problem. Family after family has been affected from unusual diseases. Almost all the people affected with unusual diseases, are of below the age of 20. Adult people are suffering from chronic health problems. The breadwinners of the family are suffering from chronic health problems that leave the families in severe economic and emotional burden. People were found generally weak, gets tired very quickly, children looked stunted in nature and suffering from frequent fever, skin diseases and epilepsy. Local panchayath representatives also confirmed that people living closer to the plantations have most prominent kind of health effects. The researcher hardly found any complaint of unusual diseases among the villagers, who are staying at a distance of about one and a half kilometer away from the cashew plantations.

By observation the researcher found the children of the area look physically weak and many are anemic. The immediate health problems like cough, fever, feeling of

suffocation, chest pain etc that followed during aerial spraying have stopped as the aerial spraying was discontinued for about two and a half years ago (December 2000). However people of the area when they are asked about the general health problems other than the unusual diseases, opined commonly that they are suffering from chronic health problems. Many of the women from the sample families looked older than their originally revealed age. They also looked anemic. People generally are suffering from cough, fever, body pain and rheumatic complaints and chest pain. They said that, the habit of smoking or drinking alcohol is less in the area. The responses regarding the health problems provided enough room for the doctors in the area to suspect some kind of immunosuppression (a side effect of Endosulfan toxicity) in the area. The community doctor reported that, the people are coming to him are mainly with major rheumatic problems. He find it difficult to cure them and he refer them to other hospitals. He further said that, people without major relief continue medication, but at higher doses of medicine. Which would then probably create its own side effects.

Peculiar Diseases in the Area

Occurrence of any disease can be analysed on the basis of time, place and the persons. An attempt at understanding these diseases should include the analysis of the geographical area, the frequency of the diseases and the comparison to the state average. Also the characteristics or conditions of the people with disease should be analysed and distinguish from those characteristics or conditions with those who are not having it. The time factor in the case of Padre village is the occurrence of diseases after a particular time period. In this case it is after the exposure of the pesticide Endosulfan. The place factor includes the geographical proximity of the affected families closer to the cashew plantations. The pollution of water supply due to proximity has already been demonstrated. Demographic characteristics such as age of the affected people, signifies the argument of time. That is, with the clear observation that the people affected with the unusual diseases are below the age group of 20. The NIOH study was a case control study, which examined the exposed group of children and their parents, compared them with a set of another children and parents, from a similar socio economic background. Findings of this study expressed the possible association of Endosulfan exposure to the

peculiar diseases and chronic health problems of the area. The study further established the presence of Endosulfan residues in water and blood samples, which signifies a continuous exposure to the pesticide.

Thus the common factor for all the affected persons is the exposure to the pesticide Endosulfan in this case. In the background of these worrying revelations, the primary health centre of Perla conducted a detailed survey in Padre village. The survey finished by 21st June 2002. The primary health centre officials visited 852 families, covered all the 5696 people of Padre village. The PHC officials made a detailed list of peculiar diseases and the affected people. To collect the information regarding the survey the PHC doctor, health inspector and Junior Public Health Nurse were interviewed. The health inspector who was in charge of the health survey confirmed the unique geographical peculiarity of the area and its association to pesticide exposure. He authoritatively said that, the people from Padre village are affected more than any other villages due to aerial spraying. According to him the survey revealed that the two square kilometer area, near the water stream, which passes through the plantations is affected most with the unusual diseases. He provided the local area map, which shows the concentration of affected families near the rivulet, which passing through the plantations (see map 3, page. 44). A small rivulet joins with Kodenkery stream at a local place Poyye. According to the doctor of the PHC in this area, people indirectly consume water from these two streams, through the 'Surangams'. Very high incidence of diseases is found in this area. At least one person from each family, of this area is affected with peculiar disease. The doctor when asked about the general disease pattern of the area stated that the people are generally coming with the fever, cough, and skin diseases. Older people are suffering from rheumatic complaints. Reproductive disorders like infertility, miscarriages and the menstrual related disorders are very high in the area. he stated that children below 20 years were suffering from epilepsy, mental retardation and physical deformities etc.

The distribution of these problems varies with the distance of the houses to the cashew plantations. There is no significant variation with caste. The NGO coordinators unanimously said that the children of the area have very low IQ compared to the other

non-exposed areas. This was asserted with the experience with schoolteachers of the local area. The detailed list of peculiar diseases collected by the PHC is as follows.

Table 5.01

Detailed List of Peculiar Diseases

Physical deformities	56
Mental retardation	52
Skin disorders	50
Breathing problems (Bronchitis and Asthma)	67
Eye problems	13
Cancer	5
Heart problems	17
Infertility	28
Epilepsy	10
Blood Pressure and Diabetic	31
Liver diseases	2
Tuberculosis	12
Kidney troubles	2
Miscarriages	6
Stillbirth	1
Total Affected people	352

Total number of affected persons according to this survey is 352 out of 852 families and 5696 people, as on June 2002. This list does not include the chronic health problems.

Dr Mohan Kumar, who is practicing for more than 15 years in the local area, confirmed the view of the PHC doctor and health inspector. He stated that he has documented about 51 cancer deaths from about 126 families from the Padre village for the past one and a half decades. Majority of these cases are of liver and blood cancer. The cost of these deaths and the unusual diseases in the living, its diverse burden upon the families points serious questions to the responsibility and governance towards the people.

Similarly, Kerala Sasthra Sahitya Parishad (KSSP) conducted their study among the exposed population and compared the facts with a control population. The study

covered the houses from the villages of 7 panchayaths surrounding the plantation area. The houses surveyed are situated within a distance of one kilometer from the plantation border. The survey team visited 153 houses from Padre village and 594 houses from other panchayaths. This study confirmed that infertility rate among cattle was also very high in Padre village. The study revealed that the consanguinity rates are similar in both the study area, but the proportion of childless couples is about three times higher in Padre village compared to other areas. In the other panchayaths the rate of childless couples per thousand was 6.6 and for Padre it was 18.6 per thousand. In the case of disability and chronic morbidity, the disability rate is 73 percent higher in Padre village compared to the rate of Kerala, which was calculated by a state level household survey of KSSP in 1996. If the locomotor and mental retardation alone considered, it is higher by 107 percent¹. The survey examined in detail to the safety precautions and environmental impacts of pesticide exposure and found considerable administrative negligence in meeting the requirements for safety precautions. They also observed a considerable reduction in honeybees, frogs and fishes, in the area around Padre

Table 5.02

Disability Rate Per 1,00,000, as Shown by KSSP

Disability	Kerala, 1996 (KSSP)	Padre	Other panchayaths
Locomotor	377	693	614
Hearing	488	495	162
Visual	133	297	226
Mental- retardation	244	594	129

According to KSSP the chronic morbidity rate per 1000, excluding diabetes, hypertension and arthritis, in Padre village was 107.9 compared to the state average of

¹ Kerala Sastra Sahitya Parishad, Kasargode District Committee, *Households Survey to Assess the Health and Environmental Impacts of Aerial Spraying of Endosulfan in PCK Plantation of Kasargode District*, August 2001.

63.6. From these studies, the environmental impact and the effects of pesticide exposure on livestock and people is clearly established.

For this study, to assess the degree of severity of these diseases in terms of age group of the affected, type of illness, and what impact they made in the affected families, a sample of thirty affected households were taken and the details of age, type of illness, sex etc were collected through detailed interviews.

Table 5.03

Table Showing the Number of Affected Children From the Sample

Total number of children in the sample families	Affected children	Male	Female	Total
79	First child born affected	20	10	30
	Second child born affected	1	3	4
	Third child born affected	1	1	2
	Total	22	14	36

From a population of 79 children, from 30 families, 36 were affected with unusual kind of diseases. It is found that the affected people are mainly under the age group of 15. There is only one case between the age group of 15 and 20. Out of the thirty sample houses, more than one child was born with deformities in four houses and among these four houses, three children were born with deformities in two houses. These houses are closer to the plantations. Thus in 26 houses, only one child are affected with unusual diseases, the rest four are containing two, or more than two children with

deformities. These four houses are located at distance of about 200 meters from the plantations.

The following table shows the age, sex and type of illnesses of the first child born as affected in the sample houses.

Table 5.04

Age, Sex and Type of Illness of the Affected Children.

