

FAO PESTICIDE DISPOSAL SERIES

6



Prevention and disposal of obsolete and unwanted pesticide stocks in Africa and the Near East

Third
consultation meeting



Food
and
Agriculture
Organization
of
the
United
Nations

Prevention and
disposal of
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pesticide stocks in
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Abbreviations

CDC

Commonwealth Development Corporation

CILSS

Permanent Interstate Committee for Drought Control in the Sahel

DANIDA

Danish International Development Agency

DGIS

Directorate General International Cooperation

DLCO-EA

Desert Locust Control Organization for Eastern Africa

EU

European Union

GCPF

Global Crop Protection Federation

GTZ

German Agency for Technical Cooperation

IFAD

International Fund for Agricultural Development

IFCS

Intergovernmental Forum on Chemical Safety

ILO

International Labour Organisation

IMDG

International Maritime Dangerous Goods Code

IMO

International Maritime Organization

IPM

Integrated pest management

IRLCO

International Red Locust Control Organization

IRPTC

International Register of Potentially Toxic Chemicals

NGO

Non-governmental organization

NORAD

Norwegian Agency for Development

OECD

Organisation for Economic Co-operation and Development

POPs

Persistent organic pollutants

SDC

Swiss Development Cooperation

Sida

Swedish International Development Cooperation Authority

UNEP

United Nations Environment Programme

UNIDO

United Nations Industrial Development Organization

UNITAR

United Nations Institute for Training and Research

USAID

United States Agency for International Development

USEPA

United States Environmental Protection Agency

WHO

World Health Organization

Contents

Abbreviations	iii
INTRODUCTION	1
OPENING ADDRESS	3
Chapter 1	
UPDATE ON FAO ACTIVITIES	5
Progress in pesticide disposal and related activities	5
State of implementation of the FAO portfolio of disposal projects	13
Progress of involvement and discussions between FAO and the agrochemical industry	14
Chapter 2	
UPDATE ON THE ACTIVITIES OF OTHER ORGANIZATIONS	17
The Global Crop Protection Federation (GCPF)	17
The German Agency for Technical Cooperation (GTZ)	
Pesticide Disposal Project	18
Danish International Development Agency (DANIDA)	19
Norwegian Agency for International Development (NORAD)	20
United States Agency for International Development (USAID)	20
Swiss Development Cooperation (SDC)	21
Swedish International Development Cooperation Agency (Sida)	21
Japan	22
Belgium	22
Italy	22
United Nations Environment Programme (UNEP)	22
International Fund for Agricultural Development (IFAD)	22
Pesticides Trust	23
Chapter 3	
COUNTRY REPORTS	25
United Republic of Tanzania	25
Ethiopia	27

Chapter 4	
OUTCOME AND CONCLUSION OF THE THIRD CONSULTATION MEETING	31
Framework for international collaboration in pesticide disposal	31
Administrative and organizational modalities for disposal operations jointly funded by aid agencies and the agrochemical industry	31
Disposal operations proposed for 1998-1999	32
Conclusions and statements by participants	32
ANNEXES	
Annex 1	
List of participants	35
Annex 2	
Programme	41
Annex 3	
Framework for international collaboration in pesticide disposal	43
Annex 4	
Benefits of incinerating hazardous wastes in cement kilns	47
Annex 5	
FAO press release: problem of obsolete pesticide stocks deserves greater attention by donor countries and industry	53

Introduction

Old stocks of obsolete and unwanted pesticides continue to pose serious hazards to public health and the environment. Contamination of soils and valuable water resources is widespread. In general, developing countries do not have the expertise, disposal facilities and funds to address the problem. Many countries turn to FAO for assistance.

FAO and other agencies have demonstrated that obsolete pesticides can be destroyed in a safe and environmentally sound manner at manageable costs. Over recent years, a quantity of slightly over 1 300 tonnes of obsolete pesticides has successfully been removed from countries in Africa and the Near East. An increasing number of agencies are expressing interest in getting involved in such disposal operations. Recently, the agrochemical industry indicated that it is prepared to make financial contributions towards pesticide disposal. In Africa, a total of about 15 000 tonnes of obsolete stocks have still to be disposed of.

Since 1994, FAO has operated a project, funded by the Government of the Netherlands, for the prevention and disposal of obsolete pesticide stocks in Africa and the Near East. The project has collected and compiled stock data from Africa and the Near East, reviewed and assessed disposal technologies, produced technical guidelines and conducted pilot disposal operations, as well as helped to facilitate and coordinate international efforts to scale up disposal operations. Under this project, regular donor consultations are being organized to enhance collaboration and coordination in pesticide disposal. The First Consultation took place in December 1994 and the second in September 1996.

At the First Consultation, participating aid agencies requested FAO to prepare a project portfolio of urgently needed disposal operations. An initial portfolio of 13 project briefs was presented at the Second Consultation. Several of the proposed projects are currently under execution or consideration. At the Second Consultation, aid agencies indicated that they would like to see a more prominent financial involvement of the agrochemical industry. FAO subsequently started a process of talks with the Global Crop Protection Federation (GCPF) and will continue until tangible results have been achieved.

The objectives of the Third Consultation were to: review progress in implementation of the project portfolio and update and expand the portfolio; discuss administrative and operational modalities for the joint funding of disposal operations between donors and the agrochemical industry; prepare a target and funding plan for disposal operations for the period up to the end of 1999; and offer participants the possibility of exchanging information and experiences regarding recently completed disposal operations and of discussing collaboration in future disposal operations.

Opening address

The Consultation was opened by Dr M. Duwayri, Director of the FAO Plant and Protection Division (AGP).

On behalf of the Director-General of FAO, Dr Jacques Diouf, I wish to welcome you to the Third FAO Consultation on the Prevention and Disposal of Obsolete and Unwanted Pesticide Stocks in Africa and the Near East.

FAO has been requested many times to help countries solve their problems with obsolete pesticides. Serious efforts started with the financial support of a two-year project by the Government of the Netherlands in July 1994. This was followed up by a second phase of three years, which began in November 1996. Such support has made it possible both to organize a number of Consultations and Expert Groups and to undertake field activities. I once again take this opportunity to express FAO's deep appreciation to the Government of the Netherlands for its commitment and continued financial support. We also acknowledge the continuing support of donors and agencies such as, in particular, the Government of Germany which, through the German Agency for Technical Cooperation (GTZ), has been involved in disposal operations in the FAO/GTZ joint disposal operations that were completed in Zambia at the beginning of 1997.

Although work has begun, a great deal still remains to be achieved. Reversing the environmental damage and clearing up the pesticide waste situation in Africa and the Near East is no simple matter.

To date, the project has successfully completed three pilot disposal operations in Yemen, Zambia and the Seychelles, respectively. Zambia and the Seychelles are now free of obsolete pesticides. It is also encouraging that the governments of the three countries have stated that they will do everything possible to avoid any accumulation in the future. With additional financial support from donors, the FAO programme will continue to act as a focal point for bringing together donor countries and organizations with an interest in and commitment to alleviating the problem in those nations that do not have the means,

the expertise or the facilities to overcome the problem by themselves. Collection of data, dissemination of information, advising of governments, creation of awareness and mobilization and sensitization of all concerned, in particular the public, through the media, receive priority. Formulation of projects, preparation of technical guidelines and distribution of these via direct mail, radio and Internet are primary commitments of the project. Training of staff members at plant protection organizations and of others working in related areas and conducting awareness workshops and seminars in individual countries or at a regional level, are also features that are addressed. However, all these tasks can only be realized with the full participation of governments in affected countries, the donor community, international organizations, non-governmental organizations and industry.

As you must be aware, the issue is also discussed in other fora, such as the Basel Convention and the Intergovernmental Forum on Chemical Safety. FAO keeps in close contact with other organizations on this subject through its cooperation in the Inter-Organization Programme for the Sound Management of Chemicals in which the United Nations Environment Programme (UNEP), the International Labour Organisation (ILO), FAO, the World Health Organization (WHO), the United Nations Industrial Development Organization (UNIDO), the Organisation for Economic Co-operation and Development (OECD) and the United Nations Institute for Training and Research (UNITAR) participate. The issue is now high on the international agenda and it should be sustained at that level until the ultimate goal is achieved. We are grateful to see so many of you here today to contribute to the solution of this problem.

An appropriate agenda should be established for meaningful cooperation and to decide on modalities for disposal operations in the future. We already have substantial information on the magnitude of the problem in some 42 countries, 37 in Africa and five in the Near East. Of these, very few have been able to dispose of their accumulated pesticides. At present, 17 countries have been selected as a priority group to be included in a project portfolio for your discussions on

implementation of disposal in 1998 and 1999. The total sum of cleaning up these countries is roughly estimated at US\$22 million. Although this is high, the risk to human health in these countries and the global environmental damage are much higher. It would be difficult for a single country or agency to come up with immediate solutions but, by working together, it may be possible to share the burden. If the situation is not attended to, the costs will increase and the damage may become irreversible. FAO is therefore looking for a positive response and commitment from the international community.

Africa and the Near East have provided the starting point. Environmental and health issues are at stake in all developing countries. It is therefore time for us to begin to look beyond the horizon of these two regions. On several occasions a conservative estimate of about 100 000 tonnes of obsolete pesticides has been said to exist in other developing countries. Unless action is taken on all fronts, the opportunities for overcoming the problem will be few and late. Looking at worldwide pesticide sales, the world has received huge new consignments of pesticides worth over US\$29 000 million and \$33 000 million in 1995 and 1996, respectively. Although a low proportion of pesticides sold may have reached developing countries, the pressure for accumulation of more and more unwanted stocks in these regions cannot be underestimated as many factors are favourable for it.

The problem is widespread and urgent. FAO will continue to follow the issue closely and will update information on unwanted stocks, maintain databases and keep donor countries constantly informed. Every possible medium of communication and information facilities will be used. Maintaining a high degree of awareness will be necessary to enhance commitment to a concerted global effort to save our environment from stocks of obsolete pesticides that are hazardous and dangerous to human health, wildlife, marine life and the environment in general.

The chemical industry, donors, international organizations and recipient countries all share the responsibility, but we are neither looking for scapegoats nor looking back to past actions unless to learn from the experience. We must work together and help each other to avoid repetition of similar problems in the future.

Once again, on behalf of FAO and the Director-General, I wish to express my thanks and appreciation for your enthusiasm, for the efforts you have made to

attend this meeting and for your determination to find ways to tackle the problem, to interact and play key roles in this important undertaking.

The coherent information that you generate from this Consultation and the working agenda you formulate, the recommendations that you make and the motivation and drive you create during the session will undoubtedly provide the basis for the solution of the problem we are facing today more than ever before.

I wish you a very successful meeting and an enjoyable stay in Rome.

Chapter 1

Update on FAO activities

A. Wodageneh

PROGRESS IN PESTICIDE DISPOSAL AND RELATED ACTIVITIES

Background

Countries in Africa and the Near East remain inundated with obsolete, unwanted and/or banned pesticide stocks. Those affected continue to appeal for FAO assistance in addressing the problem. Similar requests for assistance are also being received from individual countries in Asia, Latin America and the Caribbean.

The initial wave of requests, which began early in the 1990s, led to the formulation of a two-year project in 1994 with the financial assistance of the Government of the Netherlands. The project was extended by a further period of three years to last until October 1999. The focus so far has been on Africa and the Near East, but pressure is mounting to include other affected countries. However, action in this direction depends on additional donor support.

The aim will be to enhance large-scale operations involving multidonor programmes for the disposal of obsolete pesticide stocks. To date, surveys and inventories have been completed in 42 countries – 37 in Africa and five in the Near East. The colour-coded map shown in Figure 1 and the revised survey figures given in Table 1 show the levels and quantities of pesticide stocks. Surveys will continue in countries where information is lacking and follow-up surveys will be conducted in countries where changes may have occurred since the original surveys were completed.

FAO maintains a data bank of obsolete stocks indicating information on sites affected, types and varieties of pesticides involved, quantities in litres and kilograms, type of formulation, year acquired and, where possible, origin of the pesticides concerned.

Disposal operations completed

Table 2 gives the up-to-date status of disposal operations completed involving various agencies and donors. It should be noted that disposal operations listed are the results of efforts made by various agencies and donor participation but that there was

little or no industry involvement. This implies that industry support towards disposal operations is not yet substantive, but discussions with the Global Crop Protection Federation (GCPF) representing the industry are expected to continue.

FAO pilot disposal operations. Three pilot disposal operations were completed under FAO. The first was in Yemen where a total of 262 tonnes of pesticides were removed and destroyed in 1996. This was reported in detail in FAO Pesticide Disposal Series No. 5 (1997). The second and third FAO pilot disposal operations were in Zambia and the Seychelles where 360 tonnes and 12 tonnes, respectively, were removed and destroyed. Both operations were completed early in 1997. More detailed accounts of the operations in these two countries follow.

Zambia

A total of 360 tonnes of obsolete pesticides were removed from Zambia. The weight at the weighbridge, at the site of destruction in the United Kingdom, gave a total of 355.89 tonnes as having been destroyed by incineration.

Highlights of the disposal operation in Zambia. After a countrywide survey in 1994, the total of obsolete pesticides in Zambia was estimated at only 126 tonnes. However, a joint FAO/GTZ mission in 1995 indicated the existence of an estimated total of 336 tonnes. During the actual disposal operation (March to April 1997), the real total was found to be 360 tonnes.

Main activities in Zambia. Zambia Cooperative Federation (ZCF). The focus of the disposal activity was within the Lusaka industrial area or, specifically, the ZCF storage site. This was where the bulk of the obsolete pesticides in Zambia had been kept. The stock had been left in a heap, in the open and under extremely substandard conditions. Only part of the stocks found in about 440 rusting open drums had

been safeguarded by GTZ in late 1995. The waste at this site was made up of a cocktail of pesticides containing lindane, endosulfan, carbaryl, DDT, atrazine, diazinon, hostathion-thiodan, captan, malathion and 2,4-D. The piles of waste were unattended and had little or no security. The area where the pesticides were kept is a high water table zone. Over the years, much of the pesticide had gradually infiltrated a network of adjacent channels and/or been blown away by wind or seasonal storms into the surrounding areas. It was understood that most of the heavily contaminated soil has been washed away during the heavy rainy seasons (January to April of every year). It was clear that the runoff from the site had ended up in the area, which is populated, or had drained into seasonal streams subsequently ending up in main rivers. From this ZCF site a total of 303.388

tonnes of pesticides and heavily contaminated soil were removed. The task of sifting through the debris and recovering the pesticides and contaminated soil was daunting.

