

## **SESSION 6**

# **MANAGING RECOVERY OF PESTICIDE PACKAGING**

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## PESTICIDE CONTAINER RECYCLING IN CANADA

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### ABSTRACT

The Crop Protection Institute, a trade association representing the pesticide industry in Canada, operates a nation-wide program to collect and recycle empty, one-way, commercial pesticide containers. Introduced in 1989 as a commitment to manage packaging waste, it is one of several stewardship programs to demonstrate industry leadership through self regulation.

To the end of 1996 the program had collected more than 21 million containers for an average recovery rate of 59% over the period and 64% for the year. It is being guided by a vision of an environment free of pesticide containers. The program has objectives to recover 70% of containers in 1997, 90% by 2000 and to recycle in a safe way, all materials collected annually.

Manufacturers fund the program by paying a fee to the Crop Protection Institute for each container shipped. The amount is determined annually according to budgeted costs. For 1997 it is £0.26 per container (equivalent to \$Can 0.62 or \$US 0.44). In 1994 the Crop Protection Institute took over direct management of the program from regional stakeholder groups, resulting in a fee reduction by 1996 of 36%.

In 1996, there were 3,893,000 containers collected at 819 locations. Plastic jugs represented 98% of containers collected, with an average weight of 0.35 kg. Two-thirds of those collected were recycled into fence posts for use on farms and the remaining containers were processed for their energy value in industrial plants. Experience has demonstrated the need for a collection system that allows for inspection of containers returned by farmers to ensure they are empty and clean.

Success of the program is due to the joint participation with industry of farmers, pesticide vendors, municipalities, regional committees and government personnel. Governments recognise it as a model industry environmental stewardship program and members have benefited from freedom to operate as a result of self regulation.

### INTRODUCTION

The Crop Protection Institute is a trade association representing the manufacturers, formulators and distributors of crop protection products in Canada. As part of its strategic plan it has an objective "To demonstrate industry leadership through self regulation". This direction was set by the Board of Directors a decade ago when it recognised that the freedom to operate in the crop protection business would be better served by proactive industry actions than by government intervention caused by public reaction. It was realised



that initiatives on several fronts were needed to foster among consumers a balanced view on pesticides. Directors considered it important that the industry be seen doing the right things to ensure safety to people and the environment. This foresight resulted in the introduction of a range of stewardship programs which have gained credibility for the industry with federal and provincial governments.

The first program was launched in 1989 in the form of a communication campaign to farmers on the proper use and safe handling of pesticides. It was readily accepted by all levels of government and grower organisations, and it created an opportunity for industry to develop important alliances. The campaign resulted in a marked improvement in the application and handling of pesticides by users.

Coincident with the safe-use campaign, the industry undertook to set standards for its own manufacturing facilities, to require compliance with the standards by all members and to conduct annual audits to ensure adequate levels of safety and continuous improvement. Success has been measured by increasing audit scores and the absence of dangerous incidents.

A series of fires in pesticide storage areas during the late 1980's, and consequent wide coverage of damaging news reports, prompted the creation of an industry-led program to set standards for pesticide warehouses throughout the distribution system. The initiative met with much resistance by retailers and it was necessary for manufacturers to force adoption of the standards by shipping only to locations in compliance. Since full implementation in March 1995 there has not been a single incident and warehouse owners now recognise and reap the benefits of community acceptance and much lower insurance rates.

The most recent initiative in self-regulation is a program launched in September 1997 to certify industry personnel to a standard level of knowledge and competence about pesticides. The course was developed in conjunction with leading universities. Sales and marketing employees of manufacturers are required to comply within two years.

The major undertaking by manufacturers, also introduced in 1989, was a commitment to reduce packaging waste 50% by 1995. Out of this came actions such as an increase in refillable packs, a movement towards solid formulations, adoption of water soluble packs and development of a program to recycle non-returnable plastic and metal containers. It is this latter activity which is the subject of this paper.

The first industry involvement in the disposal of pesticide containers was at the request of governments in the prairie provinces of Alberta, Saskatchewan and Manitoba who called for financial help to remove containers from existing municipal collection sites. Rural municipalities had established these sites during 1979 to 1983, but as the return rate for containers increased they were unable to cope with the volume and did not have the funds or expertise required for disposal. Some sites were forced to close and farmers discarded containers in inappropriate places. Provincial Departments of Environment demanded action by industry to resolve the problem.



## METHODS

### Self-regulation initiative

Facing draft legislation in the province of Alberta which required individual companies to take responsibility for disposal of their empty pesticide containers, industry members decided to meet the challenge by working together through their trade association, the Crop Protection Institute. The rationale was that a national industry program would be more efficient than separate and different requirements in each province. The program started in 1989 in the three prairie provinces, which account for about three quarters of disposable commercial pesticide containers in Canada. All manufacturers agreed to participate on a voluntary basis.

A plan was prepared by industry members to establish provincial stakeholder groups to develop and operate programs to remove and dispose of containers from municipal collection sites. The intention was to finance the program by including a surcharge of one dollar per container on sales throughout the distribution chain. This method to raise funds did not work, however, because some distributors refused to pass on the surcharge or pay their supplier. The manufacturers then decided to finance the program from general revenue and that has been the case since 1990. The initial role of the Crop Protection Institute was to collect money from members and to distribute it to stakeholder groups on the basis of the number of containers sold per year in each territory.

Working through provincial stakeholder groups was an effective way to establish a collection program, but it was inefficient and fraught with problems. Major issues were accountability of funds, safe disposal of contaminated plastic, dirty containers and unwanted pesticides returned by farmers to the unattended municipal collection sites, worker safety concerns and escalating costs.

When the program was extended to the provinces of Ontario and Prince Edward Island in 1992, with the benefit of some experience, it was decided to collect containers at volunteering vendor locations. The requirement was that all containers be inspected and accepted only if they were clean and dry. This method of collection was extended to the provinces of Nova Scotia and New Brunswick in 1993, to Quebec in 1994 and to British Columbia in 1995. It has many advantages over collection at unattended sites.

### New method of management

In June 1994 the Crop Protection Institute Board of Directors approved a new strategic plan for the Container Management Program. The guiding vision is "An environment free of pesticide containers". The plan established national policy and standards, and set specific goals for performance and efficiency improvement. The role of provincial stakeholder groups changed from operational to advisory, and their relationship with the Crop Protection Institute was defined in formal agreements. The Crop Protection Institute took over direct management of the program and hired contractors for container collection, shredding and recycling. It retained control of recycling policy and end-use product approval.



Goals were set to recover 70% of the containers sold annually by 1997 and 90% by the year 2000, and to achieve recycling or energy recovery of all containers collected. Costs were to be reduced 5% per year between 1994 and 1998. The levy to members was to be determined annually on the basis of budgeted costs. A Technical Advisor was engaged on a part time contract basis to develop recycling options, to conduct safety studies and to ensure safe practices and procedures.

### Program development

A large number of studies have been carried out to guide development of the program. Worker exposure studies were conducted on field crews collecting and shredding containers, and those working in plants to recycle plastic. Samples of plastic from all territories were analysed to determine pesticides present and levels of contamination. Plastic end-use products were tested for pesticides leached by water and dislodged by handling, and risk assessments to people and the environment were conducted. In plants using plastic container shreds for energy value, studies were conducted to assess environmental risks from stack emissions and scrubber water. Monitoring procedures have been put in place to ensure the safety of plastic end-use products.

The major challenge has been to find a use for plastic from shredded containers, all of which may be contaminated with pesticides. In addition to actual contamination there is a problem of perception associated with a product made from container plastic which further limits use options. Various uses for plastic have been explored, but only two are currently employed; one is for the manufacture of fence posts for agricultural use, the other is as a fuel source in industrial plants.

An important aspect in the growth of the program has been an annual campaign to encourage farmers to participate. Communications concentrated on firstly, awareness, secondly the location of collection sites and, in recent years, the proper rinsing of containers. Promotion has been mostly through farm press and local radio. Stakeholder groups help to implement the campaign and attend stands at farm shows. Member company sales representatives promote participation by farmers at local meetings.

Transport regulations require the interprovincial movement of shredded plastic pesticide containers to be handled as hazardous waste. This classification restricts recycling efforts and increases costs. Discussions with Transport Canada and Environment Canada, and support from all provincial governments, resulted in a Permit for Equivalent Level of Safety being issued to the Crop Protection Institute by the transportation authority. It allows for the movement of shredded container materials under a less restrictive classification as Dangerous Goods, provided additional permit requirements are met. It is a good example of government co-operation with industry to enhance recycling opportunities.