Type of Illness	Sex	Age group				Total
		0-5	6-10	11-15	16- 20	
Mentally retarded	Male	1	5	0	0	6
	Female	0	3	0	0	3
Physically handicapped	Male	0	5	3	0	8
	Female	0	4	2	1	7
Deaf	Male	0	1	2	0	3
	Female	0	1	2	0	3
Blind	Male	0	0	1	1	2
Died	Male	2	0	0	0	2
	Female	0	0	0	0	0
Hydrocephalus /cerebral palsy	Male	1	0	0	0	1
Deaf, dumb, blind	Female	0	0	1	0	1
Total		4	19	11	2	36

From 79 children of thirty families 14 female children and 22 male children are affected with peculiar kind of diseases. The key informants and the medical practitioners said that the distributions of the diseases are even between males and females. Although

the male children are affected more in the sample it is not possible to make any conclusion that the male children are more vulnerable to these unusual diseases. However, the sample households significantly show a higher degree of vulnerability of male children to these diseases. It needs to be noted that the two children who died are in the younger age group. Since infant mortality over the past two decades was not checked, it could only be assumed that, possibly, the Infant Mortality Rate has also increased on children with defects who do not survive.

Out of the thirty-six affected children from the sample, only two are above the age of 16. Nineteen affected children are of the age group of 6-10. The basic argument put forward by the scientists and environmental groups in the area was that the natural capacity of the body to resist the presence of the gene mutation agent has failed due to continuous exposure. Majority of the people may be having gene mutations due to continuous exposure of Endosulfan and malformed children were born to this majority. This argument seems to be true with the fact that majority of affected are below the age of twenty.

From these facts it is clear that there is a new generation in the area with diseases, which are not curable in nature. This has had an impact on their families. The people of the area believe that these diseases are fatal to the children, as they perceive no future for the children after the death of their parents. These people are living with disturbed dreams and hopes, as they feel helpless to combat these diseases. Added to the frustration of the people, many of the couples in the area are living without children long after their marriage. The survey conducted by the Perla primary health centre found 28 such cases of infertility. The study conducted by the NIOH, analysed the 'Sexual Maturity Rate' of the affected children. They found prominent disorders in the sexual maturity of the exposed children. The study report points out the possibility of the presence of an endocrine disruptor. The study says the girls from the exposed area attained menarche early and this finding was further confirmed by higher age-related skin fold thickness in this group. The findings confirm frequent menstrual disorders in the exposed female children. On the other hand, among boys, puberty was delayed in the exposed group. The researcher himself observed that the boys of the area are looked

physically immature compared to their age. These sexual maturity abnormalities signify the exposure to oestrogenic substances and the NIOH study says that Endosulfan has been experimentally found to have oestrogenic effects².

The consequence in the environment and people's lives does not seem to be a reason for the PCK to stop spraying and the irreversibility of these damages are not a factor to the manufacturers. They argue that there is the absence of scientific proof of dose response relationship of linear causality to these disease manifestations. They are thus trying to exonerate the pesticide. Human experiments for such genotoxicity and dose response relationship are not possible as it is against the ethics of medical science. Thus if there any advantage of pesticide use it does not came to these people. In fact the least benefiting people are suffering with irreversible diseases.

Caring For the Affected Children in the Family

According to the families of the affected children, physically deformed, mentally retarded and epileptic children require an intense caring all the time. This caring will affect the occupation, and require additional physical concentration and energy. Majority of the children are looked after by the mothers itself. Women informed that they could not do outside job due to this additional caring of the affected, however they said they are not considering that this as a burden. This statement may be based on the emotion of the mothers towards their children. That whatever be the additional task they are taking for their children, are not considered as a burden. Among 26 affected families mothers are taking care of their children, 2 said there is no additional caring required and for another 2 siblings are taking care of the affected. In the previous chapter we found that almost all the houses have similar form of livestock. So the housewives doing high amount of additional works with the caring of their mentally retarded and other forms of deformed children. It can make serious impacts upon their health status both physically and mentally.

² NIOH,ICMR, no. 62 p. 27.

Treatment Details for the Affected Children

Information were collected from the people as well as the health practitioners, regarding the money spent for the treatment, the sources of it and the impact of that expense in the current financial position of the families. All the families reported that they consulted with government health care facilities for the treatment of their children. People referred from PHC to the district level or to the medical college in some cases. The following table shows the details of treatment sources for the peculiar diseases of their children.

Treatment Sources for the Unusual Diseases

Table 5.05

Treatment Sources for the Unusual Diseases

Details of the treatment source	Number of people	Percentage to the sample
No treatment done	2	5.50
In local PHC	8	20.50
Direct in Taluk hospital	11	30.00
Direct in district hospital	2	5.00
Direct in Medical college	1	2.00
Referred from PHC to District hospital	4	11.00
Referred from PHC to Taluk level	9	25.00

The economic burdens on the affected families due to the occurrence of diseases are mainly in terms of treatment cost and the employment loss of the parents. When the people of the area are asked about the treatment seeking for the unusual diseases, they state that, they know that the diseases are permanent. It is only initially for diseases like mental retardation, ear problems and eye problems that they spend money for treatment. However they spent money for the treatment of cerebral palsy, epilepsy, mental retardation.

Table 5.06

Cost of Treatment for the Affected Children

Type of illness	Amount spent for treatment					
	Less than 500	500-1000	1000-1500	1500-2000	2000-2500	2500-3000
Mental retardation	0	2	5	1	1	0
Physically handicapped	11	3	1	0	0	0
Deaf	0	3	1	2	0	0
Blind	0	0	2	0	0	0
Died	0	0	0	0	0	2
Deaf, dumb & blind	0	0	0	1	0	0
Hydrocephalus	0	0	0	0	1	0
Total	11	8	9	4	2	2

Among the 36 affected children 15 are physically handicapped and 9 are mentally retarded and 9 are deaf or dumb or blind. These cases of physical deformities are congenital and are incurable. People therefore spend comparatively less amount of money for them. Therefore majority of the respondents said that they spend only very less money for the treatment. However people spent much money for the two children who died with hydrocephalus and the cases of mental retardation in the identifying

stages. Table (5.06, page 72) shows that majority of the sample population spend limited amount of money for the treatment process. However people spent a comparatively higher amount of money for the children died with hydrocephalus and for the mentally retarded children. Almost all the people spend their savings, borrowed or sold their properties. Selling properties for treatment was the final stage of loosing all other sources of income. Expenses for traveling are also included in the treatment cost. It has been found that people became either indebted or lost their savings because of the occurrence of unusual diseases in their families. Medical practitioners were specifically asked about the treatment inclinations of the people for the peculiar diseases. They also stated that people spend most of their money for epilepsy, mental retardation in the identifying stages, ear problems. Majority of the families confirmed the diseases with the help of public health services available at the area or nearby. The cases of cerebral palsy and hydrocephalus were referred up to the medical college of Mangalore or the district hospital of Kasargode. Expenses of traveling is a very large proportion in the in the cost of treatment. Almost all the people sought treatment from more than one sources. All their treatments were done in public health institutions. They spend much money for the traveling and medicinal cost. The amount they spend and the source of money they used can be tabulated as follows.

Table 5.07
Sources of Money for Treatment

Details of the treatment	Frequency	Percent
No money spend	4	13.3
Own saving	10	33.4
Borrowed	1	3.3
Sold properties	5	16.7
Sold properties and borrowed	4	13.3
Own saving and borrowed	6	20.0

Schooling of the Affected

In general almost all children of Kerala go to school as the public are willing to send their children at any cost. Schooling facilities are also equally good and are accessible to all. In Enmakaje panchayath there are fourteen schools. In Padre village there are two schools including one higher secondary school. Teachers from these schools invariably said that the pupil coming from Padre village have high amount of learning disabilities. They said the IQ of the children in this area is less than normal, and the problems of memory loss also high. Most of the children cannot remember the lessons by next day itself. Thus they are scholastically backward and the possibility for detaining to the same class is also high among those students. Mr. C Narayanan a teacher in higher secondary school Vaninagar, Padre reported that, he joined in that school by 1982 and at that time there were 492 students studied in the school. Now there were 622 students from 1st standard to 12th standard. There were two mentally retarded children studied in the school during 1982 and now there were more than 20 mentally retarded children studying in this school. Children coming from Padre village are suffering from epilepsy, asthma and mental retardation. Teachers reported that the children of the school suffered from headache, nausea and itching in eyes immediately after aerial spraying.