Mazabuka Veterinary Research Centre. The second most affected site was the former Veterinary Research Centre, about 125 km south of Lusaka. At this site, two main locations were involved. At the first location, there were two open pits which were used as landfill or dumping sites mainly for DDT powder and large quantities of veterinary vials and expired veterinary and other medical items. It seems that over the years people had been throwing whatever waste they could find into the pits. The pits were neither demarcated by law nor licensed as landfill sites. They were on low-lying ground where the water table is high and were almost adjacent to an irrigated sugar plantation. It is

FIGURE 1
Inventory of obsolete and unwanted pesticide stocks

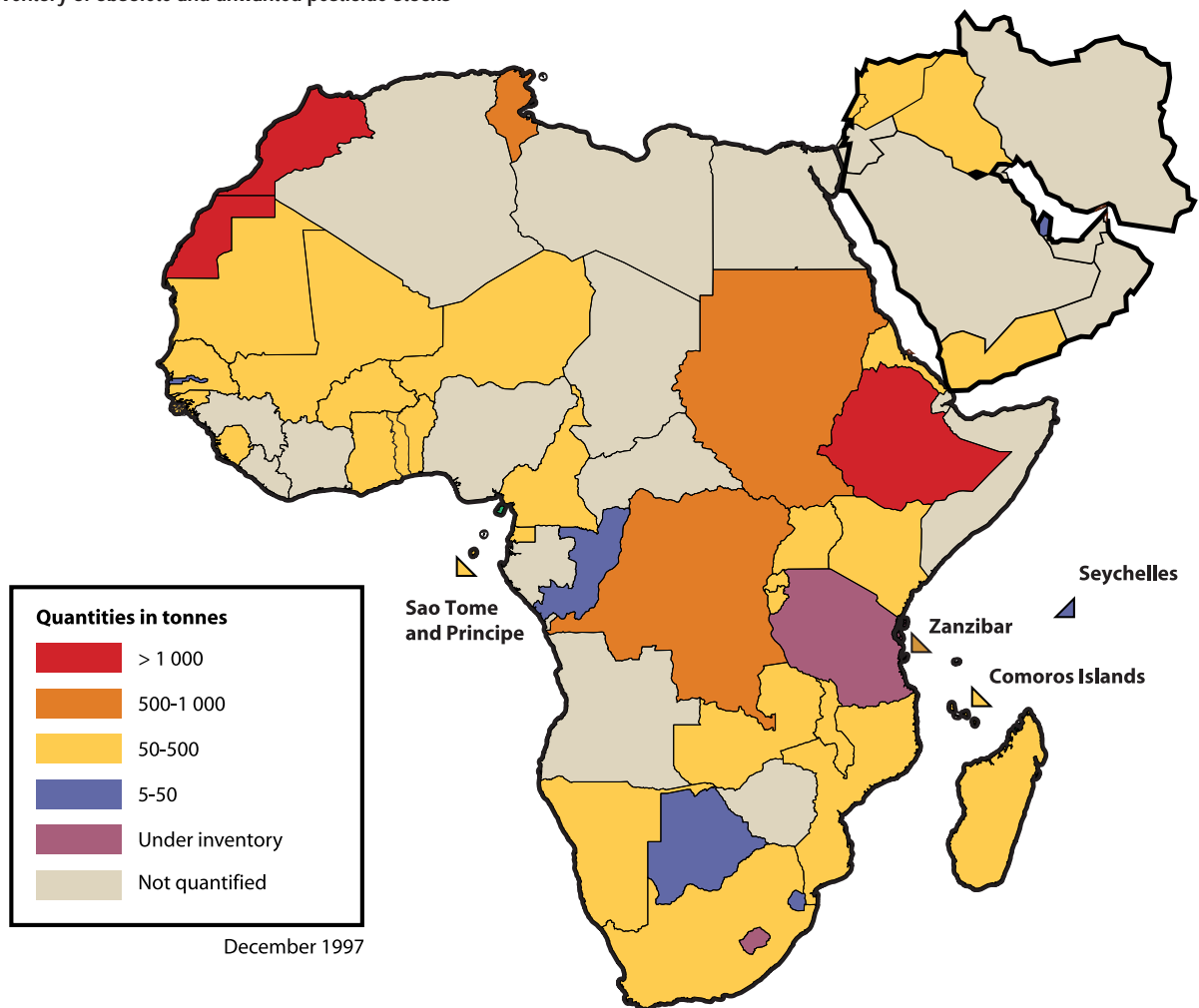


TABLE 1
Obsolete pesticides in Africa and the Near East:
surveys undertaken

Country	No. of affected sites	No. of different pesticides	Total (tonnes)	Total disposed of (tonnes)	Agencies involved in disposal
Africa					
Benin	>7	±21	245		
Botswana	>4	>20	255		
Burkina Faso	24	57	54		
Burundi	2	5	58		
Cameroon	20	10	225		
Cape Verde	1	12	23		
Central Afr. Rep.	>15	14	238		
Congo	7	1	2		
Congo Dem. Rep.	5	11	591		
Equatorial Guinea	22	17	146		
Eritrea	29	58	223		
Ethiopia	±200	>200	1 152		
Gambia	±10	±22	21		
Ghana	24	15	50		
Guinea-Bissau	>5	9	9		
Kenya	33	49	56		
Madagascar	4	14	76	70	GTZ
Malawi	>16	69	127		
Mali	>28	>14	142		
Mauritania	13	11	57	200	GTZ/Shell
Morocco	25	±170	2 265		
Mozambique	48	±150	443	160	GTZ
Namibia	1	1	245		
Niger	±15	29	52	60	USAID/GTZ/Shell
Sao Tome/Principe	1	3	3		
Senegal	8	±21	274		
Seychelles	>1	37	0	12	FAO/DGIS
Sierra Leone	5	17	7		
South Africa	several	±30	613		
Sudan	44	±80	657		
Swaziland	2	35	9		
Tanzania, United Rep. ¹		several	800	57	Only DNOC: GTZ
Togo		12	41	86	
Tunisia	21	> 5	882		
Uganda	several	various	211	50	Only dieldrin: FAO
Zambia	6	±51	0	360	
Zanzibar	several	±100	0	280	DGIS
Near East					
Iraq	16	5	232		
Lebanon	several	several	189		
Qatar	1	7	5		
Syrian Arab Rep.	>13	13	323		
Yemen	20	±130	130	262	FAO/DGIS/KfW
Total			11 176	1 511	

Note: Last updated in March 1998 (inventory data are revised on a continuous basis).

¹ Inventory in progress.

TABLE 2
Disposal operations completed

Year	Country	Product(s)	Quantity (tonnes)	Agencies involved in disposal
1991	Niger	Dieldrin	60	USAID/GTZ/Shell
1993	Uganda	Dieldrin	50	FAO/UNCDF
1993	Madagascar	Dieldrin	70	GTZ
1994	Mozambique	DDT/monocrotophos	160	GTZ
1995	Zanzibar	Various products	280	DGIS
1996	Yemen	Various products	260	FAO/DGIS/KfW
1996	Tanzania	DNOC	57	GTZ
1997	Zambia	Various products	360	FAO/DGIS/GTZ
1997	Seychelles	Various products	12	FAO/DGIS
1997	Mauritania	Dieldrin	200	GTZ/Shell
Total			1 511¹	

¹ 7 percent of total estimated in Africa.

therefore very likely that some of the DDT had leached into the groundwater, particularly as the site was open to rainwater which soaked the DDT. Next to the pits was the second location, a huge warehouse where DDT dust was kept in very scattered conditions over the entire floor area. Both of these locations are within the compound of the Veterinary Research Centre, not far from each other and, more significantly, next to a public clinic. As the door of the warehouse was left unlocked, it was accessible to children playing hide-and-seek over several years. The site lacked even the minimum environmental and safety requirements. A total of 35.062 tonnes were removed from both locations. This total included a minor quantity of stocks from Mazabuka town.

International Red Locust Control Organization centre. The third affected site was a store at Ndola (a copper-mining town) owned by the International Red Locust Control Organization for Central and Southern Africa (IRLCO-CSA) about 440 km north of Lusaka. The pesticide stock involved was mainly Dinitro-o-Cresol (DNOC) and large quantities of contaminated empty containers. Here the operation was not very difficult, as most of the DNOC had been safeguarded by GTZ a few years previously.

Kitwe and Nchanga farms. The fourth and fifth sites were Nchanga and Kitwe, about 500 km north of Lusaka, where a total of 1.05 tonnes of various pesticides was collected.

Mpongwe and Luanshya farms. The sixth and seventh affected sites were Mpongwe and Luanshya farms, from where a total of 2.34 tonnes of different types of pesticides were removed.

Centralization and shipment. The ZCF storage site was chosen as a central location for centralization of the pesticides. All pesticides from the different sites were brought to the ZCF site and repackaged. As most of the pesticide stock (84 percent) was at ZCF in Lusaka, it was chosen as a temporary central depot for all obsolete stocks prior to shipment to a designated destination in Europe. This decision was made for convenience and management purposes.

A total of 25 shipping containers were required for all the stocks removed from the different sites. Stocks were loaded by types and classes of pesticides and in accordance to the International Maritime Dangerous Goods Code (IMDG) requirements. The means of transport were rail to Dar Es Salaam, nearly 2 000 km away, and thereafter sea via the Suez Canal to the United Kingdom.

The quantities involved and the relative location of each of the affected sites are given in Table 3 and shown on the outline map of Zambia in Figure 2.

The Seychelles

Pesticides in the Seychelles fall mainly under the responsibility of the Ministry of Agriculture and Marine Resources (MAMR). Types or varieties of pesticides imported for use include insecticides, fungicides, herbicides, molluscicides and rodenticides. A committee referred to as the Input Committee makes decisions about the purchasing of pesticides. Imported pesticides are stored in the main store at Grande Anse, referred to as the Farmers' Requisite (Supply) Store. Distributions of pesticides to farmers are made at this and other specific centres.

Distribution centres include: Grande Anse, immediately next to the main store; Anse Boileau; Val d'Endor; Union Vale; Amitié (located in the second main island of Praslin); and a centre on the third island of La Digue, although this has been privatized and is apparently no longer operational. In Figure 3, arrows show the locations of distribution centres in the Seychelles.

A total of 12 tonnes of obsolete stocks were removed, most of which had been kept on the main island, Mahé. For a small country such as the Seychelles, which is entirely surrounded by sea and completely marine-oriented, a cocktail of abandoned obsolete stocks was dangerous to human health, marine life and the environment. It was therefore fortunate that the Government of the Netherlands provided financial support to remove the entire obsolete stock.

TABLE 3
Obsolete pesticide removals in Zambia

Site	Quantity (tonnes)
ZCF storage and Lusaka town	303.388
Mazabuka Veterinary open pits and warehouse	35.062
Ndola (IRLCO-CSA storage site)	18.436
Kitwe and Nchanga	1.054
Mpongwe and Luanshya	2.335
Total	360.275

Disposal activities involved. The main disposal activity was at Grande Anse where a total of six different types of stores were involved. The stores were regarded as being "dead" because all sorts of materials considered bad, toxic or old were thrown there, including completely incompatible pesticides and other chemicals that were kept together. It was a miracle that an outbreak of fire did not take place.

The stocks from various stores were all repackaged carefully in appropriate UN-approved containers and removed. Subsequently, the stores were cleaned and decontaminated. In addition, a few stocks were collected from farmers' stores, research stations, the plant protection institute in Mahé and the Ministry of Health.

Global concern

Although the world is inundated with obsolete pesticides, as Figure 4 shows, annual worldwide sales of pesticides are sharply on the rise.

It is impossible to find countries that are free from the negative effects of obsolete, unwanted or banned pesticides or from pesticide misuse and abuse. The impact on the environment and the risk to human health in developing countries are invariably serious and complicated. Although larger quantities of pesticides are used in developed countries, the damage they do is far greater in poor countries. This is because of basic unawareness of the inherent danger of pesticides, lack of facilities for both storage and disposal, aggressive pesticide sales and distribution, lack of appropriate legislation or enforcement of the law, uncoordinated or excessive donations, lack of resources, etc.

Most developing countries have large quantities of leftover stocks, which are neither usable nor disposable locally. It is not uncommon to find pesticides stored in populated areas, close to water

FIGURE 2
Pesticide disposal in Zambia

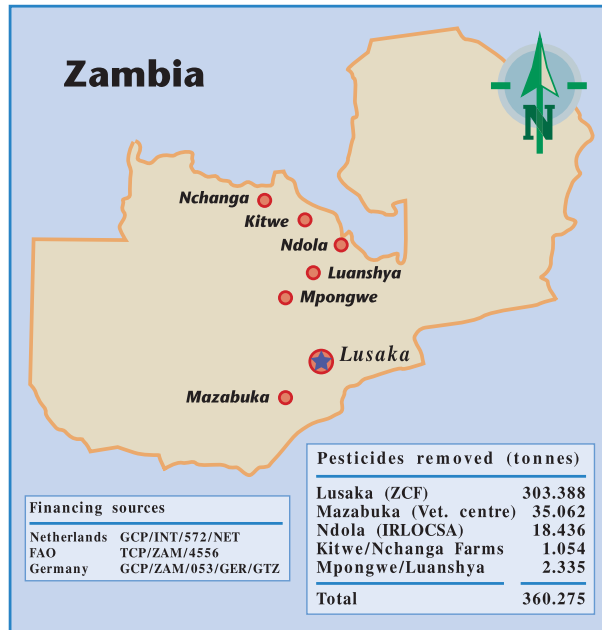


FIGURE 3
Distribution centres in the Seychelles



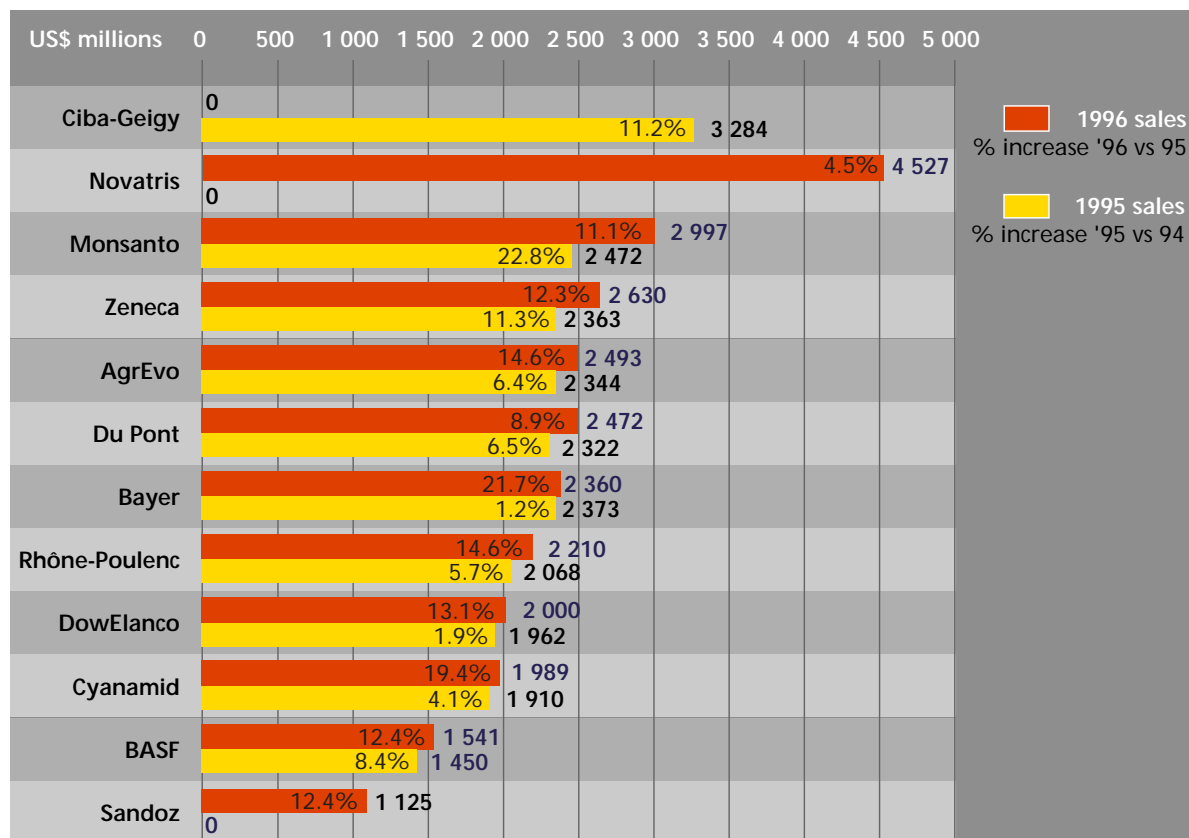
sources, with food items or in the proximity of children or disabled people. Incidents in a number of countries resulted in people either falling seriously ill or dying from eating seeds treated with unwanted and highly poisonous pesticides. This is a common occurrence in many countries although most incidents remain undocumented.

