EUROPEAN COMMISSION - DIRECTORATE-GENERAL ENVIRONMENT

STUDY ON HAZARDOUS HOUSEHOLD WASTE (HHW) WITH A MAIN EMPHASIS ON HAZARDOUS HOUSEHOLD CHEMICALS (HHC)

FINAL REPORT

WRc Ref: CO 5089-2
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EXECUTIVE SUMMARY

The Directorate-General Environment has commissioned WRc, in partnership with IFEU, to evaluate national experiences of the management of hazardous products likely to become hazardous household waste (HHW), and to make proposals for strategies for the appropriate management of such products within a lifecycle perspective. This is the Final Report for study B4-3040/2000/305357/MAR/E3 on hazardous household waste (HHW).

The study covers the fifteen Member States and two Accession Countries, namely Hungary and Romania. The data available at the country level are difficult to compare as there are currently neither precise definitions nor common statutory controls within the European Union for hazardous household wastes, each country has adopted a different strategy to deal with hazardous household wastes. Even within any given country, there are a wide range of practices in the collection, handling and treatment for HHW. Therefore until comparable data are available from Member States, any comparison of data from each country must be undertaken with caution.

For the purpose of this study the term “household hazardous waste (HHW)” is defined as: ***such wastes that could potentially increase the hazardous properties of municipal solid waste when landfilled, incinerated or composted.***

The scope of the study focuses on the identification of hazardous household chemicals rather than addressing other hazardous waste that can originate from households such as batteries, waste oils and waste of electronic and electrical equipment. Indeed, these waste streams are or will be subject to specific EC regulations that make their separate collection mandatory.

It focuses on hazardous household products that are posing a potential threat to health and environment when disposed of by households and mixed with non-hazardous household waste rather than when disposed to sewer.

The methodology adopted identified a priority list of substances in solid waste that pose the greatest risk to human health and the environment and to match the identified substances to specific HHC and other household products that are likely to result in household hazardous waste (HHW).

Fourteen hazardous substances were identified as priority substances of concerns for solid waste disposal based on an emission inventory from solid waste treatment and disposal facilities such as landfill and incineration.

- arsenic,
- lead,
- cadmium,
- chromium,
- copper,
- nickel,
- mercury,
- zinc,

- PCB,
- benzene,
- tetrachloroethylene,
- trichloroethylene,
- tetrachloromethane,
- sodium cyanide.

Household products most likely to contribute significantly to the input of these priority hazardous substances were then identified as being the most problematic for the current waste management and disposal routes, namely paints, pesticides, arsenic treated wood and fluorescent lamps.

Case studies were selected to review interesting initiatives for these priority hazardous household products in order to make recommendations between separate collection or product replacement. The main recommendations are listed below:

- The paint collection and exchange facility established in the UK through the Re>Paint scheme for unused and leftover paints could be replicated in other countries. It has environmental and social benefits.

- Separate collection and recycling of low energy light bulbs and fluorescent tubes is beneficial and further improves the overall positive eco-balance at reasonable costs. Such separate collection and treatment schemes are already in place in numerous Member States.

- There are interesting initiatives to produce mercury-free fluorescent tubes which could not yet be fully reviewed due to lack of reliable data.

- Arsenic is a major pollutant in solid waste, a major portion of which is from pressure-treated wood with chromated copper arsenic (CAA). Alternatives are readily available, far less toxic and strongly favoured by the European Commission seeking a ban of arsenic treated wood. Even if the ban is implemented, arsenic treated wood will remain a problem in MSW management, hence separate collection on the household level (likely together with other treated wood) is a recommended action to minimise improper disposal.

- There are alternatives to corrosive/aggressive cleaning products based on substances of low toxicity commonly found in kitchen, which are reported to have good efficiency. These could be promoted rather than recommending separate collection for these waste packaging.

- Spent car oil filters are found in household waste when DIY motorists change their own oil. While there is separate collection promoted for waste oil, there is usually no information provided for oil filters. It is recommended to inform DIY motorists of the risks associated with spent oil filter as well as waste oil and to promote separate collection through bring back schemes at local garages or local civic amenity centres.