With a view to improving the program in the prairie provinces a survey was conducted in 1996 among 457 farmers and 151 custom applicators. It assessed container disposal behaviour, rinsing practices, usage of container collection sites, accumulation of waste pesticides and the likely effect on these practices of moving to container collections at retailer locations.



In 1997 a feasibility study was conducted in Saskatchewan to assess the possibility of changing the collection of containers in the prairies from municipal sites to dealer locations.

## RESULTS

The Container Management Program is fully operational throughout all agricultural areas in Canada and accepts non-returnable, plastic and metal commercial pesticide containers, up to 23 litres capacity. All farmers and other users of commercial pesticides have access to collection sites and are encouraged to use the facility to recycle clean, empty containers.

Containers are collected and shredded by 5 contractors. In the Atlantic provinces, the contractor shreds containers at dealer locations. In Quebec and Ontario, containers are picked up from retailers in bags and shredded at the contractor's warehouse. The contractor for Manitoba does shredding at municipal collection sites. The contractor for Saskatchewan, Alberta and Northern British Columbia does shredding at municipal sites. The contractor in southern British Columbia collects containers in bags at dealer locations and shreds them at a central location.

Ten provincial stakeholder groups co-operate in the program. Their relationship to the Crop Protection Institute is set out in a formal agreement between the parties. The major duties of the groups are to inform and advise, and to assist with communications to farmers. Their representation of local interests varies by province and may include farmers, dealers, municipalities, the pesticide industry and provincial government departments of Environment and Agriculture.

To the end of 1996 the program had collected more than 21 million containers, representing an average overall recovery rate of 59.7%. In 1996 there were 3,893,000 containers collected at 823 sites, representing a recovery rate of 64%. Metal containers represented only 2% of the total. Containers collected in 1996 were 69% greater than in 1993.

The number of containers collected per province varies widely ranging from 10,000 to 1,500,000, reflecting the extremes in agricultural production. The predominant size of plastic containers also varies by province with weights ranging from .22 kg to .40 kg per container, with an average for Canada of .35 kg. Total weight of plastic collected in 1996 was 1,348 tonnes.

Approximately 830 tonnes of the plastic collected in 1996 was made into fence posts. These posts have a diameter of about 13 cm, are 2.4 m long and weigh about 18 kg. They carry a label indicating they are to be used only in agricultural situations. The remaining plastic was used for its heat value in industrial plants. One of these plants, a kiln which produces a light-weight aggregate, was in a start-up phase in 1997. The product is used in building blocks, as insulating material for water and sewer lines and as a soil conditioner.

The safety study on workers collecting and shredding containers identified the procedures with the greatest risks and resulted in improvements in work habits, sanitary practices and protective clothing to limit exposure to pesticides. Analysis of plastic shreds from all territories showed contamination by various products, mostly herbicides, and a very wide



range in levels of pesticide residues. Studies on fence posts showed insignificant environmental risk due to leaching from posts used in soil; they are not sold for use in water. Residues dislodged through handling were assessed for risk to plant workers. Margins of safety were considered to be adequate, even for workers handling posts daily with bare hands.

Plastic shreds used in the light weight aggregate plant reduce the requirement for natural gas by about 25%. The kiln operates at temperatures in the order of 1000° C. Analyses of stack emissions and scrubber water determined that processing plastic shreds from pesticide containers had no adverse effect on the environment.

The user survey in the prairie provinces determined that 81% of containers were emptied by farmers and 19% by custom applicators. Farmers used an average of 72 containers each whereas custom applicators averaged 1836 containers. Farmers claimed to have triple rinsed or pressure rinsed 82% of the containers taken to a collection site. On site inspections, however, determined that only about 70% of containers had been rinsed at all. In contrast to the large number of dirty containers from unattended collection sites, those collected at retailer locations are accepted only if they are clean and dry.

Of farmers interviewed, 69% said the reason they rinsed containers was to use all the product they had purchased. The major reason given for not rinsing, by those who had not triple-rinsed their containers, was a lack of time.

Disposing of waste pesticides by leaving them at unattended container collection or landfill sites was considered acceptable by 20% of farmers and 17% of custom applicators, even though there are signs posted prohibiting this practice. The survey also found that 97% of farmers had facilities to rinse containers at the location used to fill the sprayer and 99% of farmers put the rinsate in the sprayer and applied it to the crop.

In the 1997 Saskatchewan dealer collection study the objective was to assess the prospects of changing container collections to pesticide retailers in the high use area of the market. Farmers were asked to return clean containers to dealers who inspected them and placed them in large plastic bags. The bags were transported to a central location by trucks returning from making deliveries of pesticide products to vendors. Fifteen dealers volunteered to co-operate in the project and collected approximately 20,000 containers. All the dealers said they would participate in an ongoing program. Reasons for participating were given as, acceptance of some responsibility to help protect the environment, and some value to them in being seen to do the right thing in their communities. Some saw it as an opportunity to provide an additional service to their customers.

#### Program costs

Total program costs from the beginning of the program in 1989 to the end of the 1996/1997 fiscal year amounted to £11,400,000. The breakdown of that amount was 86.6% for field operations, 5.7% for communications with farmers, 4.2% for research and 3.5% for administration. During that period 21,093,000 plastic and metal containers were processed, for an average cost of £0.54 per container. Since introduction of new management for the



program in 1994, it has been possible to reduce the cost per container processed by 31% and to reduce the levy paid by manufacturers by 36%

Costs for the 1996 program were £1,680,000. The number of plastic and metal containers processed was 3,893,000, for an average cost of £0.43 per container. Total program costs for plastic containers were equivalent to about £1,220 per tonne. Costs for the collection, shredding and recycling of plastic containers were about £976 per tonne.

The break out of costs for the 1996 program was 88% for field costs, which included support to stakeholder groups, 5% for communications, 2% for research and 5% for all other costs which included consulting, financial management, project management, legal advice and administration overheads.

## CONCLUSION

With the benefit of hindsight, some lessons learned may be of use to other trade organisations starting similar programs, i.e.:

- Make formal agreements with partners which set out responsibility, accountability and funding.
- Include all players in the distribution system and seek their participation.
- Maintain a strong education program to farmers and solicit their support.
- Have a plan which includes objectives and methods of measurement.
- Develop national standards but allow for regional flexibility.
- Take the lead in program management and funding.
- Establish recycling methods prior to collection of containers.
- Be able to control quality of materials collected.
- Fit into existing systems where appropriate for maximum efficiency.
- Demonstrate the success of self regulation to governments and gain their support.

The Container Management Program is working well. Efforts for improvement will continue, particularly to further reduce costs, increase the recovery rate for containers, increase the cleanliness of containers and develop additional end uses for recycled plastic.

The crop protection industry in Canada is proud of its stewardship programs and although they have been costly, members are convinced they are worthwhile. That pride is being demonstrated by a program about to be implemented whereby members will portray on their letterheads and literature a logo which will signify their involvement in the Crop Protection Institute stewardship programs.

During the past decade the commitment to stewardship by the crop protection product manufacturers has strengthened significantly. There is no doubt the disposal of empty containers by individual companies would have been more costly to members than through the joint industry program.



The success of the Container Management Program has earned respect for the industry among farm groups, consumer organisations and provincial and federal governments. Several provincial Departments of Environment hold it up as a model for other industries to follow.

Although the industry was initially reluctant to become involved in the recycling of containers, the consensus among Crop Protection Institute members now is that it should have led the way in.

## THE IDEA OF THE CLOSED SUBSTANCE CYCLE AND WASTE MANAGEMENT ACT AND THE IMPLEMENTATION BY THE IVA - PACKAGING DISPOSAL CONCEPT

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### ABSTRACT

Since 1990 Germany introduced a new environment and waste policy with the Closed Substance Cycle and Waste Management Act (Kreislaufwirtschaft-und Abfallgesetz). The consequence of this Act has been that producers and consumers have had to undertake a radical re-think in the field of waste. The central message is: Closed substance cycles instead of waste disposal. Trade, Industry and private consumers are thus called upon to "think waste" from the very outset. Decisions on production and consumption will therefore no longer concentrate on the use and suitability of a product, but also the question of what will happen to the product at the end of its life cycle.

Since June 1991, the Packaging Ordinance (Verpackungsverordnung), as an integral part of the new waste law, compelled Industry and distributors to reclaim the packaging material. In view of the migration problem, agchem packs did not fall within the scope of the new Ordinance. Therefore a voluntary industry specific retrieval system was devised. Irrespective of pertinent legal provisions, large farms especially demanded the return of empty packs, since the conventional disposal as household waste was no longer accepted by all principalities. In particular, after reunification in 1990 in the new federal states, a solution was urgently required for the large farms.