A cocktail of 30 tonnes of pesticides buried in the early 1980s within the confines of an irrigation scheme at Surdod State Farm in Yemen is currently estimated to have grown to more than 100 tonnes as a result of dispersion and infiltration of groundwater. Although the management of the farm at the time of the pesticide burial was under senior staff from one of the developed countries, the very idea of burying was both ill-conceived and ill-advised. Such a practice should be prohibited in developing countries because it is neither practical nor applicable.

FAO's estimate of obsolete pesticides in Africa remains at 20 000 tonnes. An earlier estimate for other

developing countries was close to or a little over 100 000 tonnes, but current indications suggest that this figure should be much revised upwards. Obsolete pesticides in Ukraine alone stand at 22 000 tonnes. This is higher than the estimate of 20 000 tonnes for Africa. India and China produce large quantities of an assortment of pesticides and large quantities of obsolete pesticides are likely to exist. A total of 7 000 tonnes of obsolete lindane pesticide has been left in the open in Afghanistan for which nothing could be done because of the ongoing civil strife in that country. Several countries in central Asia are suspected of having obsolete stocks in excess of 5 000 tonnes each. The existence of such quantities in individual countries suggests that the total figure will surpass the initial estimate of 100 000 tonnes several times. Moreover, there are large quantities of heavily contaminated floor material, soil and empty containers that are no less toxic than the pesticides themselves. It is not uncommon to use empty pesticide containers

FIGURE 4
Worldwide sales of pesticides (1995 and 1996)



for domestic purposes such as for storage, hauling or drinking-water storage. Most pesticide vending companies and individuals advise people to bury pesticide containers in their backyards and, as a result, many small countries with small farm holdings in, for example, the Near East are littered with empty pesticide containers.

Obsolete pesticide stocks include all kinds of hazardous pesticides such as various organochlorine compounds (dieldrin, HCH and DDT) and highly poisonous organophosphates (parathion, methylparathion, dichlorvos, monocrotophos, etc.).

Storage conditions

Most stores are substandard. Open storage is common where the intensity of direct sunlight quickly deteriorates pesticides and containers alike. Stores are usually located in sensitive and populated zones with little or no security to protect human health. State-owned stores are subject to pilferage or mismanagement and few or no records are kept. Empty pesticide drums are often considered to be of high economic value and authorities fail to control or stop the sale or distribution of them on the market. Thus, contaminated containers almost always find their ways into private houses for domestic uses.

In tropical countries, where climatic conditions are hot and humid, the deterioration of drums is much faster and, consequently, widespread leakage and contamination are not uncommon. There are examples where drums “balloon up” because of high internal pressure. Subsequently, weak points such as seams give way and pesticides leak and spill profusely. Pesticide vendors, either knowingly or otherwise, fail to provide containers designed to withstand harsh tropical conditions. Banned pesticides that have been left in stores for up to 25 years have leaked on to the floors of stores. The liquid portion of high-vapour pesticides usually evaporates and less volatile pesticides seep into the soil or the outside of stores by oozing or trickling even through brick walls. During disposal operations in Yemen, where hundreds of tonnes of pesticides had leaked in a single store, a layer of solidified pesticides several inches thick was found bonded to the surface of the floor. Scraping and removal of this waste from the floor was a very difficult task, which took several weeks. Had it not been for heavy-duty machines, the operation would have taken several months or would have remained impossible to tackle.

Environmental hazards

Obsolete pesticides in developing countries have the potential to cause global contamination far from the point source of contamination where they are kept. Contaminated groundwater and drainage channels run into international waters, lakes or seas. The main cause of pollution of the Aral sea, for example, was drainage from a series of large state cotton farms which were under irrigation schemes in different countries several hundred kilometres away. The Nile river, which crosses the Sudan and Egypt, receives huge quantities of drainage water from large irrigated cotton farms that receive several pesticide sprays during each crop season. This is an indication of the effects that one country can have on another and the potential global environmental impact cannot be overruled. Pesticides that are at present kept in developing countries are likely to end up in the environment elsewhere.

Examples of near-disasters have been witnessed in Yemen, Zambia, Zanzibar, the Seychelles and other places. Most of the pesticides involved date back 25 years or more. A small fraction of these near-disasters have been avoided as a result of financial support provided by a few donor agencies.

Causes of accumulation of obsolete pesticides

The banning of pesticide introductions into certain countries, poor storage and lack of store management, unawareness, overstocking, inadequate assessment of needs, difficulties in forecasting outbreaks of pests, inappropriate formulations and containers supplied by pesticide distributors, excessive or uncoordinated donations, etc. have all contributed to accumulation in one way or another. In many respects, all of these drawbacks still continue and the situation is therefore being further aggravated.

Disposal options

Disposal options are limited. Landfilling or burial of pesticides in developing countries, where the majority of the people are unaware of the risks and where designated landfill sites are lacking or not respected, are not recommended. The only reliable option for disposal is at a high temperature in dedicated incinerators operating at no less than 1 150°C. In one case, very large quantities of dangerous pesticides, which a few years ago leaked into soil in one of the member countries, were safeguarded by FAO. A high solid wall was erected around the perimeter of the

affected site and guards were assigned to patrol night and day. This was a temporary measure until a better option of disposal could be found. Unfortunately, the guards, who were provided with guns, were caught digging the contaminated soil and selling it to people in urban areas for the control of domestic pests such as fleas and bed bugs.

Cement kiln. The use of cement kilns for disposal has been suggested as an alternative to dedicated incinerators, because a temperature of 2 000°C can be achieved in cement kilns. Unfortunately, most cement kilns in developing countries are substandard, lack the necessary attachments to control toxic emissions and are thus unfit as they are. However, if cement kilns were upgraded, the necessary control devices provided and cement producers convinced of the benefits, they may potentially be useful for disposal not only of obsolete pesticides but also of other toxic wastes in general. Liquid pesticides can be used as part of the energy supply and thus can be fed into the incineration system in combination with fuel. The co-firing of pesticides with fuel could achieve temperatures and residence times that are sufficient to destroy the pesticides. As countries gradually develop and become industry-oriented, they should begin to look into such options. In most developed countries, particularly in Scandinavia, cement kilns are widely used. It is however, unlikely that the disposal of pesticide drums can be achieved in cement kilns. Unless recycling facilities are available, the disposal of contaminated containers will continue to pose serious problems.

New technology. Plasma pyrolysis (electric arc-based incinerator) is a relatively new option of disposal and is neither versatile nor commendable at this stage.

Mobile incinerator. The use of mobile incinerators is not cost-effective for the vast majority of situations. Generally, small incinerators are not suitable for the destruction of bulk quantities of pesticides. In addition, they have to be attended and supervised constantly by trained staff to avoid accidental emission and pollution.

Long-term storage. Repackaging pesticides and keeping them in stores until a disposal option can be found is unsatisfactory. Long-term storage is a double exercise which is neither cost-effective nor environmentally sound. Once pesticides are transferred, new UN-approved containers or others

soon start reacting with the pesticide itself (which is acid), leading to deterioration and leakage. Therefore, this method does not work. However, for pesticides based on heavy metals for which methods of disposal are lacking (even in developed countries), immobilizing them and storing them on sites such as disused ammunition banks is recommended. However, under such conditions, the stored pesticides should regularly be monitored to avoid the likely chance of their causing serious environmental danger.

Alternatives. Because of the high cost of disposal (US\$3 000 to \$4 500 per tonne or more) and complications involved in repackaging, administration and transshipment, continued efforts should be made to investigate alternative technologies and management methods for the disposal of obsolete pesticide stocks in developing countries.

Guidelines. *Technical guidelines on the disposal of bulk quantities of obsolete pesticides in developing countries*, prepared by FAO, UNEP and WHO, give a summary of high-temperature disposal and other options. FAO is also planning to prepare guidelines on the disposal of small quantities of pesticides and on the treatment of contaminated soil.

Inventory of obsolete pesticide stocks

As indicated in Table 1, FAO has completed the inventory of obsolete pesticide stocks for a total of 42 countries. If action for disposal is not taken within two years following the initial date of the survey, a revised inventory is usually required because the countries involved request further assistance, undeclared quantities of obsolete pesticides are found, etc.

Financial support

Donors are unlikely to offer further financial support unless the industry commits itself to participate and collaborate in disposal operations.

Project portfolio for disposal operations

FAO has prepared a project portfolio, which includes 18 countries. Thirteen countries have been on the list since 1996: Burkina Faso, Cape Verde, the Gambia, Mali, Mauritania, the Niger, Senegal, Eritrea, Ethiopia, the Sudan, Madagascar, Mozambique and the Seychelles. In 1998, Botswana, the United Republic of Tanzania, Ghana, Benin and Togo were added to the list. The total sum proposed for disposal

in these countries is US\$24 million. A total of US\$6 million of this is to go on a proposal of the Government of Denmark for capacity building in waste management in Mozambique.

In addition to the 18 countries mentioned, South Africa has signed up with a disposal company to dispose of a total of 613 tonnes of obsolete pesticides without external donor support. FAO provided only minimal advice early in April 1998 and will oversee the operation to ensure that appropriate disposal standards are maintained.

Although donor countries have preferences for support, it is clear that, unless the chemical industry makes a financial contribution, donors may not consider supporting pesticide disposal operations. Other organizations also concur to this condition. In order to move forward and start disposal operations on a definite basis, the chemical industry should therefore consider making a definite and substantial commitment of financial support as soon as possible.

International opinion supporting disposal operations

Guidelines for aid agencies, published in 1995 by OECD, Development Assistance Committee (DAC), Pest and Pesticide Management, recognizes the importance and urgency of the problems associated with obsolete pesticides in developing countries. All aid agencies are therefore called upon to assist developing countries in preventing further accumulation and in conducting disposal operations of stocks already accumulated.

The European Union, understanding the importance of the issue of environmental hazards associated with obsolete pesticides in developing countries, has also indicated its policy to assist in the disposal of obsolete stocks and to maintain a sound environment in its agreement with countries in Africa, the Caribbean and the Pacific.

Although the problem deserves widespread recognition, so far only few aid agencies have actually provided funds for coordination or limited disposal operations. It should be noted that the problem cannot be solved without large-scale action and collaboration.

As well as in Africa and the Near East, developing countries elsewhere are not covered in matters of coordination, survey and inventory taking. Recently, UNEP offered a sum of US\$50 000 in support to enable surveys to be conducted in at least ten countries, five in South America (Brazil, Argentina,

Paraguay, Ecuador and Colombia), two in Central America (Guatemala and Nicaragua) and three in the Caribbean (Jamaica, Trinidad and Tobago and Saint Lucia). There is no programme for countries in Asia yet. The type of survey to be conducted in the countries mentioned will be simple and will not involve in-depth studies, otherwise far higher expenditure than UNEP's sum of US\$50 000 would be necessary for each individual country.

A concerted effort by the international donor community and the pesticide industry is the way to eliminate a large proportion of obsolete pesticide stocks. In view of this, discussions will have to continue with all parties concerned, including the pesticide industry, to work out modalities for contributions to pesticide disposal.

FAO guidelines

FAO has produced three basic guidelines in the FAO Pesticide Disposal Series. These are: No. 2, *Prevention of accumulation of obsolete pesticide stocks*; No. 3, *Pesticide storage and stock control manual*; and No. 4, *Disposal of bulk quantities of obsolete pesticides in developing countries*. All of these are available in four languages: English, French, Arabic and Spanish. Most have been and are being distributed free to member countries, organizations, research centres, universities, etc. They are also available, or being made available, on the Internet to be read, copied, downloaded or distributed. Other guidelines are being developed and include *Treatment of contaminated soil* and *Disposal of small quantities of obsolete stocks*.

A CD-ROM is also being developed containing all the guidelines on obsolete stocks, brochures and other relevant information. It will be distributed as soon as a licensing agreement on support software has been reached.

STATE OF IMPLEMENTATION OF THE FAO PORTFOLIO OF DISPOSAL PROJECTS

Mr H. van der Wulp reported on the state of implementation of projects for Burkina Faso, Cape Verde, Ethiopia, Eritrea, the Gambia, Mali, Mauritania, Mozambique, the Niger, Senegal, the Seychelles and the Sudan (Table 4).

By the end of 1997, six disposal operations were ongoing or under preparation (Table 5).

In addition to the countries mentioned in Table 5, the countries in Table 6 have requested assistance for disposal operations.

TABLE 4
State of implementation of FAO disposal projects

State of implementation	Country
Disposal operation completed	Seychelles, Mauritania (partial)
Disposal operation ongoing	Mozambique
Disposal operation under preparation: Funding in principle agreed Detailed inventory completed Discussion on funding progressing	The Gambia Madagascar, Senegal
Detailed inventory completed Discussion on funding initiated	Mali
Initial inventory completed	Ethiopia, Eritrea
Initial attempt to raise funding for detailed inventory and disposal operation failed ¹	Cape Verde, Mauritania, Burkina Faso, the Niger
No progress ²	The Sudan

¹ In 1996, FAO assisted CILSS in preparing a project proposal for a disposal programme for CILSS. The EU had indicated interest in funding such a proposal but, as a result of various administrative problems faced by CILSS and DG VIII of the Commission of the EU, the proposal has not yet entered the appraisal procedure.

² Lack of donor financial support did not allow rigorous follow-up in the Sudan.

PROGRESS OF INVOLVEMENT AND DISCUSSIONS BETWEEN FAO AND THE AGROCHEMICAL INDUSTRY

At the Second Consultation in 1996, donor representatives stated that they would want to see financial contributions from the agrochemical industry to future disposal operations. FAO and the Global Crop Protection Federation (GCPF) were requested to discuss the possibilities and modalities for such involvement.

GCPF represents the major agrochemical companies and established an International Project Team on Obsolete Stocks to coordinate such involvement. Since the Second Consultation, there have been several meetings between FAO and the GCPF team to discuss the financial involvement of the industry in pesticide disposal. The initial positions of individual agrochemical companies varied with some companies being more willing to contribute than others. It appeared difficult to discuss involvement in general terms on the basis of abstract situations. Therefore, a practical case-by-case approach was chosen, addressing concrete situations in specific countries.

In June 1997, FAO and GCPF in principle agreed on an initial agenda for GCPF involvement in pesticide disposal. As a starting point, the agenda focused on eight countries, although industry involvement was not to be restricted to these countries. Other countries could be included if a donor expressed interest in a specific country.

