Chapter 1

Introduction and Scope of Study

Introduction:

The story of pesticides is an exciting chapter in modern civilization. It embraces the discovery of DDT followed by many other pesticides and, for many people, triumph over the misery and suffering of malaria and the reduction of other insect-borne human diseases. Included also is the role of pesticides in ushering "Green Revolution". The result has been a food supply of volume and quality and better health for the people not realized before the pesticide era and unlikely to be maintained if these were suddenly unavailable. Against these benefits are the tragedies such as threat of extinction of non-target species, the ruining of our environment and high pesticide residues with unknown consequences. Last but not of least importance is an increasing incidence of pesticide-related illnesses among workers and the population exposed to these toxic compounds.

For more than 50 years there has been awareness and apprehension by some of the people over the safety of
pesticides, mostly insecticides, to human health. Kallet and Schlink's (1933) book produced a big wave of public reaction. The first chapter of the book indicated the focus of the authors "The Great American Guinea Pig". Rachel Carson's book "Silent Spring" undoubtedly did more than any other single publication to inform the public about wideranging adverse effects of pesticides on major aspects of environmental quality including public health (Carson, 1962). Despite certain scientific deficiencies, this well-written book served to stimulate during the following decade the enormous wave of public concern about safety of pesticides. The book also served to catalyze public opinion on the need for progressive action to prevent the rapid deterioration of environmental quality.

In our country pesticide's problem was highlighted by the report of the Special Committee on Harmful Effects of Pesticides (ICAR 1967). There have been many developments in this field during the last decade leading to the enactment of the Insecticides Act (1968) to ensure the safe use of these chemicals for the benefit of society.

There is every reason to believe that these chemicals purposely developed to be toxic to pests, might produce adverse effects. This is the basic cause for concern
regarding risks involved in large scale use of pesticides. What is required now is to weigh all the risks against the benefits and to ensure the programme is proceeding with maximum possible care and a reasonable margin of safety?

Benefits of Pesticides:

The economic benefits flowing from pesticide use are quite apparent; firstly to increase production of food and fibre by control of crop pests and safe storage of crop products; secondly, in public health through control of disease vectors e.g. malaria, filaria etc. Beside, these two major uses, pesticides are also beneficial in veterinary practices, forestry and for domestic pest control.

The pesticides role in the great advances made in the agriculture production in the developed countries which is widely recognized, is nothing short of revolutionary. Yield per hectare of all major crops have increased steadily as also the total output of all food crops. In United States, it is estimated that losses resulting from various pests in the farm and forest production range from $10 to $15 billion per year (Boyce, 1974). While our country too is losing at present about Rs.5,000 crores per year due to weeds, pests and diseases (Prasad, 1976). The returns obtained from the use of pesticides will vary,
but it is beyond doubt that use of chemical pesticides pays good dividends. The benefits from pesticides application are nowhere more apparent than in Japan, where pesticides have added 8 times their own value to the gross national product (Patel, 1975). In our country, it has also been demonstrated that the cost benefit ratio of pesticides is 1:7 as against 1:3.5 for fertilisers (Prasad, 1976).

The impact of pesticides on the quality of life and on the social status of man is less understood. The world-wide mortality and morbidity from diseases caused by germ spreading insects is so staggering that it has never been assessed with accuracy. These communicable diseases like malaria and filaria, in developing countries, undermine health and efficiency and result in general suffering and damaging the economy of the nation.

A little more than 20 years ago, malaria took approximately 200 million lives every year. In India, DDT has saved about 5 million lives and has prevented about 100 million cases of illness in the first eight years of its use. All over the world it has saved at least two billion people without causing loss of life by poisoning. The global programme of malaria eradication stimulated and coordinated by the World Health Organization has achieved
immense success in terms of millions of people being free from the disease. In our country, the annual loss of income, because of malaria, after World War-II, has been estimated at $1 billion. Malaria eradication efforts reduced this loss by 99.8 per cent by 1965. Now with the recurrence of malaria, the problem has reemerged.

Risks of Pesticides:

It is true that pesticides have contributed positively for the benefit of man-kind. It is equally true that, in some instances, while the intended function of the pesticides has been realized undesirable side effects have occurred to despoil the environment, jeopardize human health, or in the longer term consideration, intensify the problem the pesticides were supposed to solve (McEwen and Stephenson, 1979).