Teachers said that almost half of the children coming from the Padre area have illnesses ranging from skin diseases, mental retardation to epilepsy. Teachers observe no discrimination to the affected children by the other students but there is possibility of such incidents with the absence of the teachers. The parents of the affected children are also willing to send them to school to the maximum possible extent. Drop out of students are mainly happened amongst the mentally retarded and deaf, blind and dumb students. The parents of these children have accepted the reality that their children are not able to continue in school

Table 5.08

Education Status of the Affected Children

Education level	Number of children	Percent
Not going school	14	40.0
1-5	10	26.7
6-8	12	33.3
Total	36	100.0

Among the 36 affected children from the thirty sample families 40 percent are not attending the school. This includes the two dead cases also, so the effective number of non-school going children from the sampling population is 12. All the non-affected children, of the sample houses are going to the school from the area. The parents of the non-school going children find an uncertain future for their children. From the explanations of the schoolteachers the school going children are also at the edge of drop out and are scholastically backward. Medical practitioners informed the poorest family of the area could afford more than two square meals to all of their family members. Therefore the learning disabilities cannot possible to be termed as the effect of malnutrition.

Social Participation of the Affected Families

In the previous section we noticed the schooling of the affected children are severely affected due to the unusual diseases. In addition to affecting the schooling, the diseases also prevent them from participating at the family level and village level get-togethers. They became isolated due to the deformities; often the parents also keep themselves away from such occasions because they have to give high care for the affected children. The people said they haven't quarreled with any of their neighbors in regard to the misbehaving towards their affected children. This shows higher cooperation between the families in the area. This may be true, because the diseases

affect about fifty percent of the families from the area. All the respondent families have their relatives in other neighboring villages. The responses of the respondent families to the questions prepared to assess the social participation were precise and gave the impression that they are limited to their own families and village.

23 families from the entire 30 families said that their children are not participating in the family level functions. 20 families said that their relatives are not visiting to their families frequently. In a purely rural village level situation, visits and participation in family level gathering etc, signifies level of family level bonding. In the village with the manifestation of the unusual diseases the relationships are deteriorating. The help the relatives are providing in terms of money and emotional support are limited. The futures of the children with these diseases are dark and uncertain. Their world now is limited to their own village with severely affected children. However the cooperation of the families with other families in the area is good. They collect water from neighbor's wells and support each other by giving of money also. Many of the families got assistance for treating health problems and in other needy situation from their neighbors.

Frequently Occurring Diseases in the Families

Many people from the sample houses reported skin problems. The NGO, namely Thanal Conservation and Action Network, which conducted the health survey in the area, revealed that the skin disorders ranges from small itching to chronic cases like psoriasis. These people are also frequently visiting the community and local primary health sub centre for treatment. The researcher found two skin diseased cases in the premises of the sub centre of Vaninagar. They told that, they are suffering from this for about two or more years. They are of the age group of twenty to thirty. They told such cases are common in the area.

Private Doctor and PHC doctor revealed that there are many cases of infertility and miscarriages in the area even if they are not reported in the survey report. They told the infertility and related problems are high among men. However the researcher didn't receive such information only from the respondents. In the words of the health inspector

of Perla PHC there are many gynecological problems to the women of the area. The junior public health nurse who also participated in the health survey revealed that the women in the area have major problems to their menstrual cycles.

All the respondents from the sample said that they are suffering from some kind of diseases. Generally it was cough and fever. 25 respondents from the families told that their family members are suffering from cough fever, or chest pain or skin diseases. Five among the 30 families told that they are suffering from one of such diseases. Noticeably nobody from the sample have the opinion they are not suffering from any such diseases. This indicates health status of the general people. More than this the community doctor and the PHC doctor informed that children of the area usually suffer from difficulty in breathing and asthma etc.

Table 5.09

General Health Problems in the Families

Diseases	Number of families affected with	Percentage to the sample
Cough and fever	12	40.00
Skin diseases alone	1	3.30
Cough, fever, and skin diseases	12	40.00
Cough, fever, chest pain, body pain and skin diseases	5	16.70

Health Care Utilisation for General Health Problems

The general health seeking behavior of the respondent families shows that they prefer to go to Primary health centres and sub centres or to the community doctor for

curing the frequently occurring health problems. Only five of the respondent families said they are not doing treatments for any kind of diseases.

Table 5.10

Treatment Details for the General Health Problems

Details of the treatment undergone by the people	Frequency	Percent
Not doing treatment	5	16.7
From PHC or Sub centre only	13	43.3
Private doctor only	5	16.7
PHC, SC, and community doctor	7	23.3
Total	30	100.0

People generally spend less amount of money for the treatment of such diseases. They utilize either the public health services, or the community doctor's clinic for treatment. With the private practitioner they state that charges are not very much and the people are allowed to pay later if they are not having money at the time of consultation. The availability of the public health care facilities, like the PHC and Sub Centre are quite far in the area. The taluk and district hospitals are distant from the area. The transportation facilities are very limited. People have to walk about five kilometers to catch the buses to reach Perla. The PHC has no beds and no facility for in patient treatment. In the case of higher consultation people would go to Kasargode taluk hospital or to Kanjangadu. Kasrgode taluk hospital is about 25 kilometer and Kanjangadu hospital is about 35 kilometer away from the area. People have to spend the entire day to consult these hospitals. The area remote and the houses are scattered, the transportation facilities are also limited. Bus service to the area is very limited and people have to walk 4 to 5 kilometers to catch the buses and other transportation means. This makes the people to think against the utilisation of public hospitals. So mainly they try to satisfy with the community based services until the extreme need arises. People and the doctors know each other by face and as they reported, the relationships are very good also. They use the medicines, which they are given even though there is not

significant relief from some diseases like rheumatic complaints. People even know the diagnostic facilities are limited in the health centre, but they are optionless and satisfy with the services.

Cancer in the Area

Dr. Mohan Kumar reported that he observed higher number of cancer deaths in the families of Padre village during the period of 1995 to 2000. He recorded 51 cancer deaths from just 126 houses near the rivulet of Padre village. From the survey of the primary health centre, it is confirmed that there are higher number of reported cancer deaths in the area. Dr. Kumar listed four living cases of cancer in the area. The doctor told majority of the cases were of liver and blood. This argument was confirmed by the report of 'Thanal'. They analysed the death records of the panchayath and found some alarming facts. Cancer deaths in Enmakaje panchayath have increased from 37 during 1982-87 to 49 during 1988-93 to 71 during 1994-99. This shows an increase of cancer deaths by 33% in six years and almost doubled in 12 years. From the observation of Dr. Mohan Kumar out of this 71 cancer deaths in Enmakaje panchayath, more than 90 percent happened in Padre village itself. Death, pain created by unusual diseases and weakened health made the people of Padre village in an uncertain future.

Social Stigmatisation to the Village

The study area has got a very high media attention nowadays. Due to this high media attention people of the area are unhappy with surveys and interviews. Politicians, media persons, environmental groups and various survey groups frequently visiting the area and asking questions regarding people's miseries. This cause the suffering people to think more anxiously about their lives and they feel more helpless. People felt that they are getting nothing out of these studies. One of respondent explained that there are difficulties in marriage proposals for the people of the area from other villages. At this point the action council made by the concerned people from the area decided not to allow further studies and highlighting the area. There are examples of arrogant responses from the part of the people of the area to the scientific researchers of

Plantation Corporation of Kerala. People of the area were violent to the research team of the panel of experts set up by the Pesticide registration committee of Central Insecticide Board, and it reached to the level of physical assault.

Summary

With the available data of the panchayath records and information from the medical practitioners it is clear that the mortality and morbidity pattern of the area is changed through last decade. The villagers are suffering from different kinds of diseases. These diseases have multidimensional impacts upon their families. They isolated them from others. Many children are dropped out from the schools. The school going children are scholastically backward and are on the edge of dropping out or detaining to the same class. People of the area suffer from frequent health problems and utilises public health facilities or community doctor primarily. People knowingly take medicines of high doses even with limited relief from ailments. Mothers of these children are spending high amount of energy and time to care them. The money spent for the treatment of the diseases is high, compared to their income. The people have used a high amount of money, savings and other material properties for the treatments. They accept the helplessness of the doctors and themselves, in getting cure for their diseases or availing good facilities. Some of the people are indebted to neighbors, relatives and other villagers. People are less participating in the family level gatherings and visit their relatives in other villages infrequently. There is no misbehaving to the affected children at the village level. The teachers also find hardly any such bad behavior to the affected, however they said the possibility for such misbehaving cannot be ruled out.

Many research groups, politicians, NGO leaders and scientists have visited the area and the village got a high media attention. This made the state government to ban the aerial spraying. But there are bad effects also on the people due to this high media attention. People of the area think that they are getting nothing out of these studies. They identify that the diseases made the future of one generation stagnant and the damage that has happened to them were irreversible.

