



Agrochemicals and Residues Newsletter

JOINT FAO/IAEA DIVISION OF NUCLEAR TECHNIQUES IN FOOD AND AGRICULTURE
INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA

ISSUE No. 6
ISSN 1011-2510

SEPTEMBER 1991

CONTENTS

TO THE READER	3
LIST OF STAFF	4
ACTIVITIES SINCE LAST NEWSLETTER	5
COMPLETED COORDINATED RESEARCH PROGRAMME	
Biological Activity and Bioavailability of Bound Pesticide Residues Using Nuclear Techniques	5
ONGOING COORDINATED RESEARCH PROGRAMMES	
Radiotracer Studies of the Behaviour of DDT in Tropical Environments	6
Radiotracer Studies to Reduce or Eliminate Pesticide Residues During Food Processing	6
Pesticide Residues in Rice-fish Ecosystems	6
Development of Controlled-release Formulations of Pesticides Utilizing Nuclear Techniques	6
Development of Procedures to Stabilize Acaricides in Livestock Dips and of Simplified Methods to Measure their Concentrations, Using Nuclear Techniques	7
Adverse Side Effects on Flora and Fauna from the Use of Organo- chlorine Pesticides on the African Continent	7
NEW PROGRAMMES	
The Use of Isotopic Tracers in Studies of Herbicide Performance on Grasses and Sedges	8
Application of Immunochemical Methods to Pesticide Analysis	8
TECHNICAL COOPERATION PROGRAMMES	8
AGRICULTURAL COUNTERMEASURES TO BE TAKEN FOLLOWING A MAJOR NUCLEAR ACCIDENT	8
AGROCHEMICALS UNIT, IAEA SEIBERSDORF	
Research activities	9
Development of a bait station for use in the New World Screwworm Eradication Programme in North Africa	9

Formulations of insecticides for tsetse fly control	10
Controlled-release formulations of herbicides	10
Training	10
Publications and presentations	10
PUBLICATIONS	11
FORTHCOMING EVENTS	11
IAEA YEARBOOK 1990	12

TO THE READER

Dear Colleague,

Concern about the possible unintended effects of pesticides on human health and the environment continues more or less unabated and some countries are increasing the rigour of their legislation so as to phase out some pesticides and restrict others. At the same time, pesticide use is vital for the production of many crops and the availability of easy-to-use non-chemical plant protection techniques on a wide scale remains a distant prospect. Therefore, the main theme of the Agrochemicals and Residues Programme - the safe and effective use of pesticides - continues with undiminished relevance.

The FAO/UNEP Prior Informed Consent (PIC) procedure will be in operation by the time this Newsletter appears. The PIC principle is that a pesticide banned or severely restricted (as defined in the FAO International Code of Conduct on the Distribution and Use of Pesticides) in order to protect human health or the environment should not be imported without the agreement of the government of the importing country. In some circumstances a government will prohibit the import and use of compounds in the PIC list but there are others in which a government will agree to the import of a PIC list compound or may require data obtained locally before taking a decision. There are compounds in our programmes that will be included in the PIC list. Anyone working with these compounds should review carefully the implications of the PIC procedure for their particular situation. Compounds on the initial PIC List (August 1991) are: aldrin, chlordane, chlordimeform, cyhexatin, DDT, dieldrin, dinoseb, EDB, fluoroacetamide, HCH (mixed isomers), heptachlor, hexachlorobenzene, mercury (inorganic and organic compounds), paraquat, parathion (ethyl and methyl), 2,4,5-T.

Both our Technical Co-operation Programmes and our Co-ordinated Research Programmes generate data about pesticide residues in food and environmental samples. Such data could be useful to governments who are following FAO advice by establishing or refining pesticide legislation and are also often relevant to the work of the Joint FAO/IAEA Meeting on Pesticide Residues and of the Codex Alimentarius Commission on setting Maximum Residue Limits for Pesticides. However, if analytical results are to be used in such legal contexts their reliability must be guaranteed in some way. Therefore, we hope to establish an Analytical Quality Assurance system based at the Seibersdorf Laboratory. This will involve the distribution of labelled and unlabelled reference analytical standards and, as appropriate, 'unknown' samples of formulations or foodstuffs and environmental materials containing pesticide residues to be analysed by participating laboratories in intercomparison runs. The ultimate intention is to extend the system beyond the needs of our own programmes so as to provide a fully international system of analytical quality assurance for pesticides.