Six years ago, IVA had already decided with distributors to develop a returnable concept of cleaned agchem packs.

This paper reports the experience and results after six years from the first pilot projects in 1991 to the final concept on 168 collection sites last year. Aspects covered are legal requirements, logistic problems, disposal options, costs and the legal implementation via "PAMIRA" (the recycling logo - Packmittelrücknahme Agro - Return of Packs in the Agricultural Area).

### INTRODUCTION

What to do with emptied packs for plant protection products?

Recently agchem industry and distributors in Germany have largely solved the problem of container disposal. CPP-packs emptied of residues and well rinsed are taken back and recycled by manufacturers and wholesalers. In 1996 this became nationwide for the first time. Confronted with the challenge of ever-changing issues, the industry-specific taking-back concept was tested and continuously further developed from first pilot projects in 1990, several pilot phases between 1991 and 1995, to the final concept since 1996/97. Subsequently



the German Crop Protection and Fertiliser Association (Industrieverband Agrar - IVA) and wholesalers jointly introduced the taking-back concept as a new element of the agrochemical market. This proactive initiative was made ahead of any legal provisions and in compliance with the customer's needs in the agricultural practice. The initiative demonstrates the crop protection industry's sense of responsibility for its actions and products and is understood as a major contribution to the programmes "Responsible Care" and "Product Stewardship". But it must not be forgotten that all parties involved had to make great efforts to bring an all-area concept for taking back agrochemical packaging into being.

## **CURRENT LEGAL SITUATION**

In 1990 Germany began a new environment and waste policy with the new "Closed Substance Cycle and Waste Management Act" (Kreislaufwirtschafts- und Abfallgesetz). This Act means both producers and consumers will have to undertake a radical re-think in the field of waste. The central message is: Closed substances cycles instead of waste disposal. Trade, industry and private consumers were called upon to "think waste" from the very outset. Decisions on production and consumption will no longer concentrate on the use and suitability of a product but also look at the question of what happens to the product at the end of its life cycle.

Since June 1991 the Packaging Ordinance (Verpackungsverordnung) has been an integral part of the new "waste legislation" which obliged industry and distributors to take back the packaging material. Because of the migration problem agrochem packs did not fall in the scope of the new Ordinance so that the branch had enough freedom to build up a voluntary, branch specific collection and disposal program.

Actually the adoption of a 2nd Packaging Ordinance (the so-called "Ordinance on the Packaging for Contaminated Packaging-") was expected, but as matters stand at the moment the Federal Ministry of the Environment is likely to amend the valid Packaging Ordinance at the beginning of 1998. The forthcoming amendment will oblige the agrochemical industry and distributors to take back emptied and well rinsed packs as from January 1 1999.

Irrespective of pertinent legal provisions, especially large farmers demanded the return of old packs, since "conventional" disposal as household waste was no longer accepted by all municipalities. In particular in the new federal states (Bundesländer) action was urgently called for because of the vast sizes of agricultural undertakings and the thus equally vast quantities of packaging waste. In view of the described situation, IVA decided six years ago to jointly develop with wholesalers a taking-back concept meeting the very special needs of the plant protection market and giving due consideration to agricultural practice. (Annex 1).

## **FROM PILOT PROJECT TO FINAL CONCEPT (ANNEX 2)**

### Preliminary phase 1990

On the initiative of 16 farmers, a first collection was carried out in the Rhineland in order to gain basic experience in the collection and recycling of old packs.



### Pilot phase I - 1991

The first pilot phase commenced in summer 1991 at 7 collection sites in 5 federal states. Each collection was organised and supervised by an IVA member company. Return questionnaire provided the basis for the statistical evaluation of the collection activities. For the first time collection, transport and recycling of returned packaging materials were entrusted to private disposal companies. Studies of the waste materials' suitability for recycling in material and thermal processes revealed that from the purely technical point the recycling of plastics was feasible despite migration residues. However other processes of raw material recycling (e.g. pyrolysis and hydrogenation but also energy recycling) are politically preferred, because they are ecologically justified.

### Pilot phase II - 1993

The year 1993 saw a second pilot phase with 24 collection sites in 12 federal states. For the first time collection sites set up at wholesalers were organised by a co-ordinator in a company-neutral approach. IVA-member companies only took a supporting interest in the collection initiative.

Compliance with the demands to cleanness was no longer checked by wholesalers but by the controllers from disposal companies. All collected plastic packs underwent raw material recycling in the form of hydrogenation. As compared with pilot phase I, the share of clean packs further improved noticeably so that criteria regarding cleanness were met by 85 % (!) of the returned packs.

### Pilot phase III - 1994

In 1994 containers were taken back with no limitation of quantities throughout 2 administrative districts (Regierungsbezirke) in Northrhine-Westphalia. For the first time, manufacturers from outside IVA participated in the project. Also for the first time, financing was based on the IVA Packaging Statistics: The sum to be financed by a given manufacturer is determined by the mass of packaging materials this manufacturer placed on the market. In order to lower transport costs, a newly-developed mobile shredder was deployed, reducing the volume of collected packs by two thirds.

### Pilot phase IV - 1995

In 1995 the taking-back concept was once more tested and further optimised by the distributors in an extended pilot phase covering all areas of the 5 new federal states in East Germany. At 25 collection sites a total of more than 500 t of plastic packs was returned. Yet another "premiere": The collected waste packs underwent raw material recycling in steel production. In a new process the plastic materials substitute for crude oil. They are gasified at roughly 2000°C in the blast furnace, serving as reducing agents in the conversion of iron ore into pig iron. (Annex 3: Detailed description of the process).

## **FIRST NATIONWIDE TRIAL RUN - 1996 AND 1997**

Acceptance was subject to the following criteria: containers with a volume of up to 60 l from the agricultural sector, bearing the German original label. Packs must be emptied of residues and properly rinsed. If possible, packs should be clean not only inside but also outside. Packs were to be returned in an open state; closures could be returned separately to the collection



site. Product residues are hazardous waste and were, therefore, rejected. Plastic containers, metal packs and volume-flexible packs (e.g. bags and sacks) were also eligible for acceptance.

Altogether the initiative found an excellent response with farmers. This conclusion was substantiated by the high share of clean packs and the encouraging return quotas, although they vary largely between the regions. Whilst in certain regions more than 50% of the packs originally placed on the market were taken back in federal states with big sized farms, return quotas in regions with small sized farms did not even reach the 20% mark. The reasons for these strong divergences are not only regionally different agricultural structures (crops and farm sizes). That in regions with mostly small undertakings, disposal as household waste was still permitted so that farmers simply did not have to bother to come to the collection sites. In regions bordering on other Western European countries, the outcome of the initiative was influenced by the fact that packs of imported products were not eligible for return. Encouragingly high return quotas were reached in geographical areas which saw similar collection activities back in the years before. In total 1996 920 t (return quota of 45%) and 1997 1050 t (return quota of 50%) were collected.

The evaluations of the return questionnaires reveal that farmers are ready to cover distances of some 30 km to a collection site. Obviously IVA's comprehensive information strategy, advertisements in the agricultural press, leaflets and posters displayed at sales points as well as information support from the Official Agricultural Service and many municipalities drew the farmers' attention right on time to the collection initiative.

The committed support from the distributors also had a strong positive influence on the initiative. For example, training measures for staff in charge of collection sites were organised at the regional level by wholesalers and in close co-operation with the co-ordinator and disposal companies. These training measures were a valuable contribution to the smooth implementation of all collections.

## **COSTS**

The scheme is free to farmers. Disposal costs (collection, visual check, shredding, transport, disposal, administration and PR) will be borne by industry. On the basis of the IVA packaging statistics, expenses are apportioned to the manufacturers. Costs for providing and organisation of the collection sites are borne by the distributors. The current total costs are around 2.500 DM/t.

## **SUMMARY AND OUTLOOK**

The first two overall collection programs of the last two years showed that the agchem industry and the distributors are heading in the right direction. They will continue on this road so that the problem of adequate disposal for agchem-packs appears to be solved. The final disposal system will be operated under the name "PAMIRA" (Packmittelrücknahme Agro ≈ Return of packaging used in the agricultural sector, Annex 4) and in the legal form of a "GmbH" (Gesellschaft mit beschränkter Haftung ≈ private limited company). Since last season industry use the logo "PAMIRA" on agchem-packs so that all packs bearing this logo - on condition that they be duly emptied of residues and rinsed - will qualify for acceptance at the collection sites. The crucial factor for the project's further success is that farmers accept the "rinsing obligation" and quickly get used to the new taking-back system.