Chapter-6

DISCUSSION

Introduction

In the previous chapters the different kind of economic and social impacts on the families due to the unusual diseases were discussed. This chapter aims to understand why the pesticide control mechanisms are nonfunctional in this particular case. Here the discussion is mainly carried out on the pesticide and pollution control laws of India. Additionally some examples of pesticide exposure and the failure of government mechanisms in providing compensation to the victims are discussed in this part. It will be seen that the difficulty in establishing a biomedical mono causality of the diseases due to pesticide exposure is an issue in providing any kind of compensation or assistance to the affected families. In the Bhopal gas leak tragedy the compensation issues were delayed and undistributed for the reason that the real victims and the quantum of the disaster were not assessed. The ethical question that can be raised at this point is whether the gas victims survive until the collection and analysis of tangible data regarding the number of people affected due to the gas exposure and establishing the relationship between the gas and the biological impacts. In the case of Padre village, which is suffering with several extraordinary diseases, the same ethical question can be applied. The situation in padre is thus discussed in this context.

Environmental Protection Laws in India

The most prominent legislation of environmental protection in India is the Indian penal code (IPC) itself. IPC has many provisions that can be used in the context of environmental litigations. Section 268 defines the 'Public nuisance'¹ and this can be used in a variety of ways for environmental protection. Section 269 and 270 holds a person or an institution responsible for negligently or with intention spreading the infection of any disease dangerous to life. Section 277 deals with the pollution of public place or

¹ A person is guilty of public nuisance who dos any act or is guilty of an illegal omission which cause any common injury, danger, or nuisance to the public or in general to the public who dwell or occupy property in the vicinity or which must necessarily cause injury, obstruction , danger or annoyance to persons who may occasion to use any public right.

reservoirs and section 284 prohibits the use of hazardous substance in a manner that is likely to cause hurt or injury any person.

Environment protection is under both state and union lists according to the Constitution of India, though supremacy of the Union is upheld over the states. The procedural features of the constitution regarding the environment are in article 252 and 253 of the constitution. Under this article the Union has the supremacy to adopt the national legislation for environmental protection. Process of adoption may be on the basis of any international convention or declaration.

Prevention and control of Pollution and contamination of water was adopted under the article 252 during 1974. It was named as Water (prevention and control of pollution) Act. The act defines water pollution as "alteration of physical, chemical or biological property of water or such discharge of any sewage or trade effluent or of any other liquid, solid or gaseous substance in to water. It may be direct or indirect or is likely to create a nuisance or render such water harmful or injurious to public health or safety or to domestic, commercial, industrial, agriculture or other legitimate use, or to the life and health of animals or plants or of aquatic organisms."² The act set up a central pollution control board and state pollution control boards to enforce the law. The state pollution control boards have the functions of drawing up comprehensive plans to control or prevent the pollution of streams, wells in the state, under the direction of the central pollution control boards.

Similarly the Air (prevention and control of pollution) Act was passed in 1981 and it was amended in 1987. The main objective of the act was to avoid air pollution. The enforcement of the law was through the central and state pollution control boards as in the case of water act. From the principles of both these acts the Union government of India enacted the Environmental (protection) act on 23rd May 1986. This act extends all over India. The act defines the environment, environmental pollutants, environmental pollution and hazardous substance etc. Environment is defined as inclusive of water, air

² Water (prevention and control of pollution) Act, 1974. section 2 (e).

and land, and the inter relationship which exists among them and human beings, as well as other living organisms, plants microorganisms and property. Environmental pollution is defined as the presence in the environment of any environmental pollutants, which in turn defined as any solid, liquid, or gaseous substance present in such concentration as may be, or tends to be injurious to environment³.

The environmental protection measures include the coordinated action of state governments and central government and the pollution control boards. Planning and execution of nationwide campaigns, laying down standards for quality environment, and for the emission and discharge of pollutants, restricting the areas of industrial operations, laying down procedures for the prevention of accidents, and for the handling of hazardous substances, examining their manufacturing process, inspecting premises, etc. Within a period of six months after the promulgation of Environmental Protection Act (EPA), the central government announced the Environmental protection rules. These rules made the procedures for the setting standards for the emission or discharge of environmental pollutants. The rules also explain the procedures for taking samples, serving notices, submitting samples for analysis and submission of their lab reports.

By passing the Water (prevention and control of Pollution) Act and the Air (prevention and control of pollution) Act the Government of India empowered the central and state level pollution control boards to take action against the polluting industries. The Indian constitution was amended in 1976⁴. This amendment made environmental protection mandatory for the citizens and the states. Further article 51 a (g), of the Indian constitution imposes the fundamental duty for each citizen to protect the environment.

Environmental issues or rights are very much associated and linked with the human rights. The right to live in a safe and healthy environment is a basic right for

³ Section 32 and 5 of Environmental Protection Act, 1986

⁴ 42nd amendment, 1976. a new Article 48 A was included " the state shall endeavor to protect and improve the environment and to safeguard the forests and wild life of the country."

every human being. It is one of the pre requisite for a healthy life and survival of the society. Article 21 of the constitution guarantees that “no person shall be deprived of his life or personal liberty except according to the procedure of the law.” With this constitutional provision the right to lead a decent life in a clean and healthy environment has emerged as an inherent and implied right of the people. Thus the right to life is very much associated to the right of clean air to breath, water to drink and clean soil to live. But inspection of the violation of these rights, in the form of environmental pollution and the constitutional remedies, in the form of compensational rights to the victims composed of complex judicial procedures. Lengthy judicial procedures affect the distribution of compensations to the victims of environmental contamination.

Regulation of Pesticide Management

The regulation of pesticide manufacturing, sale, import, transport distribution etc in India is regulated by the Insecticide Act, 1968. Regulatory provisions include compulsory registration, issuing license for the manufacturer, formulation and sale at the state level. Under this act two statutory bodies namely the central insecticide board and registration committee has been formed. As per section 27 of the insecticide act the central and state governments have been given the power to prohibit sales, distribution or use of any insecticide for reasons of public safety.

These are the important laws and constitutional provisions in India to control the environmental pollution and to restitute the environmental rights to every citizen of India. However these laws failed to provide justice to the victims of Bhopal gas tragedy and it seems they may again not provide justice to suffering population of Padre village. In order to understand the situation in Padre village the discussion in this chapter is mainly directed towards

- Pollution taking place in the area, due to aerial spraying and people’s the right to a clean and healthy environment.
- The contamination of water sources and applicability of Water (prevention and control of pollution) Act

- Concealment of information by PCK regarding the health impacts and precautions during aerial spraying and thus violation of the principles of aerial spraying .
- Improper medical assessment of the dimensions of the public health risks generated by the problem
- Powerlessness of the affected people
- Factors that prevents any sort of compensation to the suffering people and
- Why the precautionary principles are not applying in this case.

Pollution in the Area and People's Right to Live in a Healthy Environment

Pollution can be defined as the release of any material into the atmosphere, which makes the air unsuitable for breathing, damage the quality of water and making it unsuitable to drink, harm the quality of the soil, give out substances which damage the health of human beings, plants, animals and odor and noises, which may affect the tranquility of the lives. The people of Padre village suffer in almost all the categories of the abovesaid broader definition of pollution. When they are asked about the immediate effects of aerial spraying, they informed that there is a noxious smell fills air and makes it difficult to breathe. This 'bad' air may last for one week after the aerial spraying and the whole area looks vaporous. From these remarks it is clear that the air pollution is happening in a high level during the aerial spraying. The immediate health impacts of the ingestion of this smoggy air include the irritation and itching of the eyes. People and the medical practitioners said that this eye problem lasts five to fifteen days. Headaches and suffocation, dizziness, skin itching, scratching and chest pain etc are happening to every body in the area during the aerial spraying. The health status of the people as well as the effect on other living beings like decrease in the birds, fishes, reptiles, honey bees, and infertility and miscarriages in cows etc are discussed in the early sections of this paper. From the situation and its comparison with broader definition of pollution the people's right to live, right to health and the right to live in a pleasant atmosphere have been seriously invaded by the Plantation Corporation of

Kerala through the aerial spraying of any pesticide. This invasion of the people's right to life cannot be simply justified with the arguments on whether Endosulfan is genotoxic nor is it causing the health problems of the people in the area. Medical ethics prevent the isolation of any such findings of such biomedical causality and the proponents, who are arguing for such a proof, also know that such a study is not possible. What they are trying to do with such arguments are the continuation of aerial spraying and further impinging of the people's right to live and to health and live in a healthy environment.