In addition to the pesticide programme we are also involved in work to prepare guidelines on countermeasures to be taken to ameliorate the agricultural consequences of radionuclide contamination following a major nuclear accident. This involves the collection, evaluation and consideration of information from a wide variety of sources though the main emphasis is to learn from the Chernobyl experience.

Since the last Newsletter, Ray Hance has taken over the Section Head vacancy. He was Leader of the Herbicide Group at the former AFRC Research Organization in the UK and subsequently worked as an independent consultant. Staffan Wiktelius has joined the Section as project officer for the Co-ordinated Research Programme on "Adverse side effects on flora and fauna from the use of organochlorine pesticide on the African continent" which is

financed by the Swedish International Development Authority. He comes from the Department of Plant & Forest Protection of the Swedish University of Agricultural Sciences, Uppsala. Also new to the Section is Vladimir Vetrov who is responsible for the preparation of guidelines for agricultural countermeasures following a nuclear accident. He has been seconded from the Natural Environment and Climate Monitoring Laboratory in Moscow.

R.J. Hance
A. Hassan
M. Hussain
C.S. Wiktelius
V.A. Vetrov

STAFF

1. IAEA Headquarters, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, Vienna International Centre, Wagramerstrasse 5, P.O. Box 100, A-1400 Vienna, Austria.

Björn Sigurbjörnsson, Director, Joint FAO/IAEA Division
Leo E. LaChance, Deputy Director, Joint FAO/IAEA Division

Agrochemicals and Residues Section

R.J. Hance, Head

A. Hassan, Professional Officer

C.S. Wiktelius, Professional Officer

V.A. Vetrov, Professional Officer

Secretarial Staff:

Traude Strnadl

Elfriede Herbst

2. Agricultural Laboratory, Agrochemicals Unit of the IAEA Seibersdorf Laboratory, A-2444 Seibersdorf, Austria.

M. Hussain, Head of Unit

H. Perschke, Professional Officer

Technical Staff:

Cynthia Post

N. Rathor

ACTIVITIES SINCE LAST NEWSLETTER

- FAO/IAEA Seminar on Isotopes and Radiation in the Diagnosis and Control of Trypanosomiasis for Developing Countries in Africa, Nairobi, Kenya February 1991.
- Second FAO/IAEA Research Coordination Meeting on Controlled-release Formulations of Insecticides for Control of Tsetse Flies, Nairobi, Kenya, 11-15 February 1991.
- Second FAO/IAEA Consultants' Meeting on Agricultural Countermeasures After Major Nuclear Accidents, Vienna, Austria, 8-13 March 1991.
- Third FAO/IAEA Research Coordination Meeting on Biological Activity and Bioavailability of Bound Residues Using Nuclear Techniques, Slough UK, June 1991.
- Third FAO/IAEA Consultants' Meeting on Agricultural Countermeasures After Major Nuclear Accidents, Vienna, Austria, 19-23 August 1991.

COMPLETED COORDINATED RESEARCH PROGRAMMES

Biological Activity and Bioavailability of Bound Pesticide Residues Using Nuclear Techniques

This programme was designed to study the bioavailability and biological activity of grain-bound pesticide residues; work which is possible only using isotope tracer techniques. Several insecticides, which are widely used to protect stored grain, were studied in eleven countries. Bound residues derived from ¹⁴C-labelled chlorpyrifos-methyl, pyrimiphos-methyl, malathion or methyl bromide measured in wheat, maize, rice, beans or lentils following 6-14 months storage amounted to up to 50% of the total remaining radioactivity. Substantial quantities of radioactivity (up to 90%) were taken up by experimental animals fed with grain containing bound residues. Most was eliminated in urine or expired air but low concentrations were deposited in various organs including liver and kidney.