## ANNEX 1

### Present Legal Situation (January 1998)

- \* **Packaging Ordinance (Verpackungsverordnung - VerpV) of June 12 1991**  
At present, packaging for plant protection products are not subject to the VerpV I (§ 2 (3)).
  - Packaging with residues or adhesions of substances/preparations which are dangerous to health (§ 4 of the Ordinance on Dangerous Substances - GefahrstoffV) or dangerous to the environment (§ 3a (2) of the Chemicals Act - ChemG) are exempted.
  - Also in future, packaging for plant protection products must be disposed over domestic refuse; the disposal obligation of rural administrative districts/municipalities is maintained.
  
- \* **Amendment to the Packaging Ordinance (Verpackungsverordnung - VerpV), draft 1/98**
  - § 7 (1)
  - Obligations to take back sales packaging for polluting goods:
    - (1) "By January 1 1999 producers and distributors of sales packaging for polluting goods shall make adequate arrangements to ensure that used packaging emptied of residues can be returned free-of-charge by end consumers within a reasonable [geographical] distance."





Starting concept  
1991

gradual adaptation  
to practical conditions

Final Concept  
1996/97

Pilot Project	Collection Sites	Objectives
I - 1991	7 collection sites/ 5 federal states	<ul style="list-style-type: none"> <li>- first experience</li> <li>- organisation by/ accompanying role for 1 member company / collection site</li> <li>- taking back protocol</li> <li>- control by traders</li> <li>- recovery of materials / energy recovery → no recycling</li> <li>- first contact with the Federal Ministry of Environment (BMU)</li> </ul>
II - 1993	24 collection sites/ 11 federal states	<ul style="list-style-type: none"> <li>- wholesale trade appoints collection sites</li> <li>- „company-neutral“ organisation by co-ordinator</li> <li>- sponsorship by IVA member companies</li> <li>- <b>limited acceptance in terms of quantities</b></li> <li>- <b>control by disposal companies</b></li> <li>- improved cleanness of containers</li> <li>- improved contacts with political institutions</li> </ul>
III - 1994	9 collection sites/ 1 federal states (Northrhine - Wesphalia - NRW)	<ul style="list-style-type: none"> <li>- collection limited to given region, with activities stretching throughout this regions</li> <li>- no limitation to quantities</li> <li>- participation of companies who are not IVA members</li> <li>- financing on the basis of IVA packaging statistics</li> <li>- <b>optimisation of costs with the help of shredders</b></li> <li>- lobby work in ministries and with the district president of NRW</li> </ul>
IV - 1995	25 collection sites in the 5 new federal states	<ul style="list-style-type: none"> <li>- all-area collection in East Germany</li> <li>- no restriction to quantities</li> <li>- participation and financing like in 1994</li> <li>- optimisation of costs with the help of mobile shredders</li> <li>- <b>feedstock recycling in steelworks (Stahlwerke Bremen)</b></li> <li>- <b>political acceptance in BMU and ministries of the new federal states</b></li> </ul>
V - 1996 and 1997	1st all-area collection throughout all 16 federal states	

**Utilisation of waste plastics as a reducing agent  
in the blast furnace method**

**Preliminary remarks:**

In steel production according to the blast furnace method, hydrocarbons have been used successfully for more than 200 years as reducing agents in the transformation of iron ore into pig iron. In 1994 "Stahlwerke Bremen GmbH" was the iron industry's first company to test waste plastics as a substitute for heavy oil. In view of the positive experience made in the trial period, Stahlwerke Bremen are planning a plant with a capacity of some 10 t/h (70,000 t/a) using this novel approach. The plant will go on stream on July 1 1995.

IVA and Stahlwerke Bremen have entered into an agreement on the utilisation of plastic packaging (plastics) collected within the pilot phase 1995.

**Description of the method:**

The blast furnace serves to produce pig iron needed as an input material in steel production. In the blast furnace method, oxygen is removed from the iron ore, and the remaining metallic iron is melted open. Reduction (oxygen removal) is the result of the iron ore's reaction with a gas whose components CO and H<sub>2</sub> bind the oxygen. The reduction gas is obtained in the gasification of coke, oil or plastics with preheated air. The heat generated in the gasification process is needed to heat up the "reaction partners" to the temperature needed for the reduction and to melt the iron. Layers of ore and coke are fed from above in the blast furnace. The coke is consumed, and the iron melts, slowly sliding downwards. It is met by the reduction gas heated up to 2000 °C which is flowing up from below. In the intensive contact, oxygen is optimally removed from the iron ore.

The plastics cannot be blown into the blast furnace without previously comminuting the agglomerate to < 5 mm. Plastic waste can be transported to the plant in bags or in silo wagons. In a comprehensive measuring programme mainly focusing on dioxin and furan contents, no significant increase in waste gas emissions linked with the use of plastics was observed.

**Assessment of the method:**

Unlike in combustion processes, in the blast furnace method more than 80% of energy contents are used as chemical energy and not as thermal energy. Therefore, the Federal Ministry of the Environment has recognised this method as raw materials recycling in the meaning of the packaging ordinance. Another advantage of the blast furnace method as compared with other processes in raw materials recycling (e.g. hydro-cracking etc) is that the blast furnace does not have to be operated especially for this purpose.

**Costs:**

Currently recycling costs are at DM 170/t.



ANNEX 4



Packmittel-Rücknahme Agrar

A Voluntary Collection and Disposal Concept of  
Industry and Wholesalers  
for Agrochemical Packagings

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## MANAGING CROP PROTECTION AND ANIMAL HEALTH PACKAGING WASTE IN AUSTRALIA

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### ABSTRACT

The Australian Government, through the Australian and New Zealand Environment and Conservation Council (ANZECC), established a Task Force to develop a national strategy for the management of empty, unwanted containers in response to recommendations by the Senate Select Committee on Agricultural and Veterinary Chemicals in Australia.

Avcare Ltd, the National Association for Crop Protection and Animal Health, participated with regulatory agencies in developing the strategy. At the same time Avcare defined an industry strategy and commenced its implementation in 1993.

The National Strategy for the Management of Empty, Unwanted Farm Chemical Containers, was adopted by ANZECC at its meeting on 19 December 1997.

Avcare has proposed an agreement between the National Farmers Federation, the Australian Local Government Association, Avcare and the Veterinary Manufacturers and Distributors Association, for an Industry Waste Reduction Scheme to implement the National Strategy.

The objectives of the Scheme are to achieve a reduction in the amount of industry packaging waste and to facilitate the collection, inspection, and processing of empty containers for recycling or material recovery. Under the proposed Scheme, manufacturers will pay a levy of 4 cents per litre on all non-returnable, rigid plastic and metal packaging to finance the program, and pass the levy on to distributors and users. The industry expects the Scheme to commence on 1 August 1998.

### INTRODUCTION

Avcare Limited, the industry association which represents crop protection and animal health companies in Australia, has worked with farmers and local government for a number of years to improve the management of empty crop protection and animal health product (farm chemical) containers.

This paper discusses the results of programs undertaken by Avcare since 1993 and the proposed agreement between the National Farmers Federation, the Australian Local



Government Association, Avcare and the Veterinary Manufacturers and Distributors Association, for an Industry Waste Reduction Scheme (Scheme).

The development of the Scheme has required extensive negotiations with the three tiers of government and with farmers who are represented by the National Farmers Federation.

The Commonwealth of Australia is a federation of six States and two Territories. The States and Territories have formal responsibility for areas such as education, transport, agriculture and environment protection. The third tier of government is local government, which are bodies created by legislation at the State and Territory level.

Local government functions generally include town planning and supervision of building codes, water sewerage and drainage systems, public health, waste and sanitary services.

Legislation and regulation that impacts upon farm chemical containers involve all three tiers of government and, at the State and federal levels, several government agencies are involved.

The Senate Select Committee on Agricultural and Veterinary Chemicals in Australia (Report 1990), recommended the development of a national strategy for the safe and effective disposal of empty chemical containers in response to concerns raised by farmers, local government councils and regulatory agencies about their disposal.

The Australian and New Zealand Environment and Conservation Council (ANZECC) established a Task Force on Farm Chemicals Container Management to review industry strategies and develop a national container management strategy.

ANZECC is a non-statutory Ministerial Council, which includes the relevant Minister from each of the States, Territories, New Zealand and the Commonwealth. The Council provides a forum for member Governments to exchange information and experience and to develop coordinated policies in relation to national and international issues.