Pollution of Drinking Water Sources

More than 30 percent of the population and about the same number of the villagers are using the water source called 'Surangams'. People make small channels in the hillside and collect water from this path. Water may be from the nearby water stream would pass through these channels and they use this water for drinking and cooking purpose. Samples collected from this water sources and analysed by CSE on 17th February 2001, about one and a half months after the last aerial spray of Endosulfan carried out on 26th December 2000, showed a high quantity of the pesticide residue. This shows the contamination of water sources. In the early section of this paper we reviewed the recommendations of a high power committee that studied all the information at national and international level regarding all possible toxicity of Endosulfan, prohibited the use of Endosulfan near water bodies. The committee strictly guided and recommended that this should be a condition for issuing the certificate of registration for the pesticide. But in Kasargode plantation division there are 174 drinking water wells inside and 1333 wells just outside the plantations. Water from the hills of plantation always reaches the streams. Some of the streams, which originate from the hills, pass through the area and they are the constant source of water for the 'Surangams'. That means about thirty percent of the inhabitants of Padre are getting water directly polluted with the pesticide due to aerial spraying. The wells just of the plantations may also be polluted with the pesticides. Some of the streams originated from the plantation area join with Chandragiri River, which is a drinking water supply source for Kasargode district itself.

The pesticide primarily pollutes the drinking water source of the Padre villagers. This may not be similar to the industrial pollution of rivers but it may highly cause the ill health of the people of the area. The emphasis of the judiciary should be on the grounds of people's access to safe water, any form of public or private sector industry or corporation should not be allowed to invade this basic right. The violation of the recommendations regarding the avoidance of Endosulfan near water bodies has been observed in this paper.

Principles of Aerial Spraying Followed in Padre Village

In the early sections of this chapter, the Insecticide Act of 1968 has been reviewed. The Act offers a good number of guidelines to control the availability and the use of pesticides in the required cases. In Kerala the state agricultural department is the licensing authority for the sale, stocking and use of the pesticides. The district collector of Kasargode district was the licensing authority to grant permission for the aerial spraying to the plantation corporation of Kerala.

The central and state governments have the power to prohibit sale, distribution and use of any such insecticide violating its directions. The central government on receipt of the report from the state government can cancel the registration of the pesticide after consultation with the registration committee. Insecticide act of 1968 was followed by the Insecticide Rules 1971. A spraying protocol has been prescribed under this rule. The rule 43 of the Insecticide Rule gives the directive for aerial spraying⁵. However, the spraying protocol does not prescribe the geographical suitability. This has provided the space for aerial spraying in plantation divisions of Kasargode. The rules of aerial spraying suggest the quantity and height from which the pesticides can spray. But the people and panchayath authorities observe that this was never followed by PCK.

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

The spraying was done much higher than the prescribed height and people never informed about the concentration by which the pesticide was spraying. As reported by the Dr. Achyuthan committee, the staff received no training for the aerial spraying and they are not aware about the concentrations. People from the area said the staffs usually wash the containers of the pesticide in the stream water itself.

Aerial Spraying and People's Right to Information

The District Collector grants permission for aerial spraying with the conditions that there should be a notice published and given to the public by PCK at a sufficiently advanced date of spraying. The notices are to be published in the village office and panchayath offices and the ration shops in the area. Further all precautionary measures including the materials to cover the wells should be given by the PCK to avoid water pollution. In any case of deaths of livestock, the corporation should arrange the post-mortem for it and should give compensation to such cases. There should be mike announcements regarding the aerial spraying at least one day before the spraying and the instructions to cover water bodies should be given with it⁶. These directives are made with an intention to safeguard the basic principles of people's right to information. The spraying authorities are supposed respect the peoples right to information, but during the interviews with the people and key informants it was clear that these directives are not followed. The report made by Kerala Sasthra Sahitya Parishad also asserted that the people were not informed about the precautions and were not given any covering materials for their water sources. The people use the stream and the 'suranga' water, which cannot be covered at all. The notices regarding the aerial spraying were published in village and panchayath offices, which are almost four or five kilometers away from the exact area but no announcements have ever been made. The notices were in Malayalam, which says the water sources will be covered by the PCK, and people and domestic animals are not supposed to enter in the sprayed area for twenty days. But PCK never covered the water sources and the information

⁶ Government of Kerala (2001), Dr. Achyuthan, Report of the Committee to Study and Analyse the Effects of Aerial Spray of Endosulfan in the Cashew Plantations of PCK Limited in Kasargode District, November, 2001, pp.20-21.

never came to the knowledge of the people. The panchayath authorities said the responsibility of providing information is upon PCK. Thus in Padre the information spread for procedural sake and not for the safety of the people.

Epidemiological Reports Regarding the Area

An epidemiological analysis of any set of disease patterns includes the three main factors. They are the time, place and persons. Whether one geographical area has high prevalence of some diseases than the other areas and whether the characteristics of the persons with those particular diseases are distinguishable from that of those without having it, and the time frame of the occurring of such diseases etc should be established in an epidemiological analysis.

As per the directive of the National Human Rights Commission, the NIOH carried out a case control study in Padre village. 619 children from the exposed area are compared with 416 children from a non-exposed area. These children were from the same socioeconomic background. Blood samples and water samples were analysed, sexual maturity rate of the children verified and the general and peculiar health problems of the two groups were taken. The study found significantly higher prevalence of congenital malformations, higher rate of learning disabilities and low IQ in the exposed group. Girls from the exposed area attain early menarche and menstrual disorders are high in this group. Endosulfan residue was found in water and blood samples. The study suspects the exposure of an endocrine disrupter, mutagenic substance or an oestrogenic substance to the exposed group for these abnormalities. CSE, New Delhi analysed blood, water, human milk, vegetables and soil samples for endosulfan residues on Feb. 17th, 2001 (one and a half month after the last aerial spraying of endosulfan on December 30, 2000). The sample analysis showed high concentration of endosulfan residues in all samples. A team of researchers from the NGO Thanal carried out a house-to-house survey in the area. The team observed high incidence of congenital malformations, Mental retardation, infertility, miscarriages, menstrual disorders and general health problems in the area. Dr. Mohan Kumar, a physician practicing in Vaninagar since 1982, has recorded a list of high incidence of

peculiar diseases in Padre village. He listed 51 cancer deaths in 126 houses of the area over a period of 10 years. PHC of Perla conducted a house-to-house survey in Padre village. The survey finished in June 21, 2002. The survey listed 352 peculiar health problems in 852 families and a population of 5696 families (see table 5.01, page. 65). Similarly KSSP conducted a study in the area during 1996. The study showed higher rate of disability, chronic morbidity, mental retardation etc, in the area (see table 5.02, page 66). However according to PCK, these studies and the established the occurrences of severe health problems in the area are not sufficient to stop the aerial spraying.

Issues Regarding Compensation

The issue of providing any kind of compensation to the people suffering from pesticide exposure remains as a complex one, in view of the fact that, the establishment of biological association between the pesticide and the diseases is difficult to prove. However the invasion of people's right to live in a healthy environment and their right to use safe water are possible to establish. And there is sufficient confirmation on the violation of the laws and principles of aerial spraying in this case. The governmental and judicial responsibilities were manifested only through the appointment of technical advisory committees and to act according to the report. The rehabilitation of the affected people, health care opportunities, and economical assistance for the affected families from the part of the government etc are not discussed in any these reports. There has been no study examining the costs to the people in terms social and economic impacts which make the PCK to side step these issues.

Powerlessness of the People

People of the area were the silent sufferers of the ill health and diseases until late 90s. The environmentalists and concerned people of the area pointed out aerial spraying as the probable reason for the disease manifestations. The reasons for the problem not being noticed earlier could be because the village is in a backward area and the people are actually separate from the people of Kerala. The village is highly remote and interior and when compared to the other parts of Kerala it is less developed economically and

socially. The literacy level was in between 70 to 75 percent. About half of the houses of the area are not electrified. Sex ratio was 964 to the Enmakaje panchayath, which is considerably lower than the state average of 1032. Gender gap in literacy rate for the panchayath was by 17 points, which was also high compared to the other areas of Kerala (Panchayath level statistics, 2001, Kasargode district).

People of the area were speaking Thulu and it culturally separates them from the other parts of Kerala. The district was formed in 1984 by joining some portions of Karnataka state. The village is about 6 kilometres away from the panchayath headquarters and the transportation facilities are very limited to the area. Bus services are limited and this makes the village more isolated. The houses are scattered in Enmakaje panchayath and the politicians have least consideration regarding the area. The area located at the extreme opposite end of the ruling centre of the state and this aggravates the disregard of the politicians to the area. However with high media attention and consciousness of the public the political parties pay their attention nowadays to the area.