TABLE 5
FAO disposal operations under preparation (end 1997)

Country	Quantity (tonnes)	Progress in preparations
Gambia	20	Full inventory and preparatory visit completed by FAO and GCPF. Funding for disposal operation in principle agreed by CDC and GCPF.
Madagascar	50 (estimate)	Full inventory under execution with assistance of GTZ and SDC. GCPF is investigating the possibility for industry funding of a disposal operation.
Mali	150 (estimate)	Partial inventory completed by GTZ and Bellona with funding from Stromme Foundation. Shell pledged to contribute to disposal costs.
Mozambique	250	Funding for incineration in adapted local cement kiln approved by DANIDA. Project implementation initiated.
Senegal	180 + 110	Full inventory completed by FAO. Funding of disposal operation for 180 tonnes under discussion with the government, EU and GCPF. Reformulation of 110 tonnes of carbaryl in principle agreed by USAID and Rhône Poulenc.
Tanzania	800 (estimate)	Full inventory under execution with assistance of DGIS. DGIS and DANIDA expressed interest in jointly funding a disposal operation if industry also makes a contribution. GCPF confirmed willingness of industry to do so.

The initially selected countries were: Botswana, Madagascar and Malawi in southern Africa; the Gambia, Senegal and Mauritania in western Africa; and Ethiopia and Eritrea in the Horn of Africa.

The countries were selected on the following criteria:

- activities/discussion/request already initiated;
- urgency factor;
- relatively large proportion of products originating from GCPF member companies;
- appropriate balance between small and large projects.

The agreed general procedure for industry involvement in disposal operations is that, upon the request of FAO or an aid agency, GCPF will solicit contributions from involved member companies towards the disposal of products manufactured by those companies. The level of contribution will be determined on a case-by-case basis and may vary from company to company. Although the industry does not want to commit itself, the trend emerging from specific cases discussed so far is that GCPF member companies would make a baseline contribution of US\$1 000 per tonne of product manufactured by the company concerned, provided that the product is definitely obsolete. Individual companies may contribute more.

TABLE 6
Countries requesting assistance for disposal operations

Country	Quantity (tonnes)	Progress in preparations
Botswana	211	Initial inventory completed
Eritrea	231	Initial inventory completed
Ethiopia	1 152	Detailed inventory including sampling programme completed by the government

Companies would cover the full disposal costs for obsolete products owned by the company concerned. Furthermore, FAO would expect companies to take full responsibility for any stocks that were delivered in violation of national legislation.

In addition, as a special case, the industry was requested to fund disposal operations fully for four countries where almost all obsolete products originate from GCPF member companies. Adoption of these disposal projects would be regarded as catching up with the many earlier projects that were fully funded by donors. The countries proposed for this special procedure were Botswana, the Gambia, Madagascar and Malawi.

It was also agreed with GCPF that disposal

operations should be done in a coordinated manner and that GCPF should prevent individual companies from rushing in to “remove” their own products ahead of planned disposal operations.

The industry also offered technical advice on the possibilities of reusing or reformulating unwanted products.

Summary of progress made on individual projects

GCPF companies have agreed to fund a disposal operation for the Gambia (in combination with a Commonwealth Development Corporation-[CDC] funded activity to remove obsolete pesticides from a former CDC demonstration farm) and are discussing their contribution to Madagascar. In Malawi, the majority of obsolete stocks have been removed, reformulated or finished. The disposal operation for Botswana was shelved because it could not be confirmed that the majority of obsolete products in Botswana actually originated from GCPF member companies. In addition, the industry pledged financial contributions to disposal operations for Senegal and Mali and indicated that similar contributions would be made to operations for Tanzania, Ethiopia and Eritrea.

Chapter 2

Update on the activities of other organizations

THE GLOBAL CROP PROTECTION FEDERATION (GCPF)

Mr P. Natkanski reported that it had been confirmed by the coordinator of the GCPF International Project Team on Obsolete Stocks that, following the Second Consultation, GCPF carried out a survey among its member companies to assess the level of commitment, both financial and technical, that would be offered in relation to this project. Replies from the survey resulted in the following GCPF position:

- GCPF is committed to providing help and assistance with obsolete stocks identified in the FAO inventory.
- Assistance includes the provision of technical and financial resources for those stocks manufactured by GCPF member companies.
- The levels of help and assistance are to be decided on a case-by-case basis and will be an individual company decision.
- The GCPF project team on obsolete stocks will act in a facilitating role between industry and other interested parties.

GCPF company members' own waste would clearly be their own responsibility.

It was highlighted that GCPF is involved in the following specific projects.

Madagascar

The industry, the German Agency for Technical Cooperation (GTZ), the Swiss Development Corporation (SDC) and the local authorities from Madagascar are the major stakeholders in this operation. The GTZ inventory has indicated 80 tonnes for disposal, 30 tonnes of which will be removed back to Japan by the original manufacturers.

The total disposal costs have been estimated at US\$200 000, of which \$50 000 have so far been committed by GCPF member companies.

Malawi

Approximately 120 tonnes of obsolete stocks have

been identified, of which only 8 tonnes remain for disposal. The majority of the stocks have been used, repackaged or reformulated. However, there has been some degree of confusion between GCPF member companies, FAO and the Malawi Government as to the exact fate of some of the identified stocks (see below).

The Gambia

This project is funded by GCPF member companies and supplements an operation carried out by the Commonwealth Development Corporation (CDC) to remove old products from one of their demonstration farms. All the necessary funds have now been raised and the contract for the removal and disposal is currently being drawn up. It was anticipated that work would begin in September 1998.

Senegal

This project is being dealt with in two stages; the reformulation of carbaryl (Rhône-Poulenc) and the disposal of the remaining obsolete stocks. The reformulation is being funded jointly by Rhône-Poulenc and the United States Agency for International Development (USAID), although work is currently suspended until an environmental impact study has been carried out. For the remaining stocks awaiting disposal, GCPF member companies have committed the cost of incineration and FAO is seeking the balance of funds from the donor community.

Other GCPF operations

The GCPF Representative also confirmed that the companies consulted so far had, in principle, agreed to offer technical and financial assistance to disposal operations for Eritrea, Ethiopia and the United Republic of Tanzania. The financial assistance would be similar to the assistance pledged for Senegal and Mali (about US\$1 000 per tonne, which roughly covers the average incineration costs). Such a contribution would be available for products that definitely require

disposal and originate from the GCPF companies concerned.

FAO appreciated the efforts of the GCPF coordinator to involve individual companies in making financial contributions to pesticide disposal. However, FAO expressed grave concern about the way obsolete stocks in Malawi had been removed from the list of obsolete pesticides. It was agreed that FAO, GCPF and the Government of Malawi would meet in Malawi to review the situation at the end of March. FAO insisted that there should be full transparency regarding future activities involving obsolete stocks listed in the FAO inventory. GCPF emphasized that the confusion illustrates the need for effective and continuous communication between all interested parties throughout the life of a project.

THE GERMAN AGENCY FOR TECHNICAL COOPERATION (GTZ) PESTICIDE DISPOSAL PROJECT

The GTZ Pesticide Disposal Project, financed by the German Ministry of Economic Cooperation and Development (BMZ), has been in existence since 1991. Members of the project are W. Schimpf, D. Gunther and G. Vaagt, who reported to the Consultation.

Every disposal operation is a step-by-step process linked to the solution envisioned, the chemicals concerned and the situation of the country. It is always important to transfer expertise on disposal techniques and to consider carefully the costs associated with each operation. The incineration of DNOC in a cement kiln in Tanzania was reported at the Second FAO Consultation in 1996. Since then, two major operations have taken place, in Zambia and Mauritania. GTZ believes that it is important to link disposal operations with preventive measures to avoid the accumulation of obsolete pesticides in the future. It is important to promote and facilitate cooperation in the field of pesticide disposal and to involve all stakeholders. Shared responsibility among the owners of the pesticides, the supplier, the producer and others should be accepted and put into practice. The two recent projects in Zambia and Mauritania are good examples in this respect.

Training is always needed, either for the disposal operations or for preventive measures (e.g. in store management) and is the essential element of technical cooperation between developing and industrialized countries. Disposal operations have to follow international standards.

In GTZ's experience, the following are key elements and issues to be considered in a disposal operation:

- Pesticide disposal is an element of pesticide management, which includes the avoidance of future obsolete stocks.
- Preventive measures must become an integral part of disposal operations. It is GTZ's experience that this is possible.
- For obsolete stocks, there needs to be shared responsibility among all stakeholders, including the current owner, the supplier and the producer. This principle has been applied effectively and successfully in GTZ's disposal operations.
- Transparency in the preparation and the execution of disposal operations is important for the application of shared responsibility and for communication with the public. This creates a network of interested parties with a common starting point.

Zambia

The following steps demonstrate the procedures and the years indicate the duration of a disposal operation:

- identify wastes and ownership (1993/94), including requests for financial assistance to various agencies and countries, including FAO, Germany, Finland, and the EU;
- conduct a nationwide inventory (1994);
- stabilize sites and provide safeguards for obsolete stocks (1995);
- develop memoranda of understanding between the Environmental Council of Zambia (ECZ), FAO and GTZ (1995);
- develop the project, clarify funding, select the contractor and conduct preparatory measures (1996);
- collect, repackage, remove, transport and incinerate wastes (1997);
- complete incineration (1998).

The following were key issues for Zambia:

- The "Clean Country" approach was realized. After the Zanzibar operation, this was the first time that a large country was cleaned.
- There was the successful application of the Basel Convention; when Tanzania did not respond to the Zambian request, the Basel Secretariat intervened and approved the transboundary transport.
- There was joint financial support from the FAO Technical Cooperation Programme (TCP) and the governments of the Netherlands and Germany.
- There was successful cooperation between two implementing agencies (FAO and GTZ).

- There was the initiation of preventive measures by the Emergency Co-ordination Unit (ECU), strengthening chemical management in the country.

Mauritania

The following steps were followed in the dieldrin disposal operation in Mauritania:

- conducting of a nationwide survey of the obsolete dieldrin stocks in the stores of the Plant Protection Service of Mauritania (1993);
- repackaging and safeguarding of the dieldrin stocks (1994);
- development of a formal request from Mauritania to the German Government regarding the disposal of the obsolete dieldrin (1995). (This request covered only 200 tonnes of dieldrin, not all of the obsolete pesticides in the country.);
- development of the German project proposal including conditions for requesting the country to become a signatory to the Basel Convention (1995);
- signature of the project agreement and selection of the disposal contractor (1996);
- signature of the Basel Convention (1996);
- Mauritania's formal request to the German Government for assistance with improving the national pesticide management of the Mauritania Plant Protection Service;
- signature of an agreement with the original producer of the dieldrin, Shell Company (1996/97);
- removal, transport and incineration of 186 tonnes of dieldrin and approximately 80 tonnes of solid material (1997);
- complete incineration (1997).

The following were key issues for Mauritania:

- Preventive measures were linked with disposal operations.
- The original producer showed a responsible attitude and covered more than the incineration costs of wastes.
- There was transparent management of the financial contribution of the Shell Company, with funds used to support preventive measures in Mauritania.

DANISH INTERNATIONAL DEVELOPMENT AGENCY (DANIDA)

Mr H. Nøhr said that DANIDA is operating in Mozambique with the Ministry of Agriculture and Fisheries. The budget amounts to approximately US\$6 million and involves a large component of

capacity building for future management of local hazardous waste.

The project will collect more than 540 tonnes of obsolete pesticides that are inadequately stored at approximately 60 sites all over Mozambique and transfer them to a central site in Maputo. Nearly half of these pesticides are hazardous to use or collect, i.e. they are illegal to use, degraded or in leaking packaging, and will be processed and incinerated safely in a cement kiln. The obsolete pesticides with a market value will be sold by tender or auction. The winning company or companies will export the pesticides or repackage and label them according to the Mozambican pesticides regulation before they are remarketed in Mozambique. According to the environmental assessment (EA) of the winning technical proposal, the implementation of the project will eliminate the human health risks caused directly by the inadequate storage of obsolete pesticides. The implementation plan covers five tasks: i) collection of obsolete pesticides in good packaging; ii) remarketing of saleable pesticides; iii) extraction of hazardous, obsolete pesticides; iv) elimination of hazardous pesticides and pesticide packaging; and v) independent supervision and quality assurance of the whole operation. The first four tasks will be conducted under the management of a Danish turnkey consultant. Task ii) involves a tender, and the tender winning company or companies will remarket the pesticides in accordance with the Mozambican and Danish pesticide regulations, or export them to another country in the region. Task iv) involves a national partnership for hazardous waste management formed during mobilization with the aim of promoting project sustainability, e.g. the ownership of the waste station at the Matola site is transferred to the partnership during mobilization. Task v) will be conducted by a project supervision environmental audit team. A Mozambican task force will assist the entire operation. Involvement of local partners in project monitoring and quality assurance will enhance the local capacity to deal with environmental issues, thus supporting the establishment of a safe system for the future storage of pesticides, and for hazardous waste management in general. The project is an environmental rehabilitation activity. It relates to the DANIDA support to the Pesticide Section at the Department of Plant Health.

NORWEGIAN AGENCY FOR INTERNATIONAL DEVELOPMENT (NORAD)

Mr S. Utne reported that, during the last year, NORAD has had close consultations with FAO, which are now leading to a US\$10 million operation for integrated pest management (IPM) run by FAO in Asia. NORAD has also recently decided to support the FAO Global IPM facility. FAO approached NORAD to join in the disposal programme for obsolete pesticides in Africa. However, collection of information will be necessary on the basis of which future decisions on possible cooperation on the disposal of obsolete pesticides will be made.

So far, NORAD has been involved in monitoring pesticide residues in certain areas of Kenya and Madagascar. The findings of this analytical work were of great interest.

NORAD has been very reluctant to finance the import of pesticides as commodity assistance. Very small quantities of pesticide have been given on very few occasions; basically assistance was given to two locust operations many years ago and a few deliveries of red copper fungicides have been made to Kenya and Nicaragua.

NORAD is very careful to avoid the harmful supply of pesticides and, therefore, there is no critical pressure to instigate clearing operations. However, if the needs arise, NORAD might investigate the possibilities for Nordic cooperation.

There has been some contact between FAO and a Norwegian research institute working on hazardous waste incineration in cement kilns in Norway, and FAO has requested a specialist from SINTEF to share his experience.

Technical information about the possibility of using cement kilns for incineration of hazardous waste is attached as Annex IV.

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT (USAID)

Ukraine

Mr R.C. Hedlund reported that USAID encourages the disposal of obsolete pesticide stocks in Ukraine through an Environmental Policy and Technology Project.

Stockpiling of (obsolete) pesticides in Ukraine started during the 1960s and, in the early 1970s, measures were taken to consolidate the storage of old pesticides at specifically designated facilities. According to current official statistics, there are

10 700 tonnes of stockpiled pesticides in Ukraine, stored in 109 state-owned facilities and on approximately 4 000 collective farms, stock companies and in rural communities. A recent study by the Ministry of Environmental Protection and Nuclear Safety (MEPNS) estimates that the total amount of stockpiled obsolete pesticides in Ukraine is approximately 22 000 tonnes. The amount of stockpiled pesticides in each *oblast* (administrative region) ranges from 30 to 1 000 tonnes and, at any given site, from 0.1 to 500 tonnes.

During the stockpiling of obsolete pesticides, many were consolidated into containers as mixtures. Documentation on which pesticides were combined and in which containers is vague. In addition, there is reason to believe that, in some cases, chemical reactions have occurred over time, resulting in new by-products of unknown quantity, character and hazard.

At present, the determination of organizational and technological conditions concerning the disposal of stored obsolete and/or prohibited pesticides is constrained by the absence of objective data regarding their potential threat to the environment and public health. Another major constraint is the lack of the necessary information to make decisions on prioritizing the stockpiled facilities for remediation efforts and selecting the most cost-effective, efficient and safe means of disposal.