A draft National Strategy for the Management of Empty Unwanted Farm Chemical Containers was published on 29 June 1995 and was widely distributed for public comment.

ANZECC endorsed the revised National Strategy at its meeting on 19 December 1997. The strategy recommends that Government cooperate with industry to implement the principles of the strategy and the adoption of voluntary industry waste reduction agreements which incorporate:-

- container reduction targets and recycling targets based on metal being re-used or recycled for materials recovery and plastic containers being re-used or recycled for material or energy recovery with appropriate monitoring and reporting mechanisms; and,
- a commitment to introduce appropriate financial support measures which have been supported by the National Farmers Federation and the Australian Local Government Association.

In mid 1996 Avcare commenced the process of developing agreement to an Industry Waste Reduction Scheme as the preferred method for implementation of the National Strategy. This has involved extensive consultation within the industry, with farmer organisations, local government and State and Commonwealth regulatory agencies.

### **AVCARE CONTAINER MANAGEMENT PROGRAM**

Avcare defined an industry strategy and commenced its implementation in 1993. The container management program included:

- education and training programs for the proper cleaning and rinsing of containers;
- pilot collection schemes and verification of inspection procedures;
- research into rinsing procedures and material recovery uses for plastic containers;
- surveys to establish base line data on rinsing and disposal practices; and,
- the development of longer term strategies to provide a permanent solution to the container problem.

#### Operation Clean Rinse

Educational and training programs were launched in 1994 to promote the proper rinsing and cleaning of containers by users, and their inspection before acceptance for either recycling or landfill disposal (McGuffog 1996).

During 1995/96 a series of meetings involving local government councils, farm chemical suppliers, farmers, environmental interest groups and Avcare committee members were held around Australia to explain Avcare's program and to encourage the development of community driven collection, inspection and recycling programs.

However, while there was general support for these initiatives, it also became clear that the funding of such programs were beyond the financial resources of most local government councils. This was one of the key factors that led to the proposals for the establishment of the Industry Waste Reduction Scheme.

#### Pilot collection schemes and rinsing research

Pilot collection schemes were commenced in 1993 and have provided valuable information to establish models for the collection, inspection, recycling and disposal of empty containers. Research was commissioned to verify the level of cleanliness of containers that were passed as clean by visual inspection in a pilot collection scheme (Avcare 1994 a).

In 1996 Avcare assisted in sponsoring a major regional collection project in Victoria to test the concept of reimbursing costs incurred by local government councils who establish collection and inspection schemes and arrange for recycling, crushing or shredding of containers through the use of contractors.



This project confirmed the feasibility of large-scale collection programs utilising contractors and demonstrated that farmers responded extremely well to pre-collection education and promotion programs by delivering only properly rinsed containers to collection sites.

#### Research and the development of material recovery programs.

Avcare sponsored research to evaluate rinsing procedures and to investigate the likely levels of residual contamination for typical products/containers following rinsing (Avcare 1993). The presence of residual chemical in containers is a barrier to recycling or material recovery uses.

A number of Avcare members have entered into arrangements with companies that collect and reprocess certain empty 20L and 200L plastic containers. The programs are suited to the reprocessing and re-use of containers used for water soluble, non-dangerous goods type products. The manufacturer purchases the reprocessed containers for filling with the same product and accepts back any residual product drained from containers during reprocessing.

Over 70% of the containers used by the crop protection and animal health industry in Australia are plastic and the lack of viable material recovery uses for plastic waste remains a significant barrier to finding alternatives to landfill disposal of these containers. Avcare has financially supported activities by the Australian plastics industry in seeking to develop a materials recovery use for empty plastic containers. The main focus for the plastics industry has been the potential to utilise containers as a fuel source in cement kilns.

The Senate Standing Committee on the Environment, Recreation and Arts, in its report on waste disposal (*Report 1994*) recommended that Government investigate the potential of using cement kilns for particular waste streams, such as plastic containers. However at present there are no commercial programs using plastic material as fuel in Australia.

Avcare has also funded research in an effort to develop the use of granulated plastic containers as fuel in electricity co-generation plants which would utilise a variety of waste sources as fuel.

Local manufacturers of steel containers operate a successful recycling scheme for their containers. This scheme will accept properly rinsed farm chemical containers.

#### Surveys and the development of an information database.

Avcare has undertaken an extensive program of research and surveys to develop a database of information to assist in developing policy and programs for container management.

##### *Industry audits*

A survey of national container usage was conducted in 1991 and audits of Avcare member usage of containers for calendar years were undertaken for 1993, 1995 and 1997.

##### *National survey of farmers*

A national survey of farmers' container management practices was conducted in early 1994 using a mail-out survey to a sample of 4000 farmers. The response rate to the survey was

77%. The report has been published in detail (Avcare 1995 a ) and as a summary (Avcare 1995 b).

A key finding of the survey was the high level of recognition of the need for rinsing among farmers. Over 90% said they rinsed their liquid containers at least once.

However, the relationship between formal training in the use of agricultural and veterinary chemicals and rinsing behavior (Turrell & McGuffog, 1997) highlights the need for on-going education and training to improve on-farm rinsing practices.

Another key finding was the methods that farmers use to dispose of containers. Figure 1 shows that 50% used the local refuse tip while 38% were storing them on farm.

The high level of reliance on refuse tips (landfills) underlined the importance of local government facilities while the very high level of on-farm storage demonstrated the lack of acceptable disposal options that were available to farmers in many areas.

#### *National survey of local government councils*

A survey of local government council container management practices and policies was also completed in 1994. An 88% response was achieved.

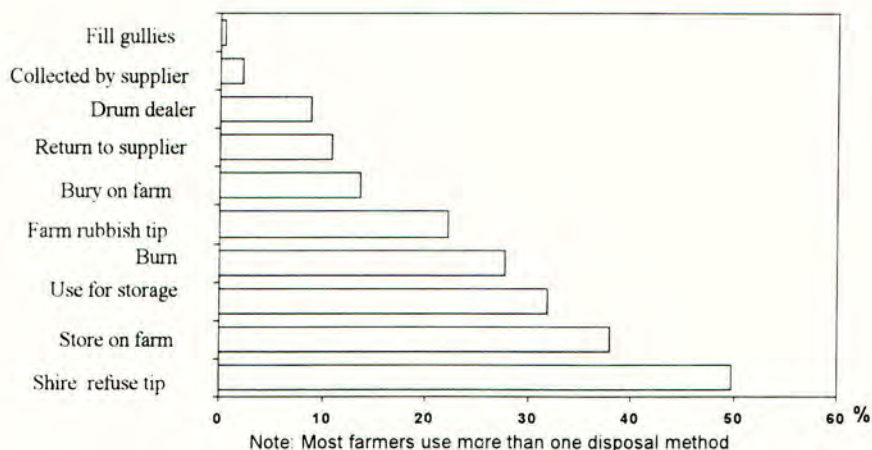
The survey found that over 40% of councils maintained a policy of not accepting containers for disposal at their refuse tips. Of those that said they accepted containers, only a small proportion exercised any degree of control over what containers were accepted.

A copy of the findings and recommendations arising from the survey (Avcare 1994 b) was mailed to all councils and local government associations in January 1995 inviting comment on the recommendations. This process was an important means of generating dialogue between the industry and local government.

The farmer survey and the local government survey identified the critical role of local government refuse tips in disposal practices and significant gaps in both the availability of safe disposal options and in procedures covering disposal of containers at council tips.



Figure 1. Disposal Methods Used by Farmers – percentage using various methods of disposal.



#### *Survey of ground spray contractors*

A survey among contractors involved in the application of farm chemical products with ground spray equipment was undertaken to establish an information base on their container management practices and the difficulties they experienced in managing empty containers.

The survey also asked respondents to rate various aspects of container design, particularly those features which impact upon ease of handling, ease of pouring and ease of rinsing.

The results of the survey (Avcare 1996) were widely distributed among industry and packaging manufacturers and this has led to some changes in package design.

#### Development of longer term strategies to provide a permanent solution to the container problem

State consultative committees, which included farmer organisations, local government representatives and State regulatory agencies, were established in all States during 1994 and 1995. These provided a valuable means of communication among the many stakeholders and Avcare has continued to use the network of contacts in developing the Scheme.

Avcare also consulted with State and Commonwealth environmental agencies who, through ANZECC, had established national targets for reductions in the amount of waste being disposed in landfill. An overall reduction target of 50% by the year 2000 (compared to the amount in 1990) has been accepted by most States, although NSW has established its target at 60%.