- Separate collection of domestic pesticides and fertilisers is recommended, especially for pesticides containing banned active substances. A combination of collection is advisable (amnesty day organised by pesticide retailers, bring back system at civic amenity centres,

etc). Information campaign should stress the need for proper storage and disposal especially for old stocks in garages or garden sheds.

As part of this contract, it was agreed to review disposal methods for HHW including separate collection schemes for batteries, waste oils and WEEEs in the fifteen Member States and two Accession Countries. The relevant authorities and agencies responsible for waste management in each country were contacted to collect information at the National level on quantities of hazardous household waste and HHW management practices.

Regulations are in place in a limited number of EU Member States for a statutory separate collection of identified hazardous household waste (HHW) other than batteries and waste oils. In the other EU countries where there are no specific regulations for HHW, there are policies and recommendations in waste management plan to encourage and implement separate collection of HHW.

The list of identified HHW differ from one country to another which means that quantities of HHW collected separately per inhabitant also vary between countries. Some waste streams not normally defined as hazardous are considered as problematic only by some countries and are collected selectively as HHW (i.e. vegetable oils).

The quantity of hazardous wastes arising from households represents only a very small percentage of the overall municipal waste stream. It is generally reported that the quantities of HHW arising represent 1% (by weight) of household waste. These quantities however vary and it has been estimated that the total quantities of HHW generated by households amount to about 1.5 million tonnes per annum.

The countries where separate collection of HHW is organised usually rely on a combination of mobile collection and free delivery points at civic amenity centres as well as take-back schemes at retailer shops. It is reported that two third of HHW is collected via bring schemes at civic amenity centres and one third via pick-up collection.

There are only reliable and detailed data on quantities of HHW collected separately in Belgium, Luxembourg and Netherlands. In these countries, apart from batteries and waste oil, the largest volumes of HHW collected selectively includes paint residues. The quantities of HHW separately collected range between 1.3 to 3.5 kg per person and per year representing about 56 and 70% of HHW arising depending on country and method of collection.

It is estimated that the total quantities of HHW collected separately in the European Union currently amount to about 400,000 tpa excluding amount collected in Austria and Germany for which it was not possible to estimate the amount.

The cost for collection at civic amenity (CA) sites ranges from € 0.12 to € 1.7 per kg. The cost for a mobile collection is at least 50% higher per kg than CA collection and ranges from € 3.2 to € 5 per kg for an annual collection via a container or for more frequent collection with a specialised vehicle between € 2 to € 10 per kg. The cost of a regular door to door collection ranges between € 1.7 to 10 per kg.

The cost of HHW treatment varies depending on the method adopted and the standards to which the chosen method has to comply with. It is reported to range between €0.42– 2.2 per kg.

The total cost for managing HHW (collection and treatment) is more likely to range between €1 and € 2 per kg. Given a total 1.5 million tonnes of HHW arising per annum, it is estimated that the total cost for collection and proper disposal of all HHW in the EU would be in the order of €1.5 to €3 billion per annum.

1. INTRODUCTION

1.1 Background

The Directorate-General Environment has commissioned WRc, in partnership with IFEU, to evaluate national experiences of the management of hazardous household chemicals (HHC) likely to become hazardous household waste (HHW), and to make proposals for strategies for the appropriate management of such products within a lifecycle perspective.

In 1997, DG Environment started to work on an initiative for providing a framework for separate HHW collection at source and specific marking of products with consumer information but this was not continued for the following reasons:

- Specific Directives covering some of HHW were already existing or planned for waste oils, batteries, electronic and electrical equipment waste;

- Experience of Member States showed that the preferred disposal option for HHC collected separately was incineration in specialised plants. Recycling was very expensive due to the collection of small quantities and large varieties of HHC.

Since the 1990's, there have been national initiatives for separate collection schemes of HHW in some Member States, but there is limited centralised information pertaining to HHW within the European Union. Some information is available on the volumes currently collected separately in some countries but not on the total volumes generated nor on the toxicity of HHC that later become wastes. Without this information the efficacy of any separate national or regional collection and disposal option remains problematic to assess.