In further work to assess biological activity, animals were fed grain containing bound residues for 3 months. In some studies there was mild but apparently reversible liver and kidney damage and sometimes there were small changes in organ weights and hemograms. The most significant finding was that bound residues of the organophosphorus compounds frequently reduced cholinesterase activity in blood and brain (by up to 50%); in some cases the size of the reduction was dose-dependent.

The programme also developed promising techniques which can be used for the characterization and identification of bound residues. These are the high temperature distillation and the super critical fluid extraction techniques. In one case, the latter technique was successfully used to identify over 90% of the grain-bound pyrimiphos-methyl residues.

The programme has generated important data on the extent of binding to grain of widely used insecticides. The results obtained have demonstrated the substantial bioavailability of grain-bound pesticide residues to experimental animals. They have also shown that these residues possess a toxicological potential, as they inhibited the sensitive nerve enzyme cholinesterase. The programme has also produced highly useful techniques for identification of bound pesticide residues. The data obtained here will have important implications for future evaluations of pesticide residues in grain by regulatory bodies and the joint FAO/WHO programme on pesticide residues. The activities of this programme will be published in the IAEA Panel Proceedings Series.

ONGOING COORDINATED RESEARCH PROGRAMMES

Radiotracer Studies of the Behaviour of DDT in Tropical Environments

This programme was initiated in 1989 with major objectives to study dissipation and degradation rates and pathways of p,p'-DDT in tropical climates. The emphasis has been on field studies which usually run for 1-2 years with supporting laboratory studies of microbial activity and of the effects of individual environmental factors such as temperature and solar radiation. Nuclear techniques have been used particularly to study residues bound in biological matrices and soil.

Several of the studies have reported appreciable losses in the field over relatively short periods of time, for example 45% after 80 days in India and 30% after 8 weeks in Egypt. Extractable residues from soil include p,p'-DDT, p,p'-DDE and p,p'-DDD. Under some conditions, binding to soil matrices was appreciable, apparently related to high microbial activity. Recently, a method developed in India using sulfuric acid successfully released soil-bound intact residues. It is anticipated that the programme will provide much needed data which can assist national authorities in regulating the use of DDT in tropical agriculture. Fourteen scientists are currently collaborating on this programme and no further participation is possible.

Radiotracer Studies to Reduce or Eliminate Pesticide Residues During Food Processing

This programme was initiated in 1989 to investigate the effects of regular and special processing techniques on pesticide residues in food in order to identify those that would be useful for reducing residue levels. The programme has involved the evaluation of current practices and their efficiency in removing chemical residues, methods to enhance efficiency, and special techniques capable of reducing residues significantly. Most participants have concentrated on crude edible oils and processes for refining to consumer-grade oils. Oil-bearing plants include cotton, coconut, sunflower, palm, corn, peanut, soybean and rice.

The early results indicate that various processes used in current practices can reduce pesticide residues. Examples: near-complete elimination of gamma and beta-BHC residues from rice bran oil was effected by deodorization; degummification and bleaching removed appreciable quantities of residues of monocrotophos from crude palm oil. Again, the use of radiotracer techniques has been vital in the examination of aged residues. Thirteen scientists are now collaborating on this programme and no further participation is possible.

Pesticide Residues in Rice-fish Ecosystems

As reported in the last Newsletter, Phase II of this programme, which is based on endosulfan, was delayed because of difficulties in obtaining the labelled chemical. There are seven participants active in this phase and results will be presented and discussed at the final Research Coordination Meeting to be held in November in Bangkok.

Development of Controlled-release Formulations of Pesticides Utilizing Nuclear Techniques

This programme has two distinct elements, one concerned with formulations for tsetse fly control and the other with controlled release herbicide formulations. A research coordination meeting for the first section was held in conjunction with the FAO/IAEA Seminar for Africa on Animal Trypanosomiases, which took place in Nairobi from 11-15 February 1991. Results on the use of cotton fabric target screens impregnated with insecticide were discussed.