In the next section we compare the situations of pesticide exposure of Bhopal and Padre village.

Environmental Laws and the Bhopal Tragedy.

The methyl isocyanate (MIC) gas leaked from the pesticide plant in the Madhya Pradesh capital on the fatal night of December 2, 1984 killed about 8000 people and harmed 50,000 people⁷. About 40 tonnes of deadly poisonous MIC gas leaked from the plant of Union Carbide India Limited (UCIL). The company was a subsidiary of the American multinational Union Carbide Corporation (UCC). The company manufactured a number of pesticides for domestic use in the green revolution. Among the products of UCIL was a pesticide called Sevin, (the main) ingredient of which was Methyl Isocyanate.⁸ The severe impacts created due to this industrial disaster include

⁷ Abraham, C.M, Abraham S., *The Bhopal case and the development of environmental law in India*, ICLQ April 1991(40), p. 334.

⁸ Ibid.

the injuries to the reproductive system of many people. According to a study conducted by a group of doctors regarding the effects of gas leak on women's reproductive health revealed that there was a fourfold rise in abortions of the women in Bhopal.⁹

"Medical experts say that the poison from the gas that circulated through the blood had damaged the eyes, lungs, kidneys, liver, intestine, muscles, brain and reproductive and immune system. A recent survey by an activist group namely Bhopal Group for Information and Action found that 30 people still die every month from the lingering effects of the gas leak. Thousands of others are suffering from body pain, breathlessness giddiness, numbness of limbs, fever, brain damage, cancers, tuberculosis, menstrual disorders, depression and mental illness."¹⁰

International medical commission on Bhopal comprising 14 specialists from 11 countries has concluded that there exists significant multi-organ damage among the survivors. Indira Jaisingh and C Sathyamala observed that the nature of the product the company manufactured, the process of manufacturing, the security surrounding all procedures, the double standard in safety maintained by the transnational company, the measures taken by the management to cut costs, the run down conditions of the plant, all added up to create the right mix for a massive environmental disaster. They further stated that the disaster was predicted earlier by a Bhopal based journalist namely Raj Kumar Kesawani. The journalist written a series of articles in 1980, and predicted the possibility of a disaster. But nobody addressed his cry to save the city.

The tragedy had widespread impacts upon the chemical industry also, in making the security standards of any such plant. The disaster made the Indian authorities to think an Environmental Protection Act in 1986, to control the environmental pollution¹¹. Apart from these, there are enough examples of false information and concealment of necessary facts from the workers and the community in the Bhopal issue. The trade union report on Bhopal pointed out the serious facts concerning the company. The UCIL

⁹ Times of India, 22 November 1987, p 8.

¹⁰ Deepak Tiwari., "Brooms from Bhopal", *The week*, Dec8, 2002; p16.

¹¹ Jaising Indira, Sathyamala, C., (1995): "Legal rights ... and wrongs: internalizing Bhopal", *The earth scan reader in sustainable development* , ed. John Thirky et al ; Earth scan publications, London.

never provided any information to their workers and to the government authorities or to the community residents about the chemicals they manufactured. Most of the workers had received no training or information regarding the hazards of the MIC or other toxic chemicals they developed. Residents of the J P nagar and other neighborhood had little idea about what UCIL produced. Many residents thought that the company is producing medicines to protect the plants¹². This could be called misinformation, as it was not revealed the fact that, these medicines are poisonous and protect plants by killing other forms of life. This way of spreading false information continued even after the gas leak tragedy by UCIL. They asserted that there would be no aftereffects due to the gas exposure, which has been proved untrue with time. Further they refused to reveal the composition of the gases in the gas cloud.

A Comparison of Issues Involved in Providing Compensation to the Victims

The world's worst ever-industrial disaster was followed by a large number of litigations for compensatory relief for those who died and to their dependents. Immediately after the disaster more than 145 cases were filed against UCC by American lawyers in different courts of United States on behalf of thousands of victims. Later these cases were joined and assigned to the southern district court of New York. The Union of India filed a separate complaint before the court on 29th June 1985. Before doing this, the government of India enacted Bhopal Act, which gave the government, the responsibility and the right to represent all the victims regarding compensation. During the trial, the American lawyers proposed an amount of 350 million US \$. The Union of India refused to accept the amount. At this stage, the UCC submitted an application to the court, that the suit to be dismissed on the ground of inconvenient forum. On 12th May 1985 United States district judge John F Keenan dismissed the American actions on this complaints with the argument that American courts are not the appropriate forums for the legal issues involved. Further the American courts refused appeals against this order¹³.

¹² International Council For Trade Unions The trade union report on Bhopal (1985), ICFTU Brussels, Geneva

¹³ Abraham CM, Abraham S., no. 7, p. 335.

Upendra Baxi observed that justice John F Keenan denied the proceedings of the cases in America by saying administrative inconvenience¹⁴. It clearly indicates that death and disability of hundreds and thousands of Indians by the 'act of commission or omission' by an American multinational is not a matter of real interest to the judicial decision makers of America. A judge so highly conscious about the ability and problems to defer an American multi national in India has no hesitation to refer the case to an Indian court. According to Sathyamala and Indira Jaising the hidden agenda behind this argument of inconvenience was clear. The UCC didn't want to pay the compensation amount that the American court usually would have been awarded. The UCC was confident in the assumption that life in India is much cheaper and the Indian court would make a comparatively lower compensation.

The American court then committed the case to the district court of Bhopal. After some legal proceedings the Bhopal district court made an order on 17th December 1987 to provide an interim relief of 270 million US \$. This order has been challenged by the UCC and later the amount of compensation was reduced to 2500 million rupees, equivalent to 270 million US \$ by the High Court. Both the orders placed the responsibility of paying the compensation on the UCC. Again this order was challenged in the Supreme Court of India by UCC. During this law struggle an out of court settlement was struck between the UCC and Union of India. The settlement pact was to provide compensation of about 7,150 million rupees, equivalent to US \$ 470 to the victims of the gas tragedy. But this also not happened due to unknown reasons.

In February 1989 the UCC in an out of court settlement agreed to pay \$ 470 million as full and final settlement of all civil and criminal liabilities. Of this amount rupees 715 crores was distributed in installments to the victims. An English weekly magazine *The week* reported that the victims got a meager 200 rupees per month out of

¹⁴ Upendra Baxi., (1986) *Inconvenient forum and convenient catastrophe- the Bhopal case*, Indian Law Institute, New Delhi, p. 1.

this amount for some installments¹⁵. The medical documentary evidence prepared by, assessing the quantum of the disaster was contradicted many times. This was questioned in many forums. The contradictions between the official figures were questioned by UCC also. The official figures of death were only around 2000 reported by the newspapers. About 60,000 persons filed claims for compensation. In 1989 epidemiological evidences based on the medical surveys found about 50,000 people suffering from the after effects of the tragedy. But the Supreme Court judgment for distributing compensation was neither based on the compensation claims, nor based on the medical survey report. The court simply accepted the figure of 30,000 affected permanently and 20,000 affected temporarily based on the hospital records¹⁶. Indian Council for Medical Research, the Defence Research Establishment, the Industrial Toxicological research development Establishment etc were given the right to conduct medical survey in Bhopal. The government of India kept all the information confidential under the Official Secrets Act.

Indira Jaising and Sathyamala observed that there was a clear conflict between the two policies of the government, in providing justice to the victims and attaining foreign capital. Further they say that there was no proper epidemiological study to assess the nature and extent of the injury. Therefore there is no proper evidence for the details of the exposed population. The company without adequate proof denied the adverse impacts like mutagenicity, carcinogenicity, genotoxicity, etc, of the gas exposure. From the review of this legal struggle for compensation, the strategy followed by UCC was to delay the payment of monetary relief. From the views of various organisations functioning for the victims there is a serious underestimation of the victims cause and this excluded many of them from getting the monetary relief¹⁷.

The Bhopal experience was the one of the major experiences where the government of India distributed a meager amount of compensation to the victims. After the extensive official and judicial process, the victims got meager amounts for their

¹⁵ *The Week*, December 8, 2002, pp. 14-16.

¹⁶ Jaising Indira, Sathyamala C., (1995) no.11, p. 178.

¹⁷ *The Week*, no. 14, p. 16.

death, disability and irreversible sufferings. The commitment of the government was questionable in this case because it failed to provide any kind of entitlements to the victims in terms of financial relief, medical care and rehabilitation of them. Many reports criticised the governmental role as, to dispose all the proceedings of civil and criminal cases against UCC¹⁸. The approach of the Indian judiciary in the Bhopal case was criticized and the critics said that the Indian judiciary had serious lack of environmental consciousness.