In addition, the use of chemicals in domestic products which are either intentionally or unintentionally disposed in a manner unsuitable to the product's hazardous properties may provide an exposure route that is not recognised in current assessments.

The Commission is now seeking additional information to decide on the best management options for hazardous household waste (HHW). This report is addressing this information gap.

1.2 Objectives

The objectives of the study as described in the Technical Annex of the call for tender are given below:

1. Identification of products or product groups containing dangerous substances which enter the domestic market and which may generate hazardous household wastes (HHW).

2. Estimation of quantities of these products marketed, generated as HHW including the identification of the dangerous substances, their quantities and concentrations.

3. Overview of current HHW management practices in Member States and two Accession countries and compare the costs and benefits of each approach.

4. Assessment of environmental impacts of substances present in each product group that may contribute to HHW, in a life cycle perspective.

5. Identification of options for reduce the impacts, revealed in 4) including product replacement, reduction of the risks associated with the products; and by considering the effects of separate collection and waste treatment. The cost and benefits should be estimated.

6. Elaboration of case studies on current HHC and existing more environmentally friendly formulations; It should cover environmental impacts, relative costs, recognition of obstacles to the use of alternatives and the experiences gained from schemes to promote environmentally benevolent products by tax schemes, eco-labelling and consumer education. If possible, not less than five case studies of the impacts of current household products and environmentally friendly alternatives will be described.

Following discussions with the Commission during the Inception period, the scope and objectives of the study were further clarified and several points were agreed:

- to concentrate the study on hazardous household chemicals as there are provisions for separate collection of spent batteries and waste oils in application of the EC Directives and there are already or will be schemes for electronic and electrical equipment waste (WEEE);

- to consider, however, batteries, used oils and electrical equipment with regard to current waste management systems in place in the countries studied, as past work has been done on quantities collected of these wastes;

- to keep the initial list of potential HHC candidates as broad as possible but to prioritise this list for further assessment;

- for the identification of HHW, it was proposed to rely on the classification and marking requirements of dangerous substances under Directive 67/548/EEC. We offer to use previous methodologies such as the IFEU work developed for the German ministry for screening of priority hazardous household products;

- to focus impacts on health during waste phase for 2 options; when HHW are collected separately and when HHW are collected together with other MSW, rather than on impacts during production phase and use phase;

- to identify alternative options (objective 5 above) only for specific case studies and not in general terms;

- to use a life cycle perspective to decide/recommend between separate collection or product replacement for hazardous household product reviewed in a case study;

- To review HHW management in Romania and Hungary as Accession countries.

1.3 Scope

The scope of the study focuses on the identification of hazardous household chemicals (HHC) rather than addressing other hazardous waste that can originate from households, such as batteries, waste oils and waste of electronic and electrical equipment (WEEE). Indeed, the

latter are (or will be) subject to specific EC regulations that make their separate collection mandatory.

The study focuses on hazardous household products that are posing a potential threat to health and environment when such products are disposed of by households and mixed with non-hazardous household waste rather than being on hazardous household products which are posing a risk due to their disposal to sewer.

The methodology is designed to identify a priority list of hazardous substances in solid waste that pose the greatest risk to human health and the environment and to match these substances to specific HHC or domestic products not routinely considered HHC.

As part of this contract, it was agreed to collect information on disposal methods for all HHW including separate collection schemes for batteries, waste oils and WEEEs during the country review of management practices.

The case studies are designed to report on interesting initiatives for priority hazardous household products in order to make recommendations between separate collection and special treatment or product replacement. The case studies also focus on chemicals rather than batteries, waste oils and WEEEs. However, the latter are not to be excluded if they were identified as contributing to priority list substances. In addition, case studies for separate collection and treatment of household products not routinely identified as HHC but contributing to hazardous nature of solid waste could also be included.

1.4 Report structure

The Report addresses the above objectives, namely:

- Section 1 – Introduction.
- Section 2 - Identification of hazardous household chemicals (HHC) and hazardous household waste (HHW) addresses objectives 1,2 and 4.
- Section 3 – Case studies addresses objectives 5 and 6.
- Section 4 - Management of hazardous household waste addresses objectives 3.