Insecticide impregnated target screens have been used for some time in programmes to control tsetse flies. As reported in the last Newsletter formulations have been developed incorporating 2,4-dihydroxy-benzophenone, a UV absorbing compound, to reduce photodegradation of the insecticide (deltamethrin) and corn oil to reduce leaching losses. One of these

formulations has been tested in field conditions in Ghana, Kenya and Tanzania. It has proved to be at least as good, usually better, than commercially available materials and is much cheaper. In Tanzania, for example, this formulation was effective after 157 days in the field.

The corresponding Research Coordination Meeting for the weed control component of the programme will take place in Beijing, People's Republic of China, in October 1991. The initial activity was to study, in the laboratory, the rates of release of ^{14}C -labelled herbicides from controlled release formulations. This allowed participants to select suitable formulations for biological evaluation in transplanted or direct seeded rice paddy. In some cases, participants have made their own formulations using locally available matrix materials.

Development of Procedures to Stabilize Acaricides in Livestock Dips and of Simplified Methods to Measure their Concentrations, Using Nuclear Techniques

This programme was initiated this year. Its major objectives are to monitor the stability of acaricide chemicals in cattle dip troughs, to develop procedures to improve it and to develop simple methods to measure the concentrations of these chemicals under field conditions. These studies should lead to practices which substantially reduce the problem of resistance development, particularly in ticks. In the second phase of the programme, studies to improve methods of disposing of the chemicals following use will be included. Seven scientists are currently participating in this programme. If interested, please write to us.

Adverse Side Effects on Flora and Fauna from the Use of Organochlorine Pesticides on the African Continent

This programme was started in 1990. The objectives of the programme are to increase knowledge about how organochlorine pesticides affect agricultural ecosystems, especially pest-natural enemy interactions, and the effect on other non-target fauna.

Organochlorine pesticides have a broad spectrum and kill not only the target pest but also beneficial and other non-target organisms. Furthermore, because of their persistence, they may accumulate in food chains both within and outside the agricultural ecosystem.

Ecological side effects of using pesticides in eradication campaigns against tsetse flies and mosquitos have been studied in Africa but very few studies have been made on the effect of pesticide use on crops.

The programme is divided into three research areas:

1. The effect of pesticides on the agroecosystem.
2. The fate of pesticides in the agroecosystem.
3. The effect of pesticides on higher fauna.

The intention is that all three research areas should be covered within the same agroecosystem in each participating country. Agroecosystems, chosen according to local conditions, include arable and vegetable crops, orchards and plantations. Eighteen scientists from twelve countries are at present involved in the programme.

NEW PROGRAMMES

The use of isotopic tracers in studies of herbicide performance on grasses and sedges

Subject to the availability of funds, this programme will be established to study the effects of application volume rate, drop size, timing of application and surfactant type and concentration on the retention, penetration and translocation of herbicides in grass and sedge weeds using ¹⁴C-labelled materials. The most pernicious weeds are tropical grasses and sedges including Cyperus rotundus ("The World's Worst Weed"). Herbicide effectiveness on such plants may be limited because spray droplets are not well retained or because penetration and/or translocation is restricted. Commercial formulations and application specifications are usually designed to give acceptable performance on a range of species without necessarily being optimum for any one in particular. Also they are commonly developed primarily for temperate species. Thus improved performance on particular targets is possible by manipulating formulation & application factors and this has been achieved for some grassweeds, notably Imperata and Elymus spp. The aim of this programme will be to extend these developments to other species. The use of radiotracers is, of course, essential for this sort of study. If you are interested in participation (or have any comments on the concept) please write to us.

Application of immunochemical methods to pesticide analysis

Again, subject to availability of funds, this programme will be set up to help to establish the viability of immunochemical methods for routine pesticide analysis. Immunoassay procedures have now been developed for a variety of pesticides and in principle they provide high specificity and sensitivity at relatively low cost. The main themes of this programme will be to validate procedures for one or two compounds and to develop suitable extraction and clean-up techniques for typical substrates using ¹⁴C-labelled active ingredients. If interested, please write to us.