It should be noted that Australia has no high temperature incinerator for hazardous waste destruction, and no facilities for the incineration of municipal waste.

## INDUSTRY WASTE REDUCTION SCHEME

The key features of the Scheme are that it seeks full industry participation and operates on a user-pays basis, and levies all empty, cleaned non-returnable rigid metal and plastic farm chemical containers greater than 1 L/kg in declared content.

### Objectives

As shown in Table 1 the aim is to reduce the weight of non-returnable chemical container packaging by 32% and the weight of non-returnable chemical container waste potentially going to landfill by 68%, by the year 2000, when compared to the estimate for 1990.

These targets will be achieved by implementing waste reduction strategies which:

- encourage manufacturers to continue the introduction of new product, packaging and distribution technologies which will reduce the number of containers requiring disposal, and;
- fund the establishment of a system to remove targeted containers from farms and other premises for reuse, recycling or safe disposal.

Table 1. Waste reduction targets for non-returnable packaging using 1990 as the base year.

	1990 estimate (tonne)	Target 2000 (tonne)	% +/-
Dry packaging	330	638	+93%
Liquid packaging	4,547	2,912	-36%
Less Cubidor** reduction	0	(52)	
Less re-used packages	(90)	(231)	+157%
Total weight	4,787	3,267	-32%
Material recovered for recycling or energy (66%)	0	1,735	
Balance of packaging that could potentially go to landfill	4,787	1,532	-68%

\*\* Cubidor is a new form of packaging using a plastic film inside a cardboard box.

The most dramatic effect of the Scheme will be the changing profile of farm chemical containers as illustrated in Figure 2, which shows the graphical comparison between the container profiles in 1991, 1993, 1995 and the industry targets for the year 2000.



### Key Industry Targets

#### *Reducing the number of containers entering the distribution stream.*

The industry target for the year 2000 will be to:

- deliver 35% of its liquid products in either bulk or refillable containers;
- increase the total market share of dry chemical formulations to 23%;
- produce 8% of its dry and gel formulations in water soluble packages.

#### *Increasing the re-use of containers originally intended for single use.*

The industry target for the year 2000 will be to:

- collect, re-process and re-use 15% of all 20 litre plastic containers.

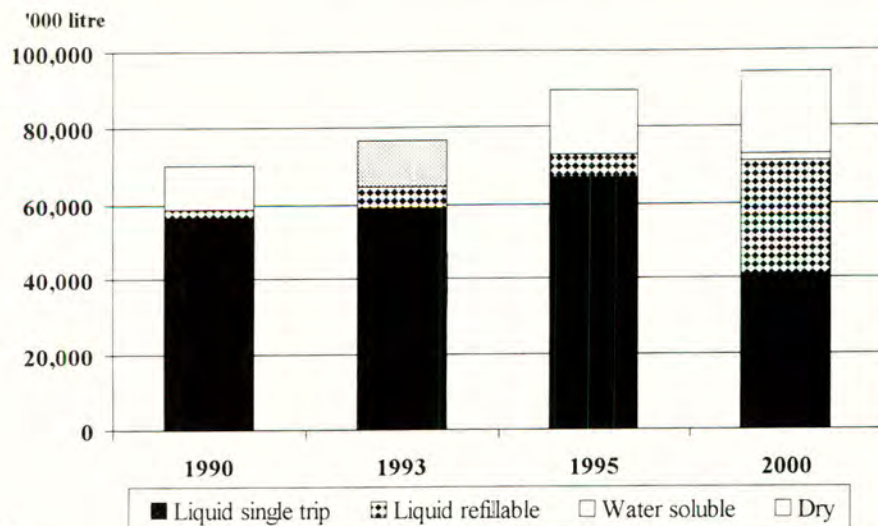
#### *Increasing the recycling of containers for material recovery.*

The industry target for the year 2000 will be to:

- increase the participation of local governments in container inspection, recycling and disposal programs;
- recover 66% of targeted containers;
- supply 50% of raw materials in recyclable or returnable packaging.

The Scheme will also cooperate with general packaging industry programs and steel can recycling initiatives to promote the return or recycling of packaging such as cardboard cutters, pallet wrapping and strapping.

Figure 2 – Volume of farm chemicals delivered in various forms and packaging for 1990, 1993, 1995 and the target for 2000



### *Improving occupational health and environmental practices.*

The industry target for 1998 will be to:

- ensure all Agsafe accredited premises carry promotional point-of-sale brochures and posters which promote proper rinsing practices.

### *Packaging*

The Scheme will also promote the adoption of easier to rinse and handle packaging, the use of safer emptying and rinsing devices, and the management of farm chemical containers in an environmentally appropriate way.

### Operation of the Scheme

The Scheme requires local governments to establish or facilitate the establishment of collection centres for the inspection and processing of targeted containers. Containers that are part of the Scheme, other than ones that have been stored on farms before its implementation, will be clearly identified by a sticker and/or appropriate label.

Farmers and other users of farm chemicals will be responsible for correctly rinsing the containers as they are used, and then bringing empty, clean containers into the collection centre. Containers must show evidence of flushing, pressure-rinsing or triple rinsing (in line with Avicare guidelines).

Containers will be inspected upon arrival at the centre and those not meeting inspection standards will be returned immediately to the farmer, whereas clean containers will be accepted and appropriately processed.

Plastic containers accepted by collection centres will be forwarded to container reprocessing centres for eventual re-use, recovered for their material or energy value, or sent to landfill. Metal containers will be recycled or sent to landfill.

Collection centres must abide by the criteria for collecting, inspecting and processing of chemical containers established under the Scheme and will receive a payment for the services provided.

### Funding

The Scheme will be funded by a levy on targeted farm chemical containers, which will initially be set at 4 cents per litre or kilogram of the contained product for non-refillable, non-water soluble rigid packages (metal or plastic) above one litre/kilogram in declared content.

To encourage the expansion of the current reprocessing and re-use of certain 20L and 200L plastic single use (non-refillable) containers a rebate equivalent to the levy will be paid to manufacturers who repurchase these containers.



Manufacturers agreeing to participate in the Scheme will pay the levy into the Scheme's fund. Manufacturers will pass the levy on to distributors and retailers, who in turn will pass the levy on to end users. To ensure the transparency of the Scheme, a generic statement is to appear on all invoices from manufacturers to distributors/retailers and from distributors/retailers to end-users as follows:

"You have paid 4 cents per L/kg for all non-returnable containers on this invoice that fall under the drum clearance program."

The purpose of passing the levy on to end users is to encourage purchase of products that are packaged in refillable, water soluble, cardboard or paper containers (which are not subject to the levy). These purchase decisions will in turn encourage manufacturers to offer better packaging options.

### Implementation

Agsafe Limited, the subsidiary of Avcare set up to administer and deliver safety, environmental and accreditation schemes on behalf of the crop protection and animal health industry will manage the implementation of the Scheme and be responsible for reporting progress to stakeholders.

Agsafe will pay eligible collection agencies from the fund upon receipt of claims in accordance with the guidelines established under the Scheme.

A Container Management Council will be established to ensure that implementation occurs in accordance with the Scheme. This Council will be comprised of farmer, industry and local government representatives and will operate within the Agsafe framework.

It is proposed that compliance on the contribution of the levy to the fund administered by Agsafe will be achieved through:

- manufacturers, formulators and importers entering into a formal Agreement that commits them to pay the levy;
- local government purchasing policy to only purchase farm chemicals on which the levy has been paid, wherever possible;
- seeking the promotion of a purchasing policy by Federal and State Governments to give preference to purchasing farm chemicals on which the levy has been paid;
- policy of local government to collect and process, without charge to farmers, containers on which the levy has been paid; and,
- policy of farmer organisations to advise members to only purchase farm chemicals which are packaged in containers that are:- a) refillable, water soluble, cardboard or paper or b) targeted containers on which the levy has been paid.

### Research and Development

To increase the effectiveness of the Scheme, an allocation of \$150,000 will be made to research recycling or material recovery uses, as well as the development and testing of safer devices for the emptying and rinsing of targeted containers.

Research and development work will be funded on the basis of proposals submitted and approved by the Container Management Council.

### Budget

The budget is based on the expected payments to local governments, transportation subsidies, the administration of the program and the provision of educational and training materials. The expected payments to local governments have been calculated using current hourly rates charged by contractors operating portable granulation equipment and mobile drum crushers. The estimate of expenditure for the initial three years of the Scheme is set out in Table 2.