Constitution of India ensures the healthy living of the people and the judiciary is expected to provide this welfare to the people. Legislations are made to control pollution and provide the environmental rights to people. In the case of chemical exposure dangerous to health, there is always the technical problem of assessing the risk to public and weighing the balance of economics and the well being of the people. When this problem in risk assessment is combined with the negligence of the authorities, indifference of the industries and the powerlessness of the suffering population. The industrial, political nexus is able to manipulate the laws in favor of those who are getting the benefits of such use of technology. Often reports of committees and technical experts may be substantially influenced by the concern of the industry and development. They tend to ignore the sufferings of few people for the sake of industrial development and put forth the argument that somebody has to pay for development.

In the case of Padre village, social action litigation has not yet been filed by the people, in any of the court against the invasion of their right to life in a healthy environment. Also the health effects for a few poor people versus the economic interests of the PCK and the pesticide industry make the decisions that incline in favor of the industry. The different committees on Padre village, recommended for and against the use of Endosulfan. One of such committee under the head of Dr. Achyuthan reached to some extent of applying the precautionary principle against the use of Endosulfan. But none of such reports pointed out the rights of this community for a healthy environment. None of the committees considered the rehabilitation of the people with

¹⁸ Coomi Kapoor., "Bhopal settlement: Delhi criticized for 'giving up' ", *TheTimes*, 16 Feb. 1989, p. 11.

uncertain future. Nobody said even a word about the compensation and they are looking for the one to one association of the diseases and the genotoxicity of Endosulfan. The reports are not highlighting the contamination of the drinking water of the community, the pollution of the air. They are looking for the association of Endosulfan and want either to criticise or to make free the Endosulfan from these disease manifestations.

In the case of Bhopal gas leak tragedy even after having a clear evidence of toxic gas exposure the under estimation of the affected and unfair compensation took place. But in the case of Padre the authorities are arguing for the identification of the genetic factors that causes unusual diseases.

Chapter-7

CONCLUSION

To understand the complexity of the impact of pesticide exposure, the village level situation was placed in the context of global environmental degradation occurring due to the use of chemical pesticide. Therefore the study incorporated the global dimensions of pesticide usage as well as the philosophy behind the extensive global use of pesticides. The harmful effects on the environment, the economic dimensions of the pesticide industry, and the possible toxic effects that can hurt the environment and people etc are also reviewed in the study. Added to this the national regulatory mechanisms for controlling the pesticide management was also analysed and the problems of these regulations in the context of Padre village was considered in the analysis. The analysis on the basis of the primary data of the present study was an attempt to explore the social, economical and health impact upon the families, affected with the diseases. The study raises the ethical question of application of science in policymaking, economic and political process of decision making and balancing the welfare of people.

To begin such an analysis, establishing the occurrence of the unusual diseases in the families was very important. For this purpose various study reports regarding the area were examined and the existence of peculiar kind of diseases in the area was confirmed. Interviews with the people of the area and the medical practitioners, confirmed time of occurrence of such diseases in the area was only after the beginning of aerial spraying (early 1980s) and after some continuous exposure of pesticide. Out of the 79 children from 30 affected families 36 were affected with mental retardation, physical and orthopedic deformities. Only one of these children was above the age of 16 years, 22 were from the age between 6 and 10 years, 4 of them were between the age of 0 and 5 years and 9 were from the age of 11 and 15 years. The argument stating the diseases are only after the commencement of aerial spraying seems correct with the fact that majority of these affected were probably affected are congenital problems were probably affected

at the time of organ formation, and are therefore less than twenty years of age. Those who are not affected with peculiar diseases are suffering from other health problems due to chronic exposure to pesticides.

Analysing the place of disease occurrence includes the examining of the unique geographical peculiarities of that place. The proximity of the diseases to the cashew plantation was established by the observation that the all the houses of the affected population are less than a distance of one kilometer from the plantations. The cashew plantations are on the high-elevated sides of the hills and the people dwelled in the valleys. Added to this the clustering of the affected families was observed closer to the water streams passing through the plantations.

The rate of incidence of mental retardation and physical deformities in the area are very high. Disability rate of mental retardation per one lakh is 544 in the area compared to the state average of 244. About fifty percentage of the new generation from Padre village, which is within two square kilometers are born with strange kind of diseases. The impacts of these peculiar diseases on the affected families are multi-dimensional in nature. Schooling of the affected children was severely affected, 11 of the affected children from the sample were school dropouts and this group was mainly suffering from mental retardation or they were deaf or dumb. School dropout happens only at the least possibility of continuing the school, as the area also have 100 percent school enrollment compared to the other parts of Kerala. Parents of these children had accepted the fact that there is no possibility for their children to continue their education. School going children from the area were also found scholastically backward according to the teachers. People of the area perceive these diseases are incurable and the damages created by them are irreversible. They believe the future of the affected are uncertain after the death of their parents.

Out of the 30 sample families mothers were the principal caregivers for the affected children in 26 families. They have the additional responsibility of household work such as cooking and livestock management. Occupation and health of the mothers

are affected due the intense caring of the affected children. Additionally, the general health status of the villagers was found to be weak with frequently occurring diseases like cough, fever, chest pain, skin diseases and rheumatic complaints. They utilise primary health centre or sub centre or the service of the private doctor for getting relief from these diseases.

The analysis of the distribution of the diseases among the different castes of the area, found did not show any association of the disease manifestation to any of the particular castes. Scheduled castes people of the area are from the caste 'Mogare', scheduled tribe are from 'Marathy', 'Kuraga' and 'Naiks', other backward classes belongs to 'Rai' caste and general category people are from 'Shastry' or 'Shetty' castes. Among the thirty affected sample households, 8 are from scheduled caste, 8 from scheduled tribes, 5 from other backward classes and 9 from the general category of peoples.

Economic profile of the area reveals that the people of this area can afford two square meals everyday for the entire family. However, housing pattern and land ownership of the area shows that these people are just above the level of subsistence. Average size of the family is four to six numbers and most of the families are nuclear. People live in houses roofed with wooden bars and tiles, or thatched with weaved coconut leaves. The walls and floors of the houses are either of mud or cement. One family from the sample have monthly income level in between Rs.1000 and 1500, seven of them have an income level in between Rs.1500 and 2000 and 22 of them have an income level in between Rs.2000 to 2500. However the supplementary income from the livestock, agricultural cultivation and unpaid income from the female heads of the houses were not calculated. 60 percent of the sample families have a land ownership of 16 to 20 cents, 16.7 has of 21 to 25 cents, 20 percent has 11 to 15 cents and only one family has a land property between 5 and 10 cents. 17 houses have their own wells, 4 are using neighbor's wells and 9 are getting drinking water from 'suranga'. Water sources were found contaminated according to the NIOH and CSE study and are the constant sources

of pesticide residue. However people of the area uses stream water for their activities other than cooking and drinking.

The economic impacts of the disease upon the affected family includes mainly; burden due to the cost of treatment for the affected, loss of health and employment due to frequent diseases problems and the overall debt due to the financial burden due to peculiar diseases. 43.3 percent of the affected families reported that they spent the money for treatment from their own savings, 30 percent of them either sold their properties or borrowed money or both for the treatment purpose. 20 percent of them additionally borrowed money for the treatment and spend their savings also for treatment. However, it is often seen that as People know that diseases of their children were incurable, they spend less amount of money for their treatment. Among the 36 affected children 14 are physically handicapped, 9 are mentally retarded and seven are deaf or dumb. These types of diseases made the families to limit their spending for treatment after the diseases are confirmed. Cost of treatment exceeded Rs2500 for two families; Rs2000 to 2500 for two families and it was between Rs1500 to 2000 for four families and 1000 to 1500 for nine families. People of the area are earning less amount money and the money they spent for the treatment is high for them.

The people confirmed the illness of their children mainly through public health facilities. Identification of mental retardation, epilepsy, cerebral palsy and hydrocephalus were the cases for which the people spend much money for treatment. Out of 30 families, it is found that 2 families have not undertaken any kind of treatment for the affected, one family availed treatment from the medical college, 2 from the district hospital, 11 from the taluk hospitals and 3 from local PHC. Some of the cases were found referred from PHC level to Taluk and district levels for treatment. It is observed that 4 of them were referred from PHCs to district hospitals and 7 from PHCs to taluk hospitals for the treatment of their affected children. This shows the extent of utilisation of government health care facilities by the people of the area.