TECHNICAL COOPERATION PROGRAMMES

The Section is responsible for the technical aspects of a number of programmes. They generally include the provision of equipment, expert services and fellowship training. Fellowship trainees in the past year have been placed at the IAEA Agricultural Laboratory in Seibersdorf and in appropriate institutions in Denmark, Japan, UK and USA. Most of the projects are concerned with some aspect of studies of pesticide residues in food and the environment and such projects are in progress in Algeria, Bangladesh, Brazil, El Salvador, Kenya, Malaysia, Panama, the Philippines, Thailand and Turkey. There are also projects primarily concerned with controlled release of pesticides in Ecuador and Indonesia. In addition there are programmes on radioecology in Brazil, trypanocidal drugs in Kenya, biomass decomposition in Korea and tick resistance to pesticides in Zambia.

AGRICULTURAL COUNTERMEASURES TO BE TAKEN FOLLOWING A MAJOR NUCLEAR ACCIDENT

The first major event was a Consultants' Meeting, held from 12-16 November 1990 in conjunction with the Radiation Safety Section of the Department of Nuclear Energy and Safety of IAEA. This meeting produced an outline to be used in developing a set of guidelines on agricultural countermeasures that can be taken to reduce levels of radionuclide contamination in the agricultural environment, crops, vegetable products, animals and animal products. The guidelines will fall into three parts:

1. 'Strategy & Data'; this will contain information needed by policy makers, agricultural scientists, farmers and others concerned with food production in order to take decisions on agricultural countermeasures.
2. 'Administrative Tasks and Responses'; this will consider the administrative procedures needed for the implementation of countermeasures.
3. 'Decision Making'; this will deal with socio-economic-ecological issues and will indicate a methodological approach and some practicable models for "net benefit" optimization.

The work is continuing with the aid of Consultants' Meetings, the second and third of which were held in March and August 1991. The consultants have been drawn from a number of Member States including Austria, France, Germany, Norway, UK and USSR.

The Section, together with the Animal Production & Health Section of the Joint Division is also participating, together with the IAEA Division of Nuclear Safety, the Agricultural University of Norway and the Norwegian Natural Institute of Radiation Hygiene, in a research project to develop the use of caesium binders, such as Prussian Blue, to reduce the uptake of ¹³⁷Cs by animals.

AGROCHEMICALS UNIT, IAEA SEIBERSDORF

Research Activities

The research of the unit continues to be largely concerned with the controlled release of pesticides. This supports a Coordinated Research Programme and Technical Cooperation Projects. There are 3 main topics, New World Screwworm (Cochliomyia hominivorax) control, tsetse fly (Glossinia spp) control and herbicide formulations in rice paddy.

Development of a bait station for use in the New World Screwworms Eradication Programme in North Africa

As most readers will know, FAO has coordinated a major programme to eradicate the New World Screwworm in North Africa following its accidental introduction into Libya. The main measure is the use of the Sterile Insect Technique (SIT) which is being applied by the Insect and Pest Control Section of the Joint FAO/IAEA Division. The Agrochemicals Unit has developed a bait station to provide some chemical control to reduce the adult fly population to levels at which SIT can be effective. A device to attract and kill flies effectively for a period of 4-6 weeks was needed. Insecticides were screened to determine those meeting three criteria: 1) they must kill flies, 2) they must not repel flies and, 3) they must be stable in the environment for up to six weeks.