From 11 to 13 June 1997, USAID sponsored a workshop on stockpiled obsolete pesticides. A total of 45 people participated. One of the key accomplishments of the workshop was the revision and approval of a draft pilot inventory programme action plan to assist in identifying funding through the international donor community and/or other agencies for implementation of the recommendation.

The Danish Environmental Protection Agency has expressed interest in supporting the implementation of such a project in Ukraine and is now in the process of project preparation.

In 1997, besides these initiatives, the Ukrainian Government undertook responsibility for the disposal of obsolete pesticide stored at a facility in the village of Vilshanytsia in Kyiv *oblast*. The budget (planned) was the equivalent of about US\$300 000. This action is still under way.

In February 1998, the Cabinet of Ministers held a meeting devoted to the problem of toxic waste handling and disposal. The issue of stockpiled obsolete

pesticides was on the agenda. The report of this meeting is not yet available.

Central America

Ms J. King Jensen reported that, since 1991, USAID and the United States Environmental Protection Agency (USEPA) have provided technical assistance on pesticide regulatory issues to Central America. The original project was based on "circle of poison" concerns of the United States public and the desire of the Central American countries to export agricultural commodities to the United States. The scope of the project was expanded to include pesticide disposal activities. Although some dates are tentative, the following information summarizes current plans:

- *Pilot of training course* (May 1997). USEPA, in coordination with two regional organizations, presented the course "Pesticide Disposal in Developing Countries" for the first time in Honduras in May 1997. This provided a realistic test of the course under developing-country conditions. The course material is based on the three FAO technical guidelines on bulk disposal, prevention and storage. Forty-two technical specialists from the private sector and the health, environmental and agricultural ministries of seven Central American countries participated in this pilot workshop. In addition to presenting an overview of disposal options, the course started the process of developing regional expertise and a technical network for future disposal work.
- *Training course* (September 1998). The course was to be offered a second time in El Salvador in September 1998. Countries will be asked to come with their inventories of obsolete stocks. Three countries have preliminary inventories. Where needed, participants from the May course will assist with the completion of the inventories. Three experts from the May course will be co-facilitators with USEPA.
- *Portfolio of disposal project proposals in Central America* (December 1998). Hosted by USEPA's regional counterparts, a meeting is planned for December 1998, in a Central American country, to develop a regional portfolio of proposals for pesticide disposal operations. These proposals will provide background information, including an estimate of costs, to enable donor agencies, banks and private industry to decide on the degree of their common interest and financial support for actions

to dispose of obsolete pesticides in Central America.

- *Donor and private-sector meeting on funding disposal projects* (March 1999). With USEPA assistance, regional counterparts will sponsor a meeting with representatives from donor agencies, development banks and private industry to review the portfolio of disposal proposals and identify financial assistance that would be available for implementing some of the projects. Working regionally or individually, countries will then be able to implement their national disposal plans.

Mr J.P.E. Des Rosiers of USAID indicated that the current possibilities for USAID funding of pesticide disposal operations in Africa are limited. However, this may change as the issue attracts increasing attention.

SWISS DEVELOPMENT COOPERATION (SDC)

Mr I. Marincek reported that interest had been expressed in the issue of obsolete pesticide disposal, which is fairly new to SDC. The meeting was a useful orientation on this subject. The importance of obsolete stocks was recognized and a constructive approach from SDC regarding future assistance can be expected. The need for networking and the exchange of information was stressed and the importance of a coordinating role for FAO was confirmed.

SDC recently contributed to the funding of an inventory of obsolete pesticides in Madagascar, which is being implemented by GTZ. The inventory identified 157 tonnes of unwanted pesticides, of which 43 tonnes need to be incinerated, 22 tonnes can be reworked/reused and 92 tonnes still need to be evaluated. Final figures, a disposal plan and a rough budget were expected by April 1998 in Crop Protection of Novartis. A financial commitment of stakeholders is expected by June 1998.

(*Note.* In June 1997, GCPF in principle agreed to investigate the possibility of full industry funding if the vast majority of obsolete products turn out to originate from GCPF member companies. If there are many other products, or if full industry funding would not be feasible for other reasons, then SDC would be requested to provide supplementary funding.)

SWEDISH INTERNATIONAL DEVELOPMENT COOPERATION AGENCY (Sida)

Mr A. Hook reported that, apart from some support within the framework of its bilateral support to Tanzania and its National Environment Managing

Council (NEMC), Sida, so far, has not been involved in pesticide disposal activities.

Sida has however found the FAO project of interest and will therefore consider supporting the project during 1998/99 pending the forthcoming project proposal.

Although Sida did not make any long-term commitments, it will stress the importance of preventive measures, such as national capacity building as an integrated part of disposal activities, to avoid future problems with obsolete and unwanted pesticide accumulation.

JAPAN

The representative of the Government of Japan expressed his interest in the issue of obsolete pesticides, but indicated that the Government of Japan was at the stage of collecting information and that therefore he was not in a position to make an official statement.

BELGIUM

Mr M. Trybou and Mr P. de Bruycker stated that the Belgian delegates were very pleased to attend this meeting. It is however clear that they attended as observers; the main goal of their participation was to achieve a better understanding of the problem itself and of its magnitude. On the basis of the information gained, they will start discussions with organizations concerned back in Belgium about the role that Belgium can play in solving the problem of obsolete pesticide stocks.

The representatives were impressed by the magnitude of the problem, especially in the African countries, and were convinced of the need for technical and/or financial aid. They will therefore start discussions with senior officials on how a potential participation can fit into the policies and priorities of the federal and regional governments. FAO will be informed about the way things should proceed.

The importance of prevention measures was underlined. Prevention leads to a long-term solution. The disposal of the present obsolete pesticides is necessary, but it should be seen as a short-term solution. Prevention is an ongoing process.

ITALY

Mr L. Fontana-Giusti, representing the Government of Italy, expressed his interest in the issue of obsolete pesticides and indicated the willingness of his

government to take part in further discussions on specific disposal projects.

UNITED NATIONS ENVIRONMENT PROGRAMME (UNEP)

Mr J. Willis reported that UNEP is grateful to FAO for its initiatives in the clean-up of obsolete pesticides in Africa and the Near East. UNEP and FAO have been working together on issues of common interest such as the guidelines on pesticide disposal. UNEP would like to continue to be a partner in efforts to address the problem of obsolete pesticides under the leadership of FAO. Because of the global nature of the problem, UNEP encourages FAO to work in other parts of the world as well. To facilitate this, UNEP has provided US\$50 000 to FAO to initiate inventory work in Latin America. In addition to obsolete pesticides, the Intergovernmental Forum on Chemical Safety has requested that UNEP considers the problem of the disposal of industrial chemicals. As UNEP prepares to lead negotiations for a global control instrument for persistent organic pollutants (POPs), to be concluded by the year 2000, it is important to recognize that obsolete pesticides form a link to POPs in the environment and that they need to be disposed of. UNEP encourages FAO to continue in its catalytic role in this very important area.

INTERNATIONAL FUND FOR AGRICULTURAL DEVELOPMENT (IFAD)

Ms M. de Wit reported that IFAD's Environmental Principles and Criteria (GC 13/L.1990) states that "The Fund shall reduce the use of chemical pesticides to the fullest extent practicable and shall promote the use of alternative or supplementary methods of pest control, such as the use of biological control and integrated pest management (IPM) in its projects. Whenever it is necessary to use chemicals in its investment projects, the Fund shall ensure the proper application, storage and disposal of agricultural chemicals."

IFAD is committed to ensuring environmental due diligence in the context of its operations, and adopted Administrative Procedures for Environmental Assessment in the Project Cycle (PB 94/03) in September 1994. Since adoption of PB 94/03, all IFAD-initiated projects are subject to environmental screening and scoping and, where necessary, proactive environmental assessment. To assist environmental screening and scoping and to facilitate prevention of

pesticide-related environmental problems PB 94/03 includes three Operational Statements (OS) on Pesticides. OS 9 Pesticides outlines the criteria for environmental screening and scoping of IFAD projects promoting pesticide application and describes the potential environmental impacts involving pesticides. OS 11 Pesticide Storage and Stock Management provides checklists to assist project designers in verifying the need for pesticides and the proper selection of pesticides. It also outlines the requirements for pesticide ordering and improved stock management and storage. OS 12 Selecting Pesticides for Use in IFAD Projects outlines restrictions and guidance on the following lists: pesticides in the WHO classes 1A “extremely hazardous” and 1B “highly hazardous”; pesticides banned by the World Bank; pesticides known to cause adverse health impacts; and pesticides banned or restricted in some Asian countries.

A President’s Bulletin on Sustainable Pest Management is in the advanced stage of preparation.

PESTICIDES TRUST

Mr M. Davis reported that the Pesticides Trust is a non-governmental organization (NGO) working to eliminate the hazards from pesticides and promoting sustainable development. Its primary roles are in the gathering and dissemination of information, research, policy development and the promotion of strategies that reduce reliance on pesticides. It is independent of government, funders, members or other external bodies and is networked globally, primarily via the Pesticides Action Network.

The Pesticides Trust has been involved in the FAO-led initiative for the disposal of obsolete and unwanted pesticides in Africa and the Near East since its inception in 1994. It commends FAO for the crucial role it is fulfilling in leading the development of solutions to the vast stocks of obsolete and unwanted pesticides, and welcomes the opportunity to contribute to this process. However, the Pesticides Trust representative came to this Third Consultation with a number of concerns, which he believed the assembly should be aware of and should consider.

Funding

Disposal operations are expensive and require input from external sources. Some donor agencies have been more forthcoming than others in supporting this work. The Pesticides Trust called upon all agencies that support development in regions where obsolete

pesticides exist to give priority to funding solutions to this worsening problem.

It is perhaps a sad irony that developed countries will become more willing to participate in disposal efforts as the issue of persistent organic pollutants (POPs) gains prominence.

The issue of bilateralism must also be taken into account. Countries receiving development aid must themselves consider prioritizing the treatment of obsolete pesticide stocks in funding programmes.

Industry’s willingness to contribute to the provision of solutions is welcomed. However, the Pesticides Trust holds that the baseline contribution, set at US\$1 000 per tonne for pesticides identified as belonging to GCPF member companies, is too low. It represents only 20 to 30 percent of the overall cost of pesticide disposal; the remaining 70 to 80 percent generally being contributed by national donor agencies using taxpayers’ money.

It is the fund-raising process that is delaying solutions to obsolete pesticides problems. Since the last Consultation, two years ago, 4 percent of estimated stocks in Africa and the Near East have been dealt with. At this rate it will take 50 years to clear Africa and that is far too long.

Operations

All disposal and treatment efforts must be coordinated through FAO in order to ensure that appropriate solutions are implemented and that solutions are holistic and not partial. Agencies should not support the implementation of low-cost options that use anything but the highest levels of technology and the most stringent standards of protection for health and the environment. Disposal operations must be monitored for quality control, adherence to national and international regulations, codes of practice and guidelines. There must be no “back-door” disposal efforts by bodies seeking quick solutions to specific problems. There must be full coordination and transparency in all efforts to solve obsolete pesticide problems including disposal, reuse or reformulation.

In short, standards of work in Africa and other developing regions should not be lower than those in the developed nations.

Prevention

Countries benefiting from external assistance to solve problems of obsolete pesticides should ensure that measures to prevent the future accumulation of such

stocks are put in place. Donors should also ensure that agreements directed at the provision of solutions include a requirement for prevention measures to be in place. Disposal should not be seen as an ongoing or repeatable operation. Improvement of chemical management capacity and measures for the prevention of accumulation of pesticide stocks should be seen as priorities for all countries and in particular those that currently hold obsolete and unwanted pesticide stocks.

The supply of pesticides now and in the future must also include measures to prevent stock accumulation. The pesticide industry must provide stewardship for their products to the point of use and beyond. Donors that fund pesticide supplies must ensure that prevention measures are in place. Within the realms of its work on obsolete pesticides, FAO has developed guidelines on the prevention of accumulation of stocks and these should be followed in pesticide procurement and supply.

The obsolete pesticide problem is not only a historical one; inappropriate practices and poor management are still contributing to the problem and

the Pesticides Trust Representative pressed that the Consultation Meeting should be aware of an example of such poor practice, in the hope that such practices will cease and solutions for existing obsolete pesticide stocks will be implemented in the near future.

In 1995, the European Union supplied 230 tonnes of the fungicide mancozeb to Rwanda. The product was formulated using poor-quality active ingredient. On supply it was stored improperly and caught fire. For over two years the damaged and contaminated pesticides in an unstable state remained unprotected and untreated. In 1997, an expert assessment of the problem proposed a solution. Experienced hazardous waste handling contractors were approached and a detailed proposal was prepared. However, before it could be implemented a contract for disposal was given to an unknown local engineering contractor with no record and, as far as was known, no knowledge of the handling of hazardous waste. A major international donor has therefore been responsible for the inappropriate supply of pesticides and for mishandling in the treatment of obsolete pesticides.

Chapter 3

Country reports

UNITED REPUBLIC OF TANZANIA

Mr F.M.T. Mpendazoe registered his appreciation to the chairperson for the opportunity of presenting the Tanzanian situation regarding obsolete and unwanted pesticides and chemical wastes. He then went on to thank Sida, GTZ and the Government of the Netherlands for the financial and technical support they have given to the Government of Tanzania in addressing the problem of pesticide wastes.

Obsolete and unwanted pesticides are a great problem in Tanzania. In 1990, Sida supported a preliminary study on pesticide wastes in the coffee and cotton growing areas of some regions in Tanzania. This study, which was carried out by government officials, found huge quantities of pesticide wastes on most farms.

The findings of the study indicated the need for a comprehensive study (inventory) to gather more data and information on obsolete pesticides and chemical wastes. A full-scale project was therefore launched in 1997 when the Government of Tanzania received financial support from the Government of the Netherlands. Tanzania has since discovered more than 800 tonnes of obsolete pesticides and 40 tonnes of veterinary wastes comprising vaccines and drugs.

These volumes of chemical wastes have accumulated over 30 years. Over 1 000 sites have been inspected including regional and district stores, cooperative unions and large estate farms. Over 250 sites had pesticide wastes and, at most of these sites, the situation was found to be serious, with many containers leaking and bags torn and in a deplorable state. Water sources are under threat of contamination and human health is obviously at risk.

The accumulation of obsolete pesticides was caused mainly by the government subsidy given to farmers and aid donations. Some obsolete pesticides have been banned but are still kept in stores (e.g. DDT) and the banning of products has also contributed to the stockpile of obsolete pesticides. For example, DDT has been banned for agricultural use for some years and its use for malaria control was stopped in 1998. Unfortunately, about 200 tonnes of DDT remain and it

is hoped that this will be disposed of soon. In addition, in the past pesticide donations have often been in excess of requirements. The government, donors and agrochemical companies have made mistakes. Much has been learned from these mistakes and future donations will almost certainly be properly managed. There will be better assessment of actual requirements and dialogue between recipients and suppliers.

The clean-up campaign cannot be considered complete unless efforts are made to ensure that neither pesticides nor chemicals are left to accumulate in the future. In light of this understanding, the Government of Tanzania is making efforts to prevent the re-occurrence of the problem after the ongoing clean-up project. These efforts include:

- A review of the existing legislation and institutions that address management of pesticides has been undertaken with the aim of ensuring that there is sufficient infrastructure to register pesticides and, therefore, safe use. The legislation will also regulate the storage and management of pesticides.
- The Government has abandoned the programme on subsidy to farmers, and distribution is now left to the private sector. The Government is now concentrating on regulation and control of distribution.
- The National Environmental Management Council (NEMC), which is the government body responsible for environmental issues in Tanzania, in collaboration with other institutions, is enhancing the awareness of users on chemicals and pesticides. It is against this background that NEMC, in May 1996, organized a national workshop on environmentally sound management of chemicals, including pesticides, the main objective of which was to solicit concrete proposals on how to abate the threats posed by chemicals. In addition, with the assistance of Sida and in collaboration with the Government Chemist Laboratory, NEMC prepared the National Profile on Chemical Management, an authoritative document that will serve as a basis for future efforts to strengthen the national system for the

management of chemicals through the involvement of all concerned bodies.