The Appendices present more detailed results for some aspects of this study:

- Appendix A - Information on household product composition, market volume and risk assessment.
- Appendix B – Country reports for each of the selected countries on HHW legislation, policy, quantities and management as well as cost estimation for management practices.

2. IDENTIFICATION OF HAZARDOUS HOUSEHOLD CHEMICAL AND HAZARDOUS HOUSEHOLD WASTE

2.1 Introduction

The first objective of the study was to identify domestic products or product groups, which may generate hazardous household waste (HHW) due to the presence of dangerous substances. It was first decided to clarify definition of hazardous household chemicals (HHC) and hazardous household waste (HHW) and to refer to existing EC legislation.

The identification of HHC was then carried out using a developed methodology based on the combination of emission inventory from municipal solid waste management and expert judgement on main risks associated with specific household products. In addition, the Dutch system of identification of HHW was also reviewed in detail and its conclusions were also taken into account in our own prioritisation of HHC/HHW. However, both methodologies have limitations, which have been point out in the text below.

2.2 Definition of hazardous household chemicals and wastes

A clear definition of hazardous household chemicals (HHC) and hazardous household waste (HHW) is a prerequisite to the success of the project. There are currently no precise definitions for either hazardous household wastes or hazardous household chemicals in the European legislation. However, the term ‘dangerous substance’ has been defined in Directive 67/548/EEC (as amended), as explosive, oxidising, easily flammable, flammable, toxic, harmful, irritant, dangerous for the environment, mutagenic, toxic for reproduction, dangerous for the environment, corrosive, carcinogenic, etc. The Directive 67/548/EEC ensures that dangerous substances cannot be placed on the market unless the labelling on their packaging indicates the name and origin of the substances, the appropriate danger symbol and risks arising from such dangers. Household products containing any of these dangerous substances have to be labelled accordingly.

In addition there are EC controls on the marketing of dangerous substances. Directive 76/769/EEC restricts the marketing and use of dangerous substances such as PCBs, PCTs, asbestos fibres, mercury, arsenic and cadmium, as well as pentachlorophenol. Directive 91/414/EEC as amended regulates the placing of pesticides on the market and harmonises the authorisation procedure. Directive 98/8/EC similarly regulates the placing of biocidal products on the market.

The term ‘hazardous waste’ is defined in Council Directive on Hazardous Waste 91/689/EEC. The Hazardous Waste Directive in its Article 1(5) however explicitly exempted household wastes from the provisions of this Directive and reported specific rules to be drafted to a near future. Rules have been defined for example for disposal of waste oils (Directive 75/439/EEC), recovery and disposal of batteries and accumulators containing dangerous substances (Directive 91/157/EEC) and a proposal has been put forward for separate collection, recovery and disposal of waste from electrical and electronic equipment (WEEE) (Proposal COM 2000 (347)).

The Hazardous Waste Directive 91/689/EEC was followed by a Council Decision 1994/904 of 22 December 1994 establishing the list of Hazardous Wastes. Wastes classified as hazardous are considered to display one or more of the properties listed in Annex III of the 91/689/EEC Directive. This Decision was replaced by Commission Decision 2000/532 as amended, which established a new list of hazardous and non-hazardous wastes. Chapter 20 of the list refers to municipal wastes (household waste and similar commercial, industrial and institutional waste) including separately collected fractions. Waste types which are identified as hazardous within chapter 20 are listed in Table 2.1.

Table 2.1 List of separately collected municipal waste identified as hazardous under the European Waste Catalogue (Commission Decision 2000/532/EC as amended)

EWC Reference	Category
20 01 13	Solvents
20 01 14	Acids
20 01 15	Alkalis
20 01 17	Photochemicals
20 01 19	Pesticides
20 01 21	Fluorescent tubes and other mercury containing waste
20 01 23	Discarded equipment containing chlorofluorocarbons
20 01 26	Oil and fat other than those mentioned in 20 01 25
20 01 27	Paint, inks, adhesives and resins containing dangerous substances
20 01 29	Detergents containing dangerous substances
20 01 31	Cytotoxic and cytostatic medicines
20 01 33	Batteries and accumulators included in 16 06 01, 16 06 02 or 16 06 03 and unsorted batteries and accumulators containing these batteries
20 01 35	Discarded electrical and electronic equipment other than those mentioned in 20 0121 and 20 01 23 containing hazardous components
20 01 37	Wood containing dangerous substances

For the purpose of this study the term "**household hazardous waste (HHW)"** is defined as "***such wastes that could potentially increase the hazardous properties of municipal solid waste when landfilled, incinerated or composted".***

As mentioned in the previous section, the study has focused on hazardous household chemicals/products other than batteries, motor oil and electronic and electrical equipment.