Deltamethrin, fenthion, chlorpyrifos, propoxur and methoxychlor were among those screened, but lindane was selected for field trials. Repellency/irritancy was screened by, firstly, seeing which insecticide-treated sides of a rotating cube flies rested on in a free choice experiment and, secondly, by determining which insecticide-soaked filter paper barriers flies would, or would not, cross towards a "Swormlure" attractant odour source. Flies were not repelled by deltamethrin or lindane but they were to some extent by propoxur. The synergist piperonyl butoxide caused insecticide preparations to become very repellent. The bait station has two components, 1) an attractant, and 2) a food containing insecticide. The first design of bait station consisted of a cork-stoppered bottle of "Swormlure" inverted into a depression in a block of bait and toxicant (dried blood/wax/sugar/ground corn grits/1% lindane). The block was placed on a plastic plate and suspended from a tree

branch. However, this device was not entirely successful. The final design consists of an upright, brown, 30 ml bottle of "Swormlure", stoppered by a plastic foam plug (releasing about 1 g "Swormlure" per day), and held by tanglefoot on a plastic plate. The bottle is encircled by a cylinder of cardboard (7.5 cm tall x 7.0 cm diameter) coated inside and out with a slurry of bait-toxicant. Flies came to this design and were killed for up to four weeks after its deployment, Two thousand bait stations of this final design have been used in Libya at a total equipment cost of US\$4-5000.

Formulations of insecticides for tsetse fly control

Recent work on insecticide impregnated target screens in the laboratory and field was reported in the last Newsletter and in the Coordinated Research Programme Section of this one (page 6). Future work will investigate the effect of the colour of the screen as it is already known that less photodegradation occurs on black than on white or blue screens, but that blue screens are more attractive to at least some species of Glossin. A further development will be to attempt to produce formulations that can be applied by brush or by dipping the screen into them, thus eliminating the need for spraying equipment.

Supplementary laboratory work has shown that care must be taken in choosing the organic solvent component of the formulation. Alcohols, especially methanol, ethanol, n-propanol and isopropanol cause quite rapid isomerisation of the DMI epimer of ¹⁴C-deltamethrin to the relatively non-insecticidal DM2 epimer. Higher alcohols, hexane, benzene, toluene and p-dioxane do not cause this reaction.

Controlled-release formulations of herbicides

In support of a Coordinated Research Programme further laboratory studies have been made with calcium alginate based formulations of thiobencarb and butachlor. In both cases the inclusion of kaolin reduced the rate of release of ¹⁴C-labelled herbicide. Once released, both herbicides were lost from water by evaporation and thiobencarb also was degraded.

Training

The following Fellows have received training in pesticide research using radiotracer and conventional techniques in the Unit:

Name	Country	Period
Mr. Jianying Gan	China, P.R.	Feb. 1990 - Feb. 1991
Ms. Philippina Muschy	Tanzania	July 1990 - Nov. 1990
Mr. Hamdy Soltan	Egypt	Sep. 1989 - Sep. 1991

Publications and presentations

1. Jianying Gan, M. Hussain, H. Perschke and M.N. Rathor. The effect of substituted benzophenones on the photochemical fate of fenithrothion insecticide. *Chemosphere* 1991, 21, 589-596.
2. M. Hussain and H. Perschke. A study of factors affecting the persistence of deltamethrin applied to cotton fabric for tsetse fly control. *Chemosphere* 1991, 22, 677-684.
3. M. Hussain and H. Perschke. Enhancement of the residual activity of insecticides applied to cotton screens for tsetse fly control. Presented at IAEA/FAO Seminar for Africa on Animal Trypanosomiasis; Tsetse control, Diagnosis and Chemotherapy Using Nuclear Techniques.

PUBLICATIONS

The following are recent additions to our list of publications:

Priced

- Studies of the Magnitude and Nature of Pesticide Residues in Stored Products Using Radiotracer Techniques. Proceedings of the Final Research Coordination Meeting on Isotopic Tracer-aided Studies of Pesticide Residues in Stored Products, Ankara, Turkey, 30 May to 3 June 1988, STI/PUB/822, IAEA, Vienna, 1990.
- Environmental Contamination Following a Major Nuclear Accident. Proceedings of an FAO/IAEA/UNEP/WHO International Symposium on Environmental Contamination Following a Major Nuclear Accident, Vienna, Austria, 16-20 October 1989, IAEA, Vienna 1990 (2 volumes).