In Tanzania, awareness has grown and the chemical pollution problem is a national issue. However, the legal and institutional framework for the management of pesticides is not well developed. Nevertheless, Tanzania has ratified both the Basel and Bamako Conventions on the Transboundary Movement of Hazardous Wastes and their Disposal.

The various types of waste stock identified in the ongoing clean-up project include various organochlorine pesticides which are known to be persistent organic pollutants (POPs), notably DDT, dieldrin and aldrin.

With financial and technical assistance from the Government of the Netherlands, NEMC is currently preparing a disposal plan for the identified wastes. As the result of a lack of disposal facilities in the country, some portion of the wastes will be transported for treatment and disposal abroad. However, if any of the products can be incinerated locally, then that would be given priority in order to cut down disposal costs. For instance, in 1996, Tanzania successfully burned 65 000 litres of DNOC with technical assistance from GTZ. DNOC was introduced to Tanzania in 1951 for the purpose of controlling red locust in the country.

In an effort to alleviate disposal problems, NEMC has prepared terms of reference for a feasibility study to investigate the possibility of using the country's existing cement kiln for incinerating some of the chemical wastes. Two Scandinavian cement kiln experts will soon be invited to participate in this feasibility study.

Tanzania requires assistance with its pesticide disposal activities. The total cost for the destruction of the wastes identified during the ongoing inventory is estimated at US\$2.5 to 3 million. Appreciation was expressed for the assistance provided by FAO in helping with the identification of potential donors and in soliciting a financial contribution from the agrochemical industries. On behalf of the Government of Tanzania, a request for assistance was formalized. There have been initial negotiations with the Government of the Netherlands and DANIDA who expressed interest in jointly funding the operation, provided that contributions from chemical companies were forthcoming, and it is to be hoped that their initial interest will be confirmed by their commitments.

Mr J. Betlem then presented the following relevant details of the inventory coordinated by NEMC.

In recognition of the potential dangers of hazardous chemicals to human health and the environment, in 1997, NEMC in collaboration with various government institutions started a nationwide programme to assess the dangers of stored waste pesticides and veterinary waste in mainland Tanzania.

The programme was funded and technically assisted through the Government of the Netherlands with a budget of approximately US\$300 000 for a one-year period. It enables NEMC to:

- visit all locations and record the situation at each location, including storage conditions, direct environmental and health risks and proposals for immediate short-term action to eliminate or reduce these risks;
- establish sources, types, quantities, locations and owners of all pesticide wastes and veterinary wastes in the country;
- obtain information on the handling of chemical waste, including final disposal methods (both in and outside Tanzania);
- evaluate the feasibility of using a cement kiln for incineration of waste in Tanzania.

The inventory started with a ten-day training course on the handling of chemical wastes (including strategies on how to find stocks, strategies on how to approach store owners, intensive training on how to carry out a nationwide inventory, sample taking, safety aspects and first aid). The training was attended by senior government staff from the following seven Government of Tanzania institutions:

- the National Environment Management Council (NEMC);
- the Department of the Environment (DOE);
- the Government Chemist Laboratory;
- the Ministry of Agriculture;
- the Ministry of Industries and Trade;
- the Ministry of Labour and Youth Development (Factories Inspectorate);
- the Tropical Pesticide Research Institute (TPRI).

At the end of the training, 12 senior government staff were nominated to form the core team for the inventory. The field inventory started in March 1997 and was expected to continue until the end of April 1998. By then, the whole of mainland Tanzania will have been covered (the Zanzibar islands were subject to a chemical waste disposal operation during the years 1995 and 1996; 300 tonnes of obsolete pesticides and other waste were collected, repackaged and shipped to the United Kingdom for final destruction).

Several field teams participated in the inventory, carrying laptop computers with reference materials, extensive field equipment and personal protection kits.

By February 1998, over 1 200 sites had been inspected and obsolete products had been found in over 250 of these sites. More than 1 000 products were recorded as obsolete pesticide or veterinary waste, mounting up to a total of over 800 tonnes. In most cases, it was very obvious that the product was obsolete. Samples were taken if there was any doubt. Some stocks had been in the country for over 30 years. Product and site information, including photographs, were assembled on a CD-ROM which was expected to be available by June 1998.

NEMC is currently preparing a plan for the repackaging and collection of waste. It is envisaged that the government itself will, in principle, carry out part of the collection. External technical assistance will be required for the packaging of products from sites with large numbers of different products in small quantities, the collection of products with multiple hazards (dust/vapour); and the clean-up of heavily contaminated sites.

ETHIOPIA

Mr Y. Tetemke welcomed the opportunity to participate in the FAO Third Consultation on the Prevention and Disposal of Obsolete and Unwanted Pesticide Stocks in Africa and the Near East. On behalf of the Ethiopian Government, the people and the Ethiopian delegation he expressed his gratitude and thanks to FAO for its effort and commitment in having initiated a programme directed at finding solutions to the issues and problems surrounding obsolete pesticides.

Agriculture is the mainstay of the Ethiopian economy. It provides employment for 85 percent of the population, generates 46 percent of gross domestic product (GDP) and produces 90 percent of the foreign exchange earnings. However, agricultural production is very low despite its dominant role in the national economy. The causes of low agricultural productivity are perhaps as diverse as the country's agro-ecological zones and cropping systems. The major biological causes are agricultural pests. Annual pre- and post-harvest losses are estimated to be up to 40 percent.

In view of the need to increase food production and to alleviate the suffering of the country's many sick and hunger-stricken, policy objectives included, among other aims, the import of pesticides, fertilizers and related chemicals either through donations or by

means of direct purchases. Several government and non-governmental organizations (NGOs) were involved in importing such products. While some of the materials were used in time for the purpose for which they were intended, unfortunately, a large stock of pesticides was left in stores or in the open for a number of years. Most such stocks subsequently became obsolete and have now resulted in a serious problem.

Nature and scope

Obsolete pesticides have accumulated in Ethiopia for the last 30 years. Although the Pesticide Decree of 1991 was enacted recently, remaining stocks have remained a serious threat to the public. There is a total of 1 152 tonnes of obsolete pesticides and 100 tonnes of contaminated equipment and soil in 256 major and minor sites in the country. The stocks are found in the premises of government offices, state farms and some enterprises. Because of a lack of storage facilities and poor store management, most metallic containers are rusty and leaking, plastic and paper containers are torn and hence large quantities of pesticides are found spilled in almost all stores in the country.

The prolonged storage of the large stock has resulted in contamination of new arrivals. Almost all obsolete stocks in the country have accumulated over more than ten years. Most such stocks were stored in the open and hence the majority have lost their labels making them difficult to identify. Most pesticides do not show the date of manufacture, manufacturer, expiry date and other relevant issues. There are reports of looting and misuse of the old stock and it is therefore a concern that timely measures be taken. Leakage and spillage are contaminating the little available storage space and the risk associated with groundwater is also an important consideration.

Causes of accumulation

Most of the stock found in Ethiopia was acquired from donations for migratory pest control or purchased by government agencies for state farm use. The government-owned state farms took few or no proper precautionary measures on the pesticides they acquired. This could be attributed to the centralized economic policy of the last three decades. As there was no legislation of any kind to monitor the import and use of pesticides, poor quality and improperly packed and labelled pesticides were imported into the country. The absence of proper prior consultation for

TABLE 7
Major pesticide groups in Ethiopia

Type	Litres	Kg	Total
Carbamate	26 064.00	32 380.00	58 444.20
Coumarin	0.00	14 876.60	14 876.60
Inorganic	0.00	30 247.00	30 247.00
Mixed pesticides	32 750.00	37 555.00	70 305.00
Organochlorine	47 816.40	210 457.42	258 273.82
Organophosphate	142 923.00	12 511.00	155 434.00
Unknown	78 073.00	228 710.00	306 783.00
Total	327 626.40	566 737.22	894 363.62

the pesticides resulted in the import of highly persistent pesticides. Fluctuations in use of the available pesticides caused by incidences of pest outbreaks and variations of climate have also contributed to the longer period of storage resulting in deterioration of available stock. Overcrowded storage and poor management of pesticides have further aggravated the problem.

Government concern on obsolete stock

Acting on the basis of the causality reports on the obsolete stock in the country, the Government funded a project to carry out a survey to assess the types, quantities and locations of the obsolete stock in order to determine the methods of disposal and the funding required. As stated earlier, a total of 1 152 tonnes of obsolete pesticides (493 tonnes of liquid and 659 tonnes of solid formulation) were found scattered over 256 different sites.

The majority of the stocks includes pesticides that are highly toxic and dangerous, such as the organochlorines and organophosphates, which are environmentally hazardous and seriously dangerous to human and animal health (Table 7). Nearly 50 percent of the stocks are either internationally banned or highly poisonous. Out of the total stocks, 70.5 percent (or 812.5 tonnes) belong to the group of insecticides (Table 8). A list of major pesticides is presented in Table 9.

Taking note of the estimated total stock of obsolete pesticides, at present Ethiopia has the second-largest stock of obsolete pesticides of any country in Africa. The situation being so desperate and urgent, obsolete pesticides have become a matter of high priority and one of the major issues among the list of national concerns requiring quick action. A strategy to dispose of the obsolete stock was determined during the project

TABLE 8
Pesticide categories in Ethiopia

Category	Litres	Kg	Total
Avicide	337.0	0.0	337.0
Chemical	2 643.0	1 756.5	4 399.5
Emulsifier	160.0	81.0	241.0
Fungicide	8 014.0	26 266.0	34 280.0
Fertilizer	0.0	7 825.0	7 825.0
Herbicide	14 803.0	7 499.2	22 302.2
Insecticide	356 372.4	456 138.8	812 511.2
Nematicide	85.0	0.0	85.0
Rodenticide	0.0	59 097.7	59 097.7
Unknown	109 938.0	100 609.0	210 547.0
Total	492 352.4	659 273.2	1 151 625.6

TABLE 9
Major pesticides in Ethiopia

Type	Litres	Kg	Total
Carbaryl	26 064.00	32 380.20	58 444.20
Chlordane	0.00	34 893.00	34 893.00
Coumatetralyl	0.00	14 876.00	14 876.00
DDT	11 380.00	47 775.50	59 155.50
Diazinon	26 801.00	3 836.00	30 637.00
Dieldrin	24 290.00	3 055.00	27 345.00
Dimethoate	30 472.00	0.00	30 472.00
Endosulfan	11 571.40	0.00	11 571.40
Fenitrothion	22 178.00	0.00	22 178.00
Gusathion	17 221.00	0.00	17 221.00
Heptachlor	0.00	20 353.50	20 353.50
Lindane	575.00	104 380.42	104 955.42
Malathion	17 853.00	8 675.00	26 526.00
Mixed pesticides	32 750.00	37 555.00	70 305.00
Pirimiphos methyl	1 600.00	170 475.00	172 075.00
Thiometon	28 398.00	0.00	28 398.00
Unknown	76 473.00	58 235.00	134 708.00
Zinc phosphide	0.00	30 247.00	30 247.00
Total	327 626.40	566 737.22	894 363.62

period and the only suitable option for the 117 different types of pesticides was to ship the stock to a country with a fixed incinerator. The overall cost required was a little over US\$4 million which is obviously beyond the resources of the country. The Government has therefore presented the issue to donors to assist in the destruction of the existing stock.

In addition, the environmental threat and the risk to

human life are also greater in Ethiopia than in many of its neighbouring countries.

These are the results of past activities that have been inherited and now pose real and serious problems; action can no longer be delayed or passed on to the next generation or administration. The Government of Ethiopia is committed and is keen to find ways and means not only to dispose of all waste identified as obsolete pesticides but also to avoid further accumulation in the environment.

Conclusions

The problem of obsolete pesticides is serious in Ethiopia. The large stocks of obsolete pesticides that remain in the country under poor storage facilities and inadequate management make these pesticides unsafe if left for long. So far, there are records of looting, leakage and misuse and hence immediate action needs to be taken. The Government is currently taking all necessary precautions to avoid further leakage, spillage and looting, and new stores are being constructed to store the pesticides safely. However, measures for safe storage will not by themselves solve the problem if the pesticides are left for much longer.

The problem of pesticide waste is widespread, serious and very urgent. Unless something positive is done quickly, the environmental loss and the damage to human health will be incalculable and irreversible. The magnitude of the problem is immense and far deeper than can be imagined, the task of cleaning up the waste is complicated and dangerous, the necessary finances are beyond the reach of the poor nation and disposal facilities and expertise are lacking, making the assistance and support of the donor community, organizations and the industry, including the guidelines, guidance and advice provided by FAO, crucial.

Those working with pesticides live at the edge of danger and routine activities have become precarious to them and to the public at large. Most pesticide stocks are located in urban areas and, because of this, people are in constant threat whether they stay indoors or go out. The most threatened are children who are usually weak, unaware and curious to play with or handle things. Pesticides must be removed in order to create new working conditions that are safe and normal.

In view of the importance and urgency of the pesticide problem being faced, Ethiopia welcomes the assistance and advice of the international donor

community to dispose of the huge stock that currently threatens the life and livelihood of its population. It also requests manufacturing companies to be involved in the destruction of the waste accumulated in the country and hopes that everyone will understand the urgency of the problem and come to Ethiopia's assistance. The country needs to have the commitment and pledges of the donors represented at the Third Consultation. Once Ethiopia has the necessary support to solve the problem, it will be determined to set examples of prudence, to keep the environment clean and to use alternative means of pest control other than totally relying on pesticides.

Finally, the representative thanked FAO for all the assistance so far provided and hoped that such assistance would continue.

Outcome and conclusion of the Third Consultation Meeting

FRAMEWORK FOR INTERNATIONAL COLLABORATION IN PESTICIDE DISPOSAL

Mr van der Graaff, Chief, Plant Protection Service, FAO introduced the agenda item. A draft text outlining FAO's concept of a Collaborative Programme on Disposal of Obsolete Pesticides had been distributed for comments. The purpose of the document was to provide further guidance to FAO regarding its role in pesticide disposal. In addition, the document was meant to provide a wider and generally accepted framework for individual projects and studies on prevention and disposal of obsolete pesticides. Such a document had been requested by various parties that required a tool to initiate or facilitate internal discussion on pesticide disposal activities.

Summary of comments made on the draft document

The meeting requested more emphasis on prevention. Many delegates reconfirmed that prevention should be an integrated part of disposal operations. GTZ proposed the establishment of a small working group to develop further the elements for policies on preventing accumulation of obsolete pesticides.