It is mainly interested in hazardous household products preferably being disposed of with normal solid domestic refuse and not poured down the drain.

It has addressed, to some extent, the waste management practices and interesting initiatives in place for all HHW including batteries, waste oils and WEEEs.

2.3 Methodology for hazardous household chemical/waste selection

The list of potentially hazardous household substances/products that are susceptible of becoming hazardous household waste is very large. A methodology is therefore required to screen such a list, in order to define a manageable priority list. Three generic methods have been identified as shown in Figure 2.1.

(a) Method 1

The starting point in Method 1 is the analysis of the composition of hazardous products likely to end up in household waste. This approach would require a comprehensive and systematic analysis of the amount of substances with hazardous properties in household products that may ultimately end up in household waste.

The list of recognised dangerous substances could be a combination of existing lists, such as:

- substances identified under the Directive 67/548/EEC on the classification, packaging and labelling of dangerous substances ;
- the constituents of waste which render them hazardous under the Hazardous Waste Directive 91/689/EEC;
- the priority hazardous substances identified under the Water Framework Directive 2000/60/EC, the OSPAR Conventions, the North Sea Conference and other Directives dealing with air pollution, etc.

A precise evaluation would require gathering data for total use, average residual amount and composition of other waste items, to determine the overall impact on hazardous properties in solid waste. A systematic approach like this is not possible because of the myriad of items in domestic use, which may end up in household waste. Aside from not being practically feasible, another disadvantage of this approach is that small waste items are mixed in with more or less benign waste fractions, and therefore diluted. The dilution does not make the entire household waste stream hazardous. In addition information on the chemical properties are not available for many products.

(b) Method 2

The starting point for **Method 2** is not the product before becoming waste, but the materials which are currently being collected as household hazardous waste in some part of the European Union. The principal problem with this list is that it was not derived from a systematic analysis of waste properties. It is unclear whether the substances are relevant contributors to the hazardous properties of municipal solid waste. Even though the starting list is smaller than in Method 1 (only those products deemed by at least one waste authority would qualify), the principal disadvantage remains that the data collection for such a large amount of substances/groups could be enormous. Furthermore, there is a danger in limiting the focus of the study to those substances, which were previously considered candidates, especially when the initial lists appear to be the result of a non-systematic approach. That

would just perpetuate misleading classifications and may focus on obsolete candidates and overlook the most important ones.

(c) Method 3

Methods 1 and 2 described above focus on the inventory of substances in the waste stream. In comparison the starting point of the third approach **(Method 3)** is the emission inventory from solid waste treatment and disposal facilities themselves, by measuring the emissions from incinerators and landfills where municipal solid waste (MSW) is being treated and disposed of. This is justified because it is the emissions into air and water that are of greatest concern. Starting with the emissions, it is then possible to determine which substances are most relevant in terms of hazardous waste characteristics, both with regard to human health and the environment. This allows us to limit the focus on those product groups, which are the major contributors to the emission inventory.