It is a basic fact that pesticides are toxic, and while the scope and degree of toxicity vary widely among compounds, there are none that can be considered harmless. Medical statistics on pesticide-related illnesses are sketchy at best. Illnesses among people occupationally exposed in pesticide formulation, in application, and in working in treated crops are quite common incidence, although the number of cases reported indicates that in the general population this is not a major problem. Another side of the
issue involves the possible deleterious effects of pesticides on future generations, such as the use of defoliants in Vietnam, and continued use of DDT, heptachlor; chlordane; 2,4,5-T; and a variety of other pesticides.

Perhaps of even greater concern and importance is the fact that some pesticides are now present in the human body as residues in fatty tissues, DDT is commonly found in man in many regions of the globe and also secreted in mother's milk. Although there is no definite evidence that these exposure levels are harmful still a big question remains unanswered what they may lead to in the long run to man and his progeny.

The environmental problems associated with pesticides have centered around DDT and the related persistent pesticides. Pesticides have damaged our wildlife, and that their continued use is "ecologically unsound". In a number of instances these chemicals when used in aquatic and/or forested areas, resulted in fish kills, and concentrations developed in some predatory birds large enough to effect their reproduction and nesting success. The degree to which this occurred is still poorly known (Sherman, 1973). There is no question but that indiscriminate use of pesticides has the potential to upset temporarily many ecological patterns. Whether this is significant in the long term remains to be
seen. It should be remembered that nature is not static and that the "balance of nature" is a shifting one, and unquestionably pesticides add elements which are capable of at least temporarily to shift the balances.

Scope of Study:

To-day a whole new set of factors influence pest control; they are the contemporary problems of society. They arise from changing life styles, new values related to environmental protection, uncontrolled human population growth and faltering economy, etc. In India, to provide food, and ensure health and sanitation facilities the use of pesticides is very critical and unavoidable. The only option left with is to weigh all the risks against the benefits and to ensure the programme proceed with maximum possible care and to reasonable margin of safety. Some of the problems with insecticides are due to over generalization i.e. ban or restriction on pesticides, like DDT in developed countries. In true perspective the total cost-benefit picture from pesticide use will differ appreciably from a developed country to a developing country; this is primarily due to differing socio-economic situation. Henceforth there is a need to put an end to generalizations, for developing countries, it is unthinkable to do without some of these discredited pesticides, as no
one would prefer famine, hunger and diseases like malaria at the cost of reasonable risks. It may be expeditious to accept a reasonably higher degree of risk as situation demands. In other words, the approach should be pragmatic to the question to use or not to use a pesticide? Research is needed to clarify just where certain pesticides can and cannot be used with safety. The influence of environmental factors (climate etc.) and host factors (genetics and nutritional, etc.) on the toxicity of these chemicals to determine the overall hazards and risks is well documented. Due to limitations in the extrapolation of the results in test animals on man there is no alternate or short-cut but to resort to "Toxicological Evaluation of Pesticides under Field Conditions" as a pre-requisite to ensure safety. The introduction of new insecticides or the newer methods of application i.e. (ultra low-volume-aerial Application, etc.), will each present a problem requiring special consideration if safe use is to be guaranteed. Under all foreseeable circumstances, the people who will be most heavily exposed to an insecticide will be those occupationally exposed i.e. workers in manufacture and formulation and applicators in farms and warehouses, etc. These will constitute the 'High Risk Group'. The population at large exposed to these chemicals through environmental and food contamination are relatively at a lesser risk. The field surveillance studies in the high risk group will
provide useful information about likely risks and potential hazards under local conditions to fore-warn against long-term consequences for the community so as to initiate appropriate measures in time. Simultaneously, the monitoring of levels of these chemicals in the body of our people will provide reliable information about the present state of body burden of pesticides in the population, an index of pesticide pollution due to current use of pesticides.

The main scope of this study "Health Risks from Exposure to Pesticides in Men" (Occupationally Exposed and the Community) is directed to contribute towards these objectives.

(1) Evaluation of health hazards from exposure to pesticide in high risk population, i.e. formulators and applicators.

(2) Assess the present status of pesticide pollution by monitoring the pesticide residues i.e. DDT in our population.