Several other participants requested more attention for networking and interagency collaboration and coordination. Mr van der Graaff and Mr Willis, Director of UNEP Chemicals, briefed the meeting on ongoing interagency activities under the aegis of the Inter-Organization Programme for the Sound Management of Chemicals which includes the interagency working group on obsolete pesticides activities in this area, which were initiated in the Intergovernmental Forum on Chemical Safety and its inputs in discussions on the development of a persistent organic pollutants (POPs) Convention. An interagency working group was established to coordinate the increasing roles of various UN agencies: UNEP is involved because of the Basel Convention and industrial waste; UNIDO may become involved where the local capacity for disposal has to be established; and WHO is involved because of the

public health risks of obsolete stocks of pesticides and the discussion on POPs. Mr Willis confirmed that, under the leadership of FAO, UNEP wanted to continue to be a partner in an international programme on the prevention and disposal of obsolete pesticides.

FAO was requested to help ensure high standards for disposal operations. It was suggested that this could involve the development of a more formal auditing system.

Several delegates requested FAO to broaden its project on prevention and disposal of obsolete pesticides to include other regions of the world. Mr van der Graaff explained that FAO would be pleased to broaden this project provided that such globalization was supported by the necessary funding. UNEP pledged US\$50 000 to enable FAO to initiate an inventory of obsolete pesticides, and possibly other hazardous waste, in Latin America.

FAO was requested to continue its coordinating role and to initiate and facilitate disposal operations and the collection and distribution of information. Other relevant parties were requested to share information with FAO, which in turn was requested to circulate such information and to provide as much transparency as possible regarding ongoing and planned activities. One delegate suggested that FAO should consider issuing an e-mail newsletter to provide a six-monthly update on developments. FAO was also requested to prepare and submit concrete proposals for priority funding opportunities.

The Secretariat revised the draft text in accordance with the comments made. The revised version is attached in Annex 3.

ADMINISTRATIVE AND ORGANIZATIONAL MODALITIES FOR DISPOSAL OPERATIONS JOINTLY FUNDED BY AID AGENCIES AND THE AGROCHEMICAL INDUSTRY

This issue was discussed very briefly. It had been put on the agenda because new modalities are to be found for merging public and private funding if one disposal

operation is funded from different sources. However, it was acknowledged that there is a large variation in situations and that this issue could best be addressed in stakeholder meetings for specific operations.

As an example, the GCPF representative explained the administrative arrangement that had recently been made for joint funding of an operation for the Gambia by the agrochemical industry and the Commonwealth Development Corporation; the overall cost for a turnkey operation was estimated together with the disposal contractor. This cost was then divided among the stakeholders according to the volume of waste. Each stakeholder then agreed to obtain a "letter of credit" from their bank for the sum agreed. An "umbrella contract" covering all the stakeholders and detailing the amounts contained in the letters of credit was drawn up by the contractor. This contract also details the procedures for repackaging, transporting and disposing of the waste. The letter of credit will be called in once the waste has been disposed of. In practice, payment will be made after the "certificates of destruction" have been issued to the stakeholders. To protect the liability of the stakeholders an independent consultant has been appointed to oversee the work of the disposal contractor during the operations in the Gambia.

DISPOSAL OPERATIONS PROPOSED FOR 1998-1999

Mr van der Wulp, FAO consultant, introduced the updated portfolio of project briefs with proposals for the disposal of obsolete pesticides from selected countries. Several of the existing 1996 entries (Mali, Senegal, Eritrea, Ethiopia and Madagascar) had been updated. New entries included Botswana and Tanzania, while project briefs for Ghana, Togo and Benin are under preparation. The new portfolio was distributed. Details were provided regarding ongoing talks on the funding of specific projects and on funding opportunities for interested donors.

The opportunity was provided to interested agencies to explore possibilities for involvement and cooperation with others. These discussions were informal and took place after the formal closing of the meeting.

CONCLUSIONS AND STATEMENTS BY PARTICIPANTS

In their concluding remarks participants thanked FAO for organizing the meeting. The importance of

opportunities to exchange information and discuss collaboration was underlined. Agencies that participated for the first time in an FAO Consultation on the Prevention and Disposal of Obsolete and Unwanted Pesticide Stocks acknowledged the importance of the problem of obsolete pesticide stocks, indicated their interest in getting involved in future activities to address this problem and said that they would discuss possibilities for such involvement within their respective agencies.

The meeting was formally closed by Mr van der Graaff, Chief of the FAO Plant Protection Service (AGPP).

After the formal closing, opportunity was provided for informal talks among aid agencies, donors and governments regarding the specific projects proposed by FAO.

Annexes

Annex 1

List of participants

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Annex 2 Programme

Monday 2 March 1998

9.00-9.30 am

Registration of participants

9.30-9.45 am

Opening of the Consultation

M. Duwayri, Director, FAO Plant Production and Production Division

9.45-10.15 am

Election of Chairman and Rapporteur

Adoption of Agenda

10.15 am-12.30 pm

Introduction and update on activities: FAO

Progress in pesticide disposal and related activities

A. Wodageneh

Video of disposal operations for the Seychelles and Zambia

Report and lessons learned from operations in the Seychelles and Zambia

A. Wodageneh

State of implementation of FAO portfolio of disposal projects

H.P. van der Wulp

Progress on involvement of agrochemical industry

H.P. van der Wulp; P. Natkanski

12.30-2.00 pm

Lunch break

2.00 pm

Update on activities: other agencies

GTZ

G. Vaagt

DANIDA

H. Nøhr

NORAD

S. Utne

USAID

R.C. Hedlund; J. Jensen

Sida

A. Höök

SDC

I. Marincek; K. Wettstein

Japan

Y. Endo

Belgium

M. Trybou

Italy

L. Fontana-Giusti

UNEP

J.B. Willis

IFAD

M. de Wit

Pesticides Trust

M. Davis

Tuesday 3 March 1998

9.00-9.30 am

Country report Tanzania

F.M.T. Mpendazoe; J. Betlem

9.30-10.30 am

Country report Ethiopia

L. Batemo Kabeto; Yibrah Tetemke

10.30-11.30 am

Framework for international collaboration in pesticide disposal policy statement by
FAO

N.A. van der Graaff

11.30 am-12.00 noon

General discussion on administrative and organizational modalities for disposal
operations jointly funded by aid agencies and the agrochemical industry

Introduced by **N.A. van der Graaff**

12.00 noon-12.30 pm

Disposal operations proposed for 1998-1999

Introduced by **H.P. van der Wulp**

12.30-2.00 pm

Lunch break

2.00-2.30 pm

Brief discussion on possibilities for cooperation in funding

2.30-3.00 pm

Conclusion and statements by participants

3.00-3.30 pm

Closing remarks by **N.A. van der Graaff**

3.30 pm

Informal continuation to discuss funding possibilities for portfolio projects

Annex 3

Framework for international collaboration in pesticide disposal

COLLABORATIVE PROGRAMME ON PREVENTION AND DISPOSAL OF OBSOLETE PESTICIDES

Introduction

Old stocks of obsolete and unwanted pesticides pose a severe threat to human health and the environment in developing countries. FAO estimates that Africa alone has about 15 000 to 20 000 tonnes of obsolete pesticides. Generally, these are leftover pesticides that can no longer be used because they have deteriorated as a result of prolonged storage or because their use has been banned while they were still kept in storage. In addition, there are heavily contaminated stores and large quantities of contaminated soil, material and empty containers. Obsolete pesticide stocks include large volumes of organochlorine compounds that are highly persistent in the environment, such as DDT, dieldrin and HCH, as well as highly toxic organophosphorus compounds (WHO Classes 1A and 1B).

Most of the stocks are kept in substandard stores and are in a deplorable state. Large numbers of containers are leaking. Many stores are located in urban areas or near water bodies. Groundwater, irrigation water and drinking-water are at risk. Urgent action is required to address this alarming situation.

The main causes of accumulation of obsolete pesticides are: inadequate storage facilities and poor stock management; overstocking of pesticides, often as a result of excessive donations; unsuitable products (not effective or of the wrong formulation) or unsuitable packaging (inappropriate size; not durable); and banning of pesticides that are still kept in storage. Particularly in Africa, a large proportion of obsolete pesticides are leftover pesticides that countries obtained under aid arrangements.

At present, for obsolete products that can no longer be used and that cannot easily be reformulated, the preferred disposal method is high-temperature incineration. In general, developing countries have neither the facilities nor the funds to ensure that obsolete pesticides are incinerated in a safe and environmentally sound manner. Nor do they have the expertise to prepare disposal operations. FAO members therefore requested the Organization for advice and assistance in addressing their problems with obsolete pesticide stocks.

In response to such requests, FAO and various bilateral agencies have successfully exported obsolete pesticide stocks from a number of countries to Europe for safe and environmentally sound destruction in a hazardous-waste incineration plant.

The need for an international effort to address this alarming situation

The total costs of removing obsolete pesticides from Africa alone are in the region of US\$80 million. Such costs cannot be met by the countries concerned. Aid agencies are prepared to contribute but insist that the agrochemical industry also makes a financial contribution.

FAO regards the problem of obsolete pesticides in Africa and other developing regions as an international environmental problem that requires coordinated international assistance.

The problem has built up over a 30-year period and reflects the evolution of products and the history of their use. Every phase has left its mark in the form of a certain category of obsolete products. Past mistakes have been recognized, lessons have been learned and measures are being taken to prevent repetition, but large volumes of obsolete pesticides remain as a heritage of practices that were once considered sound, but have now become outdated.

Every government, agency or company that has been involved in pesticide supply over the last 30 years is likely to have contributed in one way or another to the present problem. Because of this, and because of the international dimensions of the environmental problems caused by these stocks, FAO sees it as a joint responsibility of governments, international organizations, donors, aid agencies and agrochemical companies to help solve the problem.

In addition, there is an urgent need for policies to prevent further accumulation of obsolete pesticides. Such policies should be established at both the receiver and the supplier levels. Many developing countries need assistance to improve their stock planning procedures and product management capabilities.

The magnitude of the problem, and the funds and work involved to help solve it, require a coordinated framework for assistance to ensure the effective use of resources. FAO hopes to offer such a framework with this collaborative programme.

Consultations on the prevention and disposal of obsolete pesticides

Since 1994, FAO has collected and compiled stock data from Africa and the Near East, reviewed and assessed disposal technologies, produced technical guidelines and conducted pilot disposal operations. Consultations have been organized to raise broad attention for this issue and to increase the number of disposal operations. At the First Consultation in 1994, donor representatives requested FAO to encourage and enhance coordination among parties involved or interested in addressing the problem of obsolete pesticide stocks. In this respect, FAO was requested to prepare a portfolio of urgently needed disposal operations. The portfolio was presented at the Second Consultation in 1996 and updated for the Third Consultation in 1998. Disposal operations are now under implementation or consideration for several of the countries included in the portfolio.

FAO will continue to update the portfolio and inform interested donors of funding opportunities. The portfolio contains project briefs for disposal projects in countries that have severe problems with obsolete stocks, give high priority to the issue and have requested assistance. Aid agencies, donors or companies can also propose countries if they want to fund a disposal operation in a specific country and if they are looking for partners. The funding of disposal operations for individual countries or groups of countries on a case-by-case basis appears to be the most practical approach. For each case, an effort will be made to strike an appropriate balance between public and private funding.

The role of FAO

In response to requests from member countries, aid agencies and international organizations, FAO seeks to play a coordinating and facilitating role in activities to address the problem of obsolete pesticides in developing countries. At the Third Consultation in 1998, FAO's role was specified as follows.

Collect and compile information on:

- stock inventory data, storage sites, environmental and health hazards, etc. regarding obsolete pesticide stocks in developing countries;
- disposal technologies;
- planned and ongoing disposal operations;
- lessons learned from completed operations.

Disseminate this information to relevant actors.

Initiate and facilitate disposal operations by:

- preparing project briefs and other documentation for inclusion in the portfolio of urgently needed disposal operations;
- assisting in the identification of donors for specific disposal operations and liaising with the agrochemical industry to solicit their financial and technical assistance. Communication with agrochemical companies takes place through the Global Federation for Crop Protection (GCPF);¹
- facilitating communication between governments and other stakeholders, particularly with regard to practical implementation aspects and government contributions.

Enhance international collaboration and coordination among entities involved or interested in contributing to pesticide disposal activities by:

- once every 18 months, organizing a meeting on pesticide disposal for all parties involved in this international effort. The purpose of these meetings is to review progress, exchange experiences, review new disposal methods, identify new priority countries and discuss cooperation on pipeline projects;
- bringing up the issue in international fora whenever relevant and coordinating interagency collaboration in this respect.

Ensure high safety standards for disposal activities and offer technical advice or assistance where necessary by:

- in collaboration with other relevant UN agencies, regularly reviewing the available disposal methods and advising as to the suitability of these options;
- preparing technical guidelines on relevant subjects;
- providing technical advice on all aspects of pesticide disposal operations, including the selection of contractors, contractual arrangements and government contributions;
- offering technical services, such as assistance in project preparation and monitoring of field operations.

Promote the development and implementation of policies and measures to prevent further accumulation of obsolete pesticide stocks by:

- evaluating the effectiveness of strategies and policies to prevent further accumulation of obsolete pesticide stocks;
- identifying existing causes of accumulation and assist the actors concerned in finding solutions to reduce the risk of accumulation;
- developing training packages and organizing workshops on prevention.

Implementation of disposal operations. Actual implementation of disposal operations is not regarded as a primary task of FAO and will, as much as possible,

¹ It is realized that not all supplying companies are covered by GCPF. In particular, brokers and other sources would not be reached. However, in the longer term, FAO anticipates that the demonstrated willingness of companies to take back leftover products or to help dispose of these products will become an important criterion for the selection of companies to supply pesticides under aid arrangements.

be left to parties willing to conduct such operations. Generally, the funding party will enter into a direct contract with a specialized disposal contractor. However, where a donor wants to contribute to pesticide disposal but does not want to execute a disposal project, FAO may execute such a project under a Trust Fund arrangement.

Further international policy support

Several important international fora provide broad policy support for international assistance to help solve the urgent problem of obsolete pesticides in developing countries.

In 1995, the OECD Development Assistance Committee (OECD/DAC) published *Guidelines for aid agencies on pest and pesticide management*. OECD/DAC recognizes the importance of the problem of obsolete pesticides and has given obsolete pesticides a prominent place in these guidelines. The international community is called upon to assist developing countries in preventing further accumulation of obsolete pesticide stocks and in providing technical and financial assistance to disposal operations to eliminate the present obsolete stocks. The Intergovernmental Forum on Chemical Safety (IFCS), which was established to implement the relevant section of UNCED Agenda 21, made obsolete pesticides a topic of special concern. IFCS urges the international community to help prevent unnecessary release into the environment of the many obsolete stocks of pesticides. In a follow-up meeting, relevant UN agencies agreed to coordinate their involvement in this issue.

International momentum is gathering towards a phasing out of persistent organic pollutants (POPs). POPs are now broadly acknowledged to cause serious immune and metabolic effects, neurological defects, reproductive anomalies and cancer. They remain in the environment for long periods and accumulate in food chains. An initial list of priority substances was drawn up during an international conference on the subject held in Washington DC in 1995. The list contains various pesticides of which large obsolete quantities exist in developing countries. Disposal of these pesticides will prevent their release into the environment.

Benefits of incinerating hazardous wastes in cement kilns

K.H. Karstensen

The following information about cement kilns was provided by NORAD/SINTEF.

Introduction and background

NORCEM is the sole cement producer in Norway and operates at present two cement plants, one in the south and one in the north of the country. Both plants have recently been modernized at a cost of about US\$200 million and have a capacity of approximately 1.6 million tonnes of cement per year.