Table 2 - Estimated expenditure for the period 1998/99 to 2000/01 (\$'000)

Administration and Monitoring	Promotion and Training	Research	Collection and Transport	Total
870	550	150	4,470	6,040

### **INTRODUCTION OF THE SCHEME**

Under Australian law (Trade Practices Act 1974) it would be illegal for manufacturers to agree to the establishment of a levy which would be passed onto users. Therefore, implementation of the Scheme is dependent upon authorisation by the Australian Consumer and Competition Commission (ACCC) which has the power to authorise arrangements that may contravene the Act but are considered to deliver a public benefit.

The current proposals are for all participants in the Industry Waste Reduction Scheme to be ready to formalise their support for the Scheme by the end of February 1998. The parties will then seek authorisation for the establishment of the levy from the ACCC, a process that may take several months.

The Scheme is therefore planned to commence on 1 August 1998.

### **CONCLUSION**

Avcare has promoted a program of shared responsibility to deal with the proper management of empty farm chemical containers.



The success of the program to date can be attributed largely to the level of shared responsibility achieved between the principal stakeholders, namely; farmers, local government and Avcare.

The process of developing a long term solution to this issue has involved extensive dialogue and negotiations with a multiplicity of government and private organisations that have an interest in the problem. As a consequence it has taken several years to reach a consensus among the parties involved.

However, there is little doubt among all concerned, both in industry and government that an industry driven program involving cooperation among the principal stakeholders is a more cost effective alternative to Government imposed legislation and regulation.

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## MANAGING PESTICIDE WASTE AND PACKAGING

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### ABSTRACT

In the past, the efforts of the U.S. pesticide industry were aimed at providing a product that maximized the ability of the active ingredient to control the target pest(s) in a safe, reliable and cost effective manner. The U.S. society and the pesticide industry concerned itself primarily with the chemistry of the product. The package was almost an afterthought. The package was something to hold the product until it was delivered to the customer. Once the pesticide was used, little additional thought was given to the package. In the late 1980s and early 1990s, there was a dramatic awakening to the importance of the package. Today it is recognized that the package does not just contain the product, rather it is an integral part of the product. This paper discusses the U.S. Agrochemical Industry's efforts relating to management of the pesticide container. Areas addressed include: 1) specific recycling programs for steel drums and plastic containers, 2) the U.S. Agrochemical packaging trends, and 3) the U.S. packaging management strategy.

### INTRODUCTION

For those closely associated with the chemical pesticide industry, it is sometimes helpful to reflect on why this industry exists and why we must use packaging. Discussions with the general populace sometimes require that we offer a simple explanation to the two previous questions before we can explain (and hope that they will fully understand) the "what's" and "why's" of our various stewardship programs relating to packaging. Sharing the following few simple thoughts has often helped as a lead-in to the story of packaging management for the U.S. crop protection industry.

The pesticide industry exists today because it offers products which members of our global society find of value. These products are active molecules that control various pests. One of the major challenges for the pesticide industry involves the delivery of the active molecule from its point of manufacture to the desired target. This must be done in a reliable, cost effective manner that meets appropriate safety and environmental considerations.

The delivery of the active molecule is made by "packaging" it twice. First the active is packaged into what is commonly referred to as a formulation. The active (in its formulation) is then packaged again into what is normally called a container or package. In the United States, as late as the mid-1980s, the primary driving forces for package selection included:



- compatibility of the container with the formulation and the formulation with the container;
- compliance with transportation and environmental regulatory requirements;
- compatibility with the chemical manufacturer's filling equipment;
- customer convenience in using (emptying) the container.

For all intents, container management ended when the end-user could safely empty the container. The empty container was little more than an afterthought.

This all began to change when industry and the general society became aware of an apparent landfill shortage in the country. Landfills were getting full and were being closed. It was very difficult to get the necessary approvals to open new ones. It was a well known fact (which was later shown to be very erroneous) that packaging was the main reason the U.S. landfills were so full. Packaging began to take the brunt of a lot of bad press.

## **HISTORY OF CONTAINER RECYCLING**

### Plastic

Because of the many forces at play, new definitions of container management began to take shape in the United States. In 1988 the U.S. Congress passed amendments to the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). These called for expanding the authority of FIFRA and the Environmental Protection Agency (EPA) in the area of packaging, storage, transportation and disposal of pesticides, containers, and rinsates. Congress mandated a report from the EPA that would impact containers by presenting options for encouraging or requiring<sup>1</sup>:

- the return, refill, and reuse of pesticide containers and
- the use of bulk storage facilities to reduce the number of pesticide containers requiring disposal.

That same year the National Agricultural Chemicals Association (NACA), which is the predecessor of the American Crop Protection Association (ACPA), surveyed dealers, applicators, and farmers throughout the country regarding packaging. The number one area of concern: Container Disposal. For those that expressed concern with container disposal, the number one issue was lack of acceptable options for disposal.<sup>2</sup>

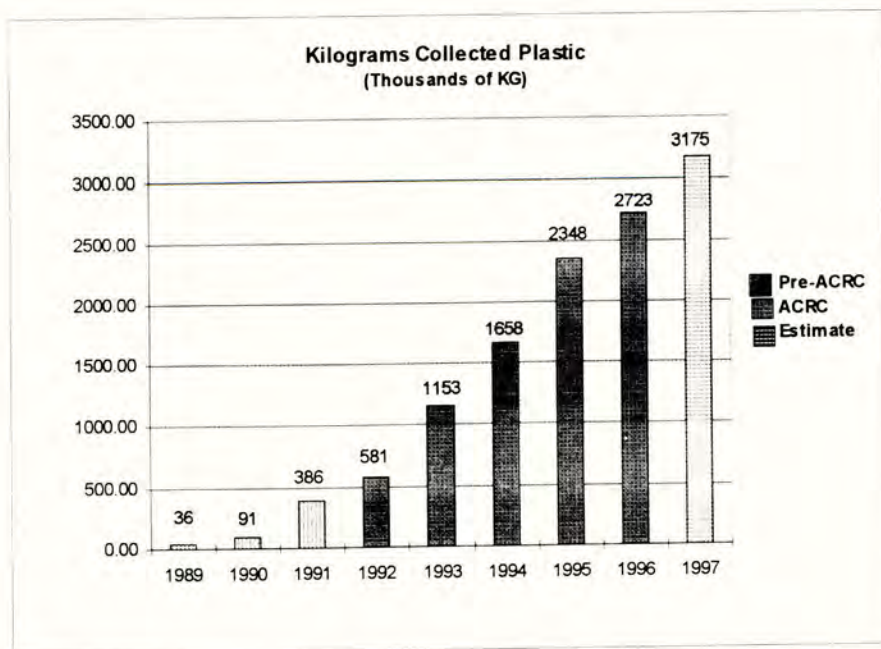
NACA members determined the predominant container used within their industry was the high density polyethylene (HDPE) jug. They formed a working group and established a pilot program in the state of Mississippi to collect plastic containers. This program was so successful it was expanded the following year. It soon became obvious the industry needed to focus more resources on these programs. With the help of the NACA, the industry formed a non-profit joint venture to make empty plastic pesticide container recycling a reality in the United States.

The Agricultural Container Research Council (ACRC) was formed in February 1992. The

ACRC actively supports recycling programs in the United States by:

- working closely with federal, state, and local agencies to assist in establishing new collection efforts;
- providing agencies with audio-visual materials, in both English and Spanish, that teach proper container rinsing and inspection procedures;
- providing contractors to granulate and transport containers from collection sites to approved recyclers;
- conducting research to identify acceptable end uses of the material recovered from empty and properly-rinsed HDPE pesticide containers;
- performing research to identify appropriate processes for making the acceptable end-use products.

Since its inception the ACRC has seen constant expansion in the support of its programs. The amount of plastic recovered each year by the ACRC contractors has shown steady growth. The following chart shows the amount of plastic collected, starting with the NACA pilot programs. The amount shown for 1997 is an estimate.



The costs to the ACRC for collection and disposition of this plastic has dropped from £1.04/KG of plastic collected in 1993 to an estimated £0.64/KG for 1997. This cost reduction is due to the two major components. First, with the increase in volume, the ACRC and its contractors have become more efficient in the collection, transfer and storage of the collected plastic. The second reason deals with the disposition of the plastic. The ACRC has identified end-uses which have created a demand and market for the collected plastic. These end-uses were identified by the ACRC's Technical Committee, which is



responsible for:

- conducting research, developing data and evaluating potential end-use products;
- evaluating facilities and processes used in ACRC sponsored research projects;
- identifying viable end-uses for recovered Post Consumer Resin (PCR) and making recommendations to the ACRC Board regarding these identified end-uses.