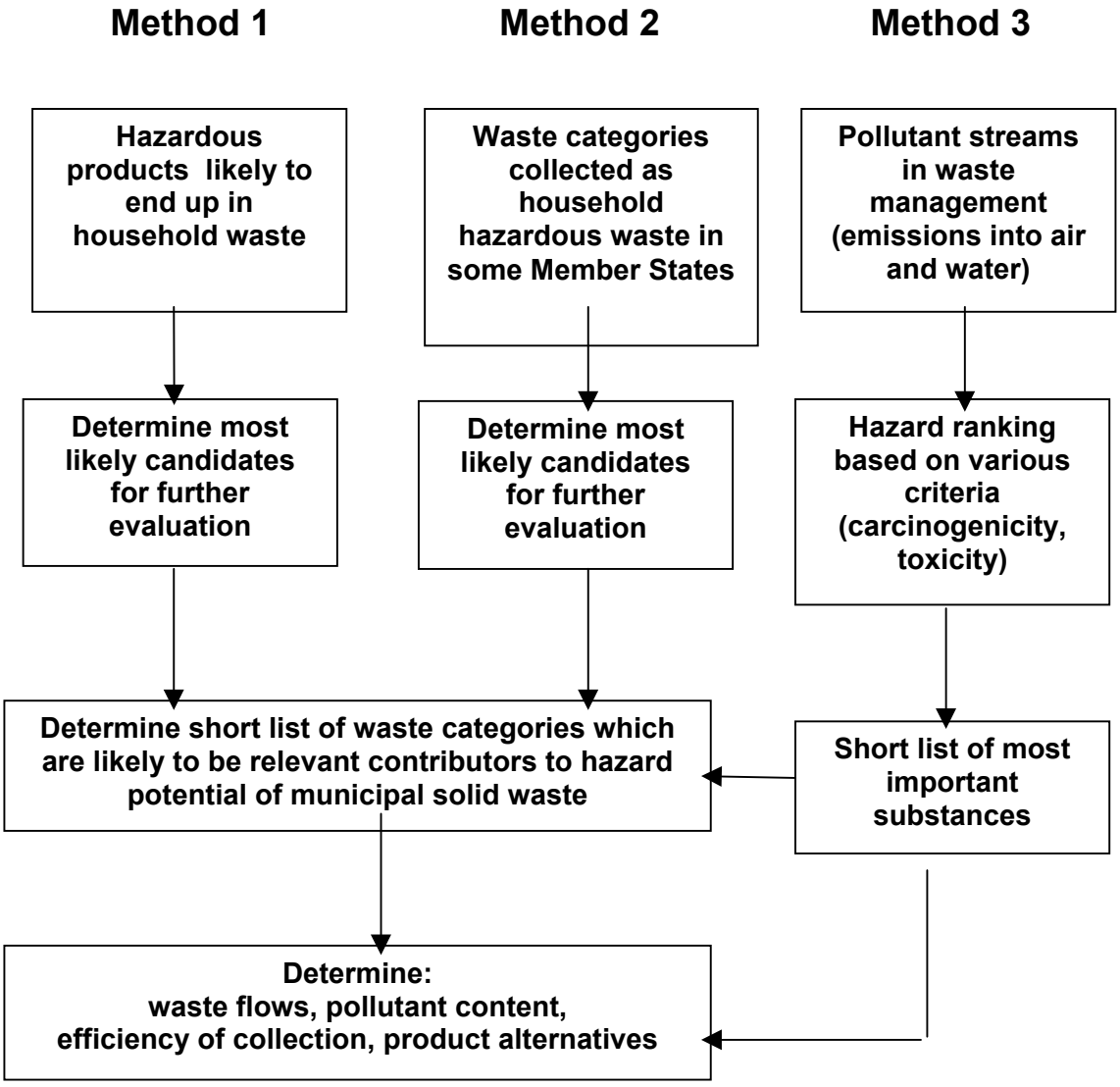

Figure 2.1 Screening process to determine the priority list for HHW types for further analysis

The hazardous substances entering the waste stream are then ranked by order of importance. Ranking can be undertaken by multiplying the amount of each substance by a factor that expresses the relative toxicity compared to a reference substance. The general method is shown in Figure 2.2. The calculations are done on a complex database that is comprised of data for a total of 104 substances. Details are described in a report of a major study by IFEU for the German Environmental Agency (Giegrich *et al* 1993). It should be mentioned that only some of the hazardous properties were taken into account in this methodology. The explosive, oxidising, corrosive or flammable nature of HHW pose a safety risk in the collection and treatment of waste and are not reflected in the emissions from either landfills or incinerators. Such properties are addressed in the Dutch system and are discussed in section 2.4 below. The ranking procedure and the results of this investigation are summarised below.