NORCEM started to incinerate liquid hazardous wastes in 1980. The background for NORCEM's involvement in the development of waste destruction in cement kilns was mainly owing to the following reasons:

- the cement industry and, in particular, plants with wet process kilns were looking at opportunities to reduce fossil fuel costs following the so-called oil crisis in the 1970s;
- the Norwegian Ministry of the Environment was seeking options for disposal operations according to sound environmental practices.

As a result of this situation, NORCEM and the government, through the State Pollution Control Authority, jointly started test burning of liquid hazardous wastes in a wet kiln in 1979/80. This plant was replaced by a dry process in 1985 and, as a result of concerns about possible operational difficulties with the shifting from a wet process to a dry process kiln – in particular problems arising from the presence of halogens (chlorine) in the fuel – it was decided to carry out new tests.

In addition, it must be added that the Dalen plant, where tests were carried out, is situated close to the village of Brevik and public concern about possible emissions and accidents with the proposed waste destruction facility further triggered the need for new and extensive measurements.

As a consequence, NORCEM together with SINTEF has carried out thorough tests with the burning of liquid, solid and gaseous hazardous wastes in cement kilns.

The plant for hazardous-waste destruction in Brevik was engineered by NORCEM Research and Development. It was successfully commissioned in 1987 and has been in continuous operation since then.

Aim of the study

The tests carried out by NORCEM and SINTEF as a result of concerns about possible operational difficulties with the shifting from a wet process to a dry process kiln involved the following:

- waste preparation and feeding;
- combustion and process control;
- mass balances and distribution pattern of heavy metals and chlorine;
- environmental, safety and health aspects;
- product quality.

Waste policy and legislation in the European Union

The European Union's (EU) action programmes on the environment have set out certain basic lines of policy for the EU to act on in relation to waste management. These are:

- waste prevention;
- waste recycling and reuse;
- safe disposal of non-recoverable residues.

The rationale for this policy was simply that comprehensive, medium- and long-term strategic thinking and the setting of general priorities must determine waste management. The concept put forward is that the EU must be self-sufficient for the treatment and disposal of all forms of waste in order to achieve sustainable development. The following principles, which should all lead to waste minimization, are identified as:

- direct reduction of waste streams;
- optimization of environmentally sound treatment and disposal;
- reduction of movements;
- liability.

European situation – secondary fuels

The cement industry's prime objective is to produce a high-quality product that can meet the challenges of other competing building materials. At the same time, the cement industry must meet the emission standards as defined by the Council Directive on the Incineration of Hazardous Wastes, issued by the European Commission.

The Directive allows the incineration in plants not solely destined for the purpose of incineration of hazardous wastes, e.g. those used by the cement industry. Within the range of 10 to 40 percent of hazardous waste as additional fuels in cement kilns for example, the emission limit values shall be in proportion to the hazardous waste used, whereas below 10 percent and above 40 percent, the emission limit values shall be the same as for dedicated incinerators.

The reason for establishing the rule of 10 to 40 percent is, according to the lawmakers, that it is difficult to measure the real efficiency of hazardous waste destruction of all the pollutants at levels below 10 percent, because of the considerable dilution effect in a cement kiln. When the fuel is more than 40 percent waste product, the operation is regarded by the lawmakers as being one of waste destruction.

Trial burn plan

In the United States a trial burn of the incinerator is required to demonstrate the compliance of the unit with operating standards. The trial burn operating conditions will then be written into the permit if the incinerator complies with these standards.

The trial burn is conducted in accordance with a detailed trial burn plan prepared by the applicant and submitted with the rest of the application. The trial burn is unique to incineration facilities. It documents all important design and operating features of the unit and establishes the basis for future facility operation.

The trial burn plan consists of five principal elements:

- waste analysis;
- engineering description of the unit;
- sampling and analysis procedures;
- test schedule and protocol;
- control information.

Waste analysis. A thorough waste analysis is required as part of the trial burn plan. Information regarding the presence and concentration of all relevant constituents, as well as routine variations in these constituents and in overall waste composition, must be included in this characterization. These data will be used to place limits on the composition of the waste that can be fed to the incinerator; therefore, they must reflect accurately the range of waste feed composition that the facility is likely to process.

The ash (or non-combustible) content of the waste must be determined to specify permit conditions for allowable variations in the waste feed. Measurement of carbon, hydrogen, sulphur, nitrogen, phosphorus and oxygen concentrations and the water content of the waste feed is needed to calculate air requirements and to evaluate the proposed excess air rates. Measurement of organically bound chlorides is necessary to determine potential emissions of gaseous hydrogen chloride and to establish permit conditions for allowable variations in waste constituent quantities.

Engineering description of the unit. The trial burn plan must include an engineering description of the incinerator system. Information such as incinerator component dimensions, design rates of air and waste feed, auxiliary fuel systems and descriptions of continuous monitoring devices should also be submitted in this section.

Sampling and analysis procedures. The sampling and analysis procedures, including those for monitoring process operations, waste and supplemental fuel feed rates, and stack gas composition with respect to POHCs, particulate and HCl, should be noted. These sampling and analysis methods must be in accordance with published procedures and must be sufficient to allow calculation of the rate of POHCs in the system.

Test schedule and protocol. A trial burn schedule and protocol must document the dates and duration of the trial burn, the quantity of waste feed to be burned and the planned operating conditions for each performance test.

Control information. Procedures for stopping the waste feed, shutting down the incinerator and controlling emissions in the event of an equipment malfunction or other emergency are to be included in the plan. The set points for each operating parameter used with this system must be specified. These are the levels that would activate feed cut-off. These operating limits will be written into the permit and must be sufficient to allow the operator some flexibility in unit operation.

Assessment of incinerator performance

Key parameters that influence or determine the destruction and removal efficiency of hazardous compounds during high-temperature incineration are the following: temperature, residence time, turbulence/mixing, oxygen availability, thermal stability and exit gas cleaning.

Features of cement kilns

Chlorinated waste streams are neutralized by the alkali present in the cement clinker; conversely, the chlorine component in chlorinated waste can supply the chlorine necessary in the process to reduce the alkali content.

Investment in capital equipment is minimal because the cement kilns are already in place.

Organic wastes with a significant heating value, such as waste oils, will allow fuel savings for a cement kiln. Fuel costs can run as high as 65 percent of the operating costs of a cement kiln.

Ash from destruction of the waste is absorbed in the clinker. Heavy metals tend to be trapped within the clinker as trace contaminants.

There is a very high thermal inertia within the kiln. The mass of clinker processed through the system tends to eliminate the possibility of rapid swings in temperature or other changes in the process. The process requires thermal stability to ensure product quality.

The cement process requires that temperatures in the kiln be maintained at 1 450°C. These temperatures will destroy all organic wastes.

Air emissions control equipment is already in place for the collection of particulates. In dry processes CaCO₂ is fed counter-currently of the exit gases and functions as a scrubber.

The cement kiln operates under negative pressure. This is a requirement for kilns used as hazardous-waste incinerators, which must be maintained at a negative pressure to prevent emissions.

Cement kilns compared with dedicated incinerators

In comparing combustion in a cement kiln with other methods of disposal that are considered not harmful to the environment, the following points become apparent:

- Incineration of these wastes is normally done at a flame temperature of 1 200°C to 1 500°C while cement kiln flame temperatures are 2 000°C or higher. For the production of cement clinker these temperatures are necessary, and so there is no need for the constant monitoring of temperatures that is required when burning in a dedicated incinerator.
- The retention time in a cement kiln flame envelope is considerably longer than normally found in a dedicated incinerator.
- To prevent operating difficulties, such as kiln rings, in a cement kiln the amount of chlorine is restricted to approximately 0.6 percent relative to clinker.
- There is always a high quantity of lime in the cement kiln to react with hydrogen chloride and thus prevent emission of this compound to the atmosphere.
- Burning of wastes in a cement kiln saves fossil fuels, which are used to ensure combustion of these in a dedicated incinerator.
- Beneficial use is obtained in a cement kiln of persistent and toxic waste materials, which normally require disposal.

Wastes utilized in trial burns in cement kilns in Norway

In the Dalen plant: waste oil(s), liquid organic hazardous wastes (PCB and TCE) shredded tyres and car parts and solid hazardous waste (mixed with sawdust).

In the Kjølsvik plant: solid refuse-derived fuel (RDF), liquid organic hazardous wastes (TCE – mainly as a chlorine source), gaseous CFCs and plastics.

Main results

Waste preparation and feeding. The plants for waste preparation and equipment for introduction of liquid, solid and gaseous wastes function very well. Liquids and gases are fed through the main burner (or primary air duct) and solids in the precalciner/preheater.

Combustion and process control. The combustion and the process control function very well, even for low calorific value wastes and solid wastes.

Mass balances and distribution pattern of heavy metals and chlorine. Mass balances have revealed special distribution patterns for volatile heavy metals and process limitations for selected heavy metals and for chlorine in the Dalen plant.

This is caused mainly by the internal recycling of CKD/EPS dust.

Environmental, safety and health aspects. The present plants have been burning up to 15 000 tonnes of hazardous wastes and 30 000 tonnes of waste oil per year without any incidents. Emissions into the air are low for all pollutants and are also independent of whether there is waste burning or not.

Product quality. Extensive physical and chemical testing has revealed a good product quality, which is far better than the quality criteria. Heavy metals will be retained in the clinker, but the concentration will be within the normal range of variations.

Benefits of burning hazardous wastes in cement kilns

The following are benefits of burning hazardous wastes in cement kilns:

- recovery of energy;
- reduction of production costs;
- DRE that is as good as it is in a dedicated incinerator, i.e. comparable residence time, temperature, turbulence and gas “scrubbing” in an alkaline environment;
- no residues to dispose of;
- lower total emissions (of CO₂) in Norway;
- solution of the “hazardous waste problem” – utilization of existing technology;
- conservation of non-renewable fossil fuels;
- environmentally sound and as effective as a dedicated incinerator;
- utilization of long experience with waste handling;
- lower destruction costs.

Concerns in the use of cement kilns for waste disposal

A number of concerns must be addressed in the use of a cement kiln for waste disposal. Process design features and institutional factors can affect the use of a cement kiln. Typical of these considerations are the following:

- The location of the waste feed must be carefully considered. If waste is introduced at the low-temperature end of the kiln, volatiles may be released too soon, without sufficient residence time to completely burn out. If waste is placed in the kiln too close to the product discharge, there may be insufficient contact time to ensure homogeneous mixing of waste residual; clinker and product quality may deteriorate.
- Excess chloride degrades cement quality. An excessive level is difficult to predict and must be determined by tests on the actual waste stream.
- Conventional cement kilns are run with very little operator attention required. Hazardous waste requires continuous operator attention to feed and product quality control, which represents an increase in the cost of operation.
- The storage and feeding of hazardous wastes at a cement kiln requires that extensive personnel safety procedures are implemented. This represents another increase in the cost of operation of the facility.

In balance, the use of existing cement kilns has been found to be effective in the disposal of hazardous waste and there is a potential for cost savings.

Important issues in waste utilization

The following are key issues that have to be considered in relation to the use of alternative fuels and/or alternative raw materials in the cement industry:

- existing directives and regulations, i.e. licence conditions;
- environmental, safety and health aspects;

- public opinion;
- product quality aspects;
- process implication;
- costs.

In addition, the following process and quality considerations should be taken into account:

- heating value and water content;
- content of chlorine, sulphur and heavy metals;
- waste composition, i.e. treatment and introduction.

The following are the licence conditions:

- differentiate between waste oil (WO) and hazardous organic wastes (HOW);
- waste composition (general classification);
- content of organic chlorine, PCB and lead (different for WO and HOW);
- feeding amounts (tonnes per year and tonnes per hour);
- process and temperature conditions;
- storage safety.

Conclusions

For nearly ten years, NORCEM has utilized different types of liquid and solid wastes as a co-fuel in its precalciner/preheater kilns. High calorific value wastes such as solvents and paints have been incinerated without incidents of any kind. Extensive studies have revealed that this is a sound environmental practice that reduces, by up to 40 percent, the need for non-renewable fossil fuels (i.e. coal) in cement production and the Norwegian need for destruction of organic hazardous wastes.

Based on these findings, the Ministry of the Environment in November 1995 decided not to build a dedicated incinerator for hazardous wastes in Norway. Instead the Ministry decided to utilize the advantages of the existing cement kilns, which are the high temperature, long residence time, turbulence, oxidizing conditions and efficient scrubbing of the exit gases with the raw materials containing high amounts of limestone.

Annex 5

FAO press release: problem of obsolete pesticide stocks deserves greater attention by donor countries and industry

Rome, 4 March 1998: Huge amounts of obsolete and unused pesticides continue to threaten human health and the environment in many developing countries, the UN Food and Agriculture Organization (FAO) warned today following the conclusion of a two-day expert consultation on pesticide disposal. FAO urged the international community to increase its efforts to solve “this environmental tragedy”.

The meeting listed priority countries where it said clean-up operations should begin soon. These include the Gambia, Madagascar and the United Republic of Tanzania. Several donor countries indicated their interest in funding such operations.

It is estimated that there are more than 100 000 tonnes of obsolete pesticide stocks in developing countries, of which Africa has about 15 000 to 20 000 tonnes. “Leaking and corroding metal drums filled with obsolete and dangerous pesticides dot urban and rural landscapes of developing countries,” said FAO expert Alemayehu Wodageneh. “If stocks are located in urban areas or near water bodies, which is often the case, groundwater, irrigation and drinking-water are at risk.” Enormous stocks of pesticide waste also exist in Eastern Europe and parts of the former Soviet Union.

Particularly in Africa, large proportions of obsolete pesticides are leftovers from earlier foreign assistance programmes. They can no longer be used because they are now banned or they have deteriorated as a result of prolonged storage.

According to FAO, in Africa and the Near East only 1 511 tonnes have been disposed of in ten countries (the Niger, Uganda, Madagascar, Mozambique, Zanzibar, Yemen, Tanzania, Zambia, the Seychelles and Mauritania).

Among the highly toxic and persistent pesticides identified were aldrin, DDT, dieldrin, endrin, HCH, lindane, malathion and parathion.

Total costs to remove obsolete pesticides from Africa alone are estimated at US\$80 million. Most of the money spent on disposal of pesticides in Africa was financed by the Netherlands, Germany and FAO. Denmark recently committed \$6 million for pesticide removal and capacity building. Until now the agrochemical industry contributions have been very limited, but they are expected to grow in the near future.

“Aid agencies are prepared to contribute, but do not wish to cover all costs without a substantial contribution from the agrochemical industry,” FAO stressed.

During the meeting, industry representatives indicated their commitment to finance, on a case-by-case basis, up to 30 percent of disposal costs. The industry said it would help to clean up pesticide waste in countries such as Senegal (275 tonnes), Madagascar (75 tonnes) and the Gambia (21 tonnes).

The preferred way to dispose of obsolete pesticides is high-temperature incineration. Safe incinerators are rare in developing countries, and pesticides are repackaged and shipped to a country with a hazardous waste destruction facility. In the past, waste was shipped to Europe.

Unless prevention occurs, FAO warned, it is likely that the accumulation of hazardous pesticides in the environment will continue unabated. Worldwide sales of pesticides increased substantially in both 1995 and 1996.

According to FAO, the main causes for the accumulation of pesticides are:

- pesticides that have been banned while in storage;
- inability to forecast pest outbreaks and excessive donations;
- poor assessment of pesticide requirements;
- inadequate storage facilities and poor stock management;
- ineffective or wrong pesticide formulations;
- aggressive sales practices.

FAO called upon its members to apply integrated pest management (IPM) and to reduce the use of pesticides, where this is possible.