The general health seeking behavior of the community illustrates the maximum utilisation of the primary health centre and sub centre for their general health problems. 43.3 percent of the respondent families generally consult primary health centre or sub centre only, 23.3 percent consult both primary health centre, sub centre and community doctor for their health disorders. 16.7 them consult only the private doctor and same number of people was not doing any kind of treatment for their health problems. People knowingly take high doses of medicine for their day-to-day physical problems to get some relief. The remoteness and lack of transport facilities tempt them to utilise community-based services. With such a health care utilisation, it has been found that the cost for treatment was minimal and less than Rs250 per month. However all the thirty families have an average monthly income of less than Rs2500. Therefore the money they spent for treatment are relatively high.

Social networking of these people was severely restricted due to the occurrence of the peculiar kind of diseases in their families. Absence of schooling of the affected children limits their socialization and they are not at all participating the family level or village level functions. Thus the children became isolated with deformities, lack of education and with an uncertain future. People from the neighborhood have good relationship between each other. About fifty percent of the families from this area are affected with some kind of peculiar diseases; therefore they could not express lack of cooperation between each other, as the suffering is common to all of them. But the cooperation from the relatives staying outside the village is somewhat less to the villagers. In a village level situation this shows serious impairment in social relationships between people due to the diseases.

There was a fall in price for the agricultural and milk products and land properties of this area. People reported that this happened due to the excessive media attention to the area due to the frequent visits of journalist, politicians and study groups. People feel that they became study objects and they get nothing out of such studies.

Any form of science and technological application has its own merits and demerits. The importance of chemicals in the modern societies cannot be denied. Present century witnessed a chemical revolution, which has led to the integration of chemicals in to everyday lives of people. The problems like environmental pollution, ecological destruction and exploitation of the natural resources etc are taking place with this high extent use. Environmental problems related to the high use of chemicals have given a heavy task to the judiciary in weighing and balancing various considerations of people's welfare, possibility of administrative and industrial negligence and the weakening of the environment etc.

Risks generated from technology could not be established by a one to one relationship. However, the possibility of risks cannot be simply ruled out. The uncertainty or absence of proof in the assessment of risk should not be the criteria for the continuation of the pesticide use. The regulatory situation of such risks should involve the application of this precautionary principle so that irreversible damage to the society can be avoided. The hazardous potential of the Endosulfan or similar pesticides, their persistence, their capacity for bioaccumulation, mutagenic properties and reproductive toxicity etc may be proved after a long time. But the damage created to the society will be irreversible. This can be avoided through the application of precautionary principle. In the case of Padre Village the court denied the permission of aerial spraying of Endosulfan by arguing on the grounds of precautionary principle.¹ But the report from the committee constituted by the Registration Committee exonerated Endosulfan from the diseases. The report advocates the continuation of the spraying with an argument of the absence of a dose response relationship. If such a continuation of aerial spraying takes place it would be the negation of precautionary principle.

So the problem of the area raises serious ethical issues regarding the policy of usage of science and technology. It seems the economic motives guided the Government

¹ When risk assessment is complex over technological risks, deferring or avoiding the technological application for the sake people and environmental safety can be done as a precaution. This principle has high implications on policy making. Keys issue in this case also the debate over cost- benefit, risk assessment and the process of decision-making.

owned PCK to have an extensive use of pesticide in the area. This was despite the regulatory standards of India on the safety and public health risks of Endosulfan and many reviews. This condition is however not a law in India. The technical committees constituted to check the risks caused by Endosulfan, were looking for linear association of the genotoxic effects of Endosulfan and the diseases. This is not possible to establish and this argument gives the strength for further use of the pesticide in the area. But the application of precautionary principle in using a chemical was never mentioned by any such studies. Principle of precaution can be applied in this type of chemical usage in such a way so to anticipate the possibility of bad effects upon the people rather than waiting for the scientific accuracy of dose response relationship and proven genotoxicity. People's right to live in a safe and healthy environment never obtained importance in this context.

Powerlessness of the people, remoteness of the area, distance from the ruling centres of Kerala and the cultural identity as Karnataka people etc made the authorities to neglect the issue for a long time. Absence of guidelines to the geographical suitability for aerial spraying of pesticide in the insecticide rules of India made the aerial spraying possible in the area. The contradicting reports from the concerned study groups such as KSSP, NIOH and CSE, and the studies by the industrial people shows the controversial relationship between industry and study groups. The continuous usage of pesticide for about two decades, lack of covering the water bodies, hiding the information on aerial spraying and it impacts or publishing the information for name sake, neglecting the fact of unsuitability of the area for aerial spraying, not stipulating the prescribed height during spraying and using untrained staff etc done by PCK shows the violation of insecticide rules. This negates the people's constitutional right to live in a safe environment and a healthy life. Severe environmental impacts like minimizing birds, absence of honeybees, fishes, frogs and reptiles, deaths of livestock and miscarriages to them etc were also observed during the time of aerial spraying. Continuation of aerial spraying on the basis of any technical advisory committee would be the negation of precautionary principle and the violation people's basic right for a healthy environment.

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APPENDIX 1

Interview Guide for the Affected Families

General profile of the area

Name of the village, ward number, total number of houses in the hamlet, Distance of the house to the plantations, total number of children in the village hamlet, their general diseases and treatment seeking patterns.

Religion and caste

Type of housing

Source of drinking water

Land ownership

Livestock ownership

Availability of employment in the area and average family income.

Details of the affected family

How long have you been staying in the area?

Number of children in the family?

Distance to plantations

Details of the family members

Si. no	Sex	Age	Educational Qualification	Relationship to the head of the family	Occupation & Income/month	Affected by illness/not	If yes how long have been affected

How the illness is noticed first? Confirmed by doctor ? if yes were ?

What treatment done, from where and expenses of treatment?

How the financial source has been arranged for treatment?

Family's perception, on the reason of illness.

Exposure to endosulfan

Did anyone of your family worked in Cashew plantations of PCK?

How frequently aerial spraying was done till it was stopped?

Have you priorly informed regarding the spraying?

If yes how and what advices they given for precaution

What precautions you done during aerial spraying

If dine nothing why

Are you using any pesticide for your crops?

Water source for the family, is water is available throughout the year, if not other sources during scarcity?

Have you observed any strange things happened to animals, birds, and other organisms?

Recently happened illness to the family members and treatment done for it, from were the treatment done and expenses for it and the source of that money.

Impacts upon families

How the relatives and neighbours are behaving to the affected persons?

Do they visit the family frequently?

Have you ever been quarrelled with any of them with regard to the misbehaving to the affected persons?

If yes, to whom?

Does the affected person participate to the family functions?

Who is looking after the affected person?

Does it affect the occupation, schooling of the caring person?

How do the other villagers looking at the area?

Have any of your children dead?

If yes, how? What treatment done? From were? Expenses for it? And source of money?

Do any of your family members have pregnancy related problems? If yes? What?

Action taken against campaigns against endosulfan

Have any of your family participated in any of the campaigns of endosulfan?

Do you have enough time to participate against aerial spraying?

APPENDIX 2

Interview guide for the key informants

Name

Occupation

Educational qualification

Dimensions of Unusual diseases in the area (number of affected, their age, economical standards, caste, gender and geographical proximities to the plantations)

How he/she is linking the unusual disease pattern of the area to aerial spraying of endosulfan (on the basis of studies, observation)?

A general history of endosulfan spraying in the area.

What are the reasons behind the extensive use of endosulfan by a public sector company?

How these unusual diseases affecting the families and the total village?

What are the experiences of the person regarding the action taken against endosulfan spraying?

What is his/ her awareness against ban or restriction against endosulfan in other countries?

What are the Precautionary measures taken by the PCK during aerial spraying?

Precautionary measures done by the people of the area during aerial spraying?

Is there any assistance or rehabilitative programs for the affected people?

Are there any strange observations on animals, insects, fishes etc generally in the area and during aerial spraying?

APPENDIX 3

Interview guide for the doctors/ health care professionals.

Various dimensions of unusual diseases in the area.

(Number of affected, their age, economical standards, caste, gender and geographical proximities to the plantations).

Differences in the morbidity pattern of the area compared to other areas.

Do you think both of them are linked with aerial spraying of endosulfan? If yes how it is associated?

Impacts of aerial spraying upon insects and other small animals.

Treatment seeking behaviour of the people for the general illnesses.

Do they usually visit hospitals?

Are they able to manage the treatment costs?

Is there any special trends in the IMR, CMR, MMR and miscarriages of the area?

What are the limitations to the medical science to establish a single one to one relationship between the aerial spraying and unusual diseases?