The ACRC Technical Committee established some logical criteria to evaluate all of the possible end uses proposals it considered for the recovered plastic. These criteria for End-Use Options include:

- environmentally acceptable;
- publicly acceptable;
- economically acceptable;
  - as an end-use product and
  - as a research project. The ACRC's limited funding can only afford a finite amount of research. It is important to select projects that have a higher potential for success and that need less funding to accomplish success.
- timing - It is important to identify end-use research projects that will bring positive results quickly. End-use products that take multiple years to validate are given less or no consideration. To cite an example, qualifying fence posts for the agricultural market is not a long-term project when compared to qualifying sign posts for the Department of Transportation.
- quantity - the ACRC devotes its efforts to end-use products that have the potential of using large quantities of PCR.

Through the efforts of the ACRC, numerous end-uses have been evaluated and tested. These include:

- jugs for crop protection chemicals,
- energy recovery (fuel),
- pallets (all plastic or wood/plastic composite),
- construction site mats,
- commercial truck / manure spreader deck boards,
- field drain tile,
- speed bumps, parking stops,
- fence posts, and
- hazardous waste drums.

Prior to 1997, most of the recovered PCR was used in energy recovery. The ACRC created a white paper titled "White Coal" which explains the value of using empty HDPE pesticide containers as an energy source. In 1993-4, several industry members did market some products (mostly dry granular formulations) in jugs made with 25% PCR. They ceased doing this because of concerns with EPA policies regarding cross-contamination limits.

Starting in 1997, much of the ACRC's research began to bear fruit. Approximately 50,000 kilograms of PCR a month is now being sold to one manufacturer of industrial plastic pallets. One of the largest tile manufacturers in the United States has started to use the PCR for manufacturing field tile at several of its facilities in the country. This company's

total usage of plastic is greater than the current amount of plastic recovered by the ACRC's program. It is anticipated they will continue to expand their purchase of PCR obtained from properly cleaned pesticide jugs.

Today the ACRC is limiting the number of customers that can obtain the collected PCR. These locations are participating in a large research project which involves sampling of the pallets and tile which are made from plastic collected around the country by the ACRC's contractors. Statistical sampling is done to ensure all parts of the country (and the pesticides they use) are properly represented in this study. The plastic is being analyzed for pesticide content and the data is then evaluated using the ACRC's Risk Assessment Model (RAM). The RAM is a computerized model for assessment of human health and ecological risks associated with pesticide residues in recycled plastic products. It is the hope of all involved that the results of this large study will allow the ACRC to expand its list of acceptable end-uses. This study should be completed in 1998.

### Drums

The United States saw a dramatic decrease in the demand for steel and plastic drums for the agrochemical markets with the introduction of the mini-bulk. In 1990, a total of 1,127,795 drums were used by the NACA membership. One year later, the number had plummeted to 392,915. In this time frame, several companies began converting the single use plastic drums to returnable/refillable systems. One company established a drum reclamation program for their customers that used steel drums. This steel drum reclamation program is still operational today and collects a large percentage of the drums sold each year by that company.

## **PACKAGING TRENDS IN THE U.S. AGROCHEMICAL INDUSTRY**

The ACPA and its predecessor has surveyed its membership on packaging consumption and has published the figures for 1988 to 1995. They are currently tabulating 1996 results. The full tabulated results are beyond the scope of this paper. A brief review of the data suggests the following trends<sup>3</sup>:

- Drum usage dropped dramatically from 1990 to 1991. Plastic drums went from 530,255 to 132,385. Steel went from 597,540 to 260,530;
- Steel drum usage has continued to decline. In 1995, only 91,333 drums were used by ACPA members in the U.S. row crop markets;
- Plastic drum usage has shown a continued and steady recovery since 1991. The 1995 survey indicated 337,528 plastic drums were used;
- The plastic 2-1/2-gallon (10-liter) jug, which was under attack in the late 1980s and early 1990s declined from a 1988 usage of 27.7 million containers to a low of 21.8 million containers in 1992. Since 1992 this plastic container has seen a continuous increase in demand. In 1995, ACPA members reported using 24.6 million 2-1/2-gallon jugs;
- The usage of water soluble film systems has seen dramatic growth. In 1990, this package system was not even included in the survey. In 1991, the industry reported selling 1.74 million kilograms of pesticides packaged in water soluble



films. In 1992 the usage jumped to 5.56 million kilograms. In 1995 the industry reported selling 8.42 million kilograms of dry pesticides packaged in water soluble packaging systems;

- Liquid refillable systems doubled their volumes in 1991 over previous years. Since 1991 to the present, the total volume shipped in bulk, mini-bulks and refillable smaller containers has fluctuated between 214.5 and 268 million liters.

All of these trends are consistent with the industry's goals relating to packaging management.

### **U.S. AGROCHEMICAL PACKAGING MANAGEMENT STRATEGY**

With the increased awareness in the late 1980s relating to the importance of packaging, the agricultural chemical industry, through NACA, developed a strategy for responsible management of pesticide containers. The NACA Container Management Goals were approved in 1989 and were expressed in the following order of preference:

- reduction in the number of empty containers through the use of reusable containers, formulation modifications and other innovative container minimization approaches;
- recycling of empty containers for their material or energy value; and
- disposal of empty containers in accordance with environmentally sound and cost effective practices.<sup>4</sup>

These goals continued to evolve. Initially the industry focused on the primary container; the container which was in actual contact with the formulation. Eventually, the industry recognized the importance of providing stewardship for the secondary and tertiary packaging as well. To help stress this expansion in focus, the ACPA made a nomenclature change from "container" to "packaging" when referring to its stewardship programs.

In 1995 the ACPA hosted the 4<sup>th</sup> International Crop Protection Packaging Management Conference. This conference was well attended by all major agrochemical companies, as well as many country associations from North and South America, Europe and the Pacific region. One of the main topics at this conference dealt with the subject of packaging management strategies. As a result of these discussions and agreements, the ACPA established the following position paper. As a member of the ACPA, individual companies operating in the United States have committed to comply with this written article.

#### **American Crop Protection Association's Position on Packaging Systems Management Goals**

The American Crop Protection Association (ACPA) is committed to the safe and beneficial use of crop protection products. Responsible management of packaging systems is an integral part of this overall commitment. Therefore, ACPA member companies will strive

to manage packaging systems for our industry's products in ways that foster safety, environmental protection, customer convenience and resource conservation. A hierarchy approach to managing packaging systems will embrace the following order of preference where technically and economically feasible:

- Reduce the amount of packaging components (e.g. primary containers, corrugated boxes, pallets, stretch wrap, etc.).
- Reuse packaging systems or components where possible.
- Recycle empty containers and other packaging systems components for material or energy value.
- Dispose of those packaging system components which are currently non-reusable or non-recyclable in accordance with environmentally sound practices.

There are a variety of options for achieving Packaging Systems Management Goals. The following are examples of some:

Reduce packaging by:

- Using higher activity chemistry.
- Increasing concentrations of formulations.
- Using water soluble film packaging.

Reuse packaging by:

- Using bulk/reusable containers (mini-bulk or small volume reusable [SVRs]) delivery systems.
- Reusing secondary packaging components (e.g. pallets, outer secondary packaging, etc.).

Recycle packaging by:

- Continuing to promote container rinsing and supporting collection programs to facilitate container recycling.
- Continuing to support efforts to identify end-use products prepared from recycled packaging system components.
- Continuing to promote the recovery of energy from plastic packaging at qualified facilities as a viable recycle option.

Disposal (Last Option):

- Expand education to end users on properly preparing packaging for disposal.
- Explore technology and research options on degradable paper, corrugated and plastic packaging.



## FUTURE TRENDS

Packaging management for the U.S. pesticide industry continues to evolve. Forces such as regulations, advances in technology, competitive situations, and customer needs will continue to help force this evolution. The role of technology is beginning to have a larger impact on the types of packaging as well as the amounts required. Biotechnology has created a whole new way to "package" the active. Actives that are still delivered in a chemical formulation and packaging system are much more active. Grams now are the measurement where kilograms once were used. This dramatic reduction in the amount of formulation required has had an equal impact upon the amount of packaging needed.

Recycling programs continue to gain momentum. Bulk and re-fillable systems play a major role in the U.S. industry and they will continue to do so.

As the marketplace in the U.S. continues to evolve, the crop protection industry's packaging management strategies are positioned to ensure its packaging systems will be in step with this evolution.

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