Non-priced

- Radioactive Fallout in Food and Agriculture. A background review prepared by F.P.W. Winterringham, IAEA and FAO, Technical Document No. 494, IAEA, Vienna, 1989.
- Also published as FAO Soils Bulletin No. 61, FAO, Rome, 1989.
- Radiotracer Studies of Fungicide Residues in Food Plants. Report of a Final Research Coordination Meeting, Technical Document No. 554, IAEA, Vienna, 1990.

FORTHCOMING EVENTS

FAO/IAEA Research Coordination Meetings

- September 1991: Adverse effects of flora and fauna from the use of organochlorine pesticides on the African continent, Arusha, Tanzania.
- October 1991: Development of controlled-release formulations of pesticides using nuclear techniques - weed control component, Beijing, P.R. China.
- November 1991: Radiotracer studies of behaviour of DDT in tropical environments, Jakarta, Indonesia.
- November 1991: Use of isotopes in studies of pesticides in rice-fish ecosystem - Phase II, Bangkok, Thailand.
- December 1991: Development of procedures to stabilize acaricides in livestock dips and of simplified methods to measure their concentrations, using nuclear techniques, Jakarta, Indonesia.
- April/May 1992: Radiotracer studies to reduce or eliminate pesticide residues during food processing, Quito, Ecuador.
- Sept/Oct. 1992: Adverse effects of flora and fauna from the use of organochlorine pesticides on the African continent, Vienna, Austria.

FAO/IAEA Consultants' Meeting

- Nov./Dec. 1991: Fourth FAO/IAEA Consultants' Meeting on Agricultural Countermeasures After Major Nuclear Accidents, Vienna, Austria.

FAO/IAEA Training Courses concerned with the application of nuclear and related technique to pesticide research

- Interregional: Seibersdorf, Austria, 1993.
- Regional: Asia and Pacific, Bangkok, Thailand, February 1992.
Latin America, 1993

FAO/IAEA Seminar

Research and Development of Controlled-Release Formulations of Pesticides Using Nuclear Techniques, Vienna 1993.

IAEA YEARBOOK 1990

Publication date: September 1991

Price: Approximately Austrian Schillings 550.-

Summary: The Yearbook provides descriptions of the IAEA's major programmes, with articles on particular projects and areas of activity, together with reports of particular current interest and general information about the IAEA. The Yearbook presents the work of the IAEA in the context of scientific, technical and economic developments worldwide.

Contents: Foreword by the Director General; IAEA Services to Strengthen Nuclear Safety; Part A - Transfer of Nuclear Technology; Part B - Applications of Nuclear Techniques and Research; Part C - Nuclear Power, Nuclear Fuel Cycle and Waste Management: Status and Trends; Part D - Nuclear Safety Review; Part E - IAEA Safeguards; Part F - The IAEA. Parts A, B, C and D are also available separately. IAEA Yearbook 1990 (STI/PUB/861).

AGROCHEMICALS AND RESIDUES NEWSLETTER

MAILING LIST UPDATE

- I wish to continue receiving the A & R Newsletter: YES NO
- I wish to be added to the mailing list for the A & R Newsletter:

NAME, TITLE, INSTITUTE:
.....
ADDRESS:
.....
Telephone: Telex:

- The address is Changed Unchanged New entry

- My main interest(s):

Pesticide residues

Radionuclide contamination

Bioconversion

Other

Please give details:
.....
.....
.....

If you have comments (positive, negative) on our Newsletter please use the reverse of this page.

Signature: _____

Date: _____

Please return this form to:

Dr. Ray J. Hance
Head, Agrochemicals & Residues Section
Joint FAO/IAEA Division
P.O. Box 100
A-1400 Vienna
AUSTRIA

Agrochemicals and Residues Newsletter

**Joint FAO/IAEA Division of Nuclear Techniques
in Food and Agriculture**

**International Atomic Energy Agency
Wagramerstrasse 5, P.O. Box 100
A-1400 Vienna, Austria**

**Printed by the IAEA in Austria
September 1991**

91-03656

14/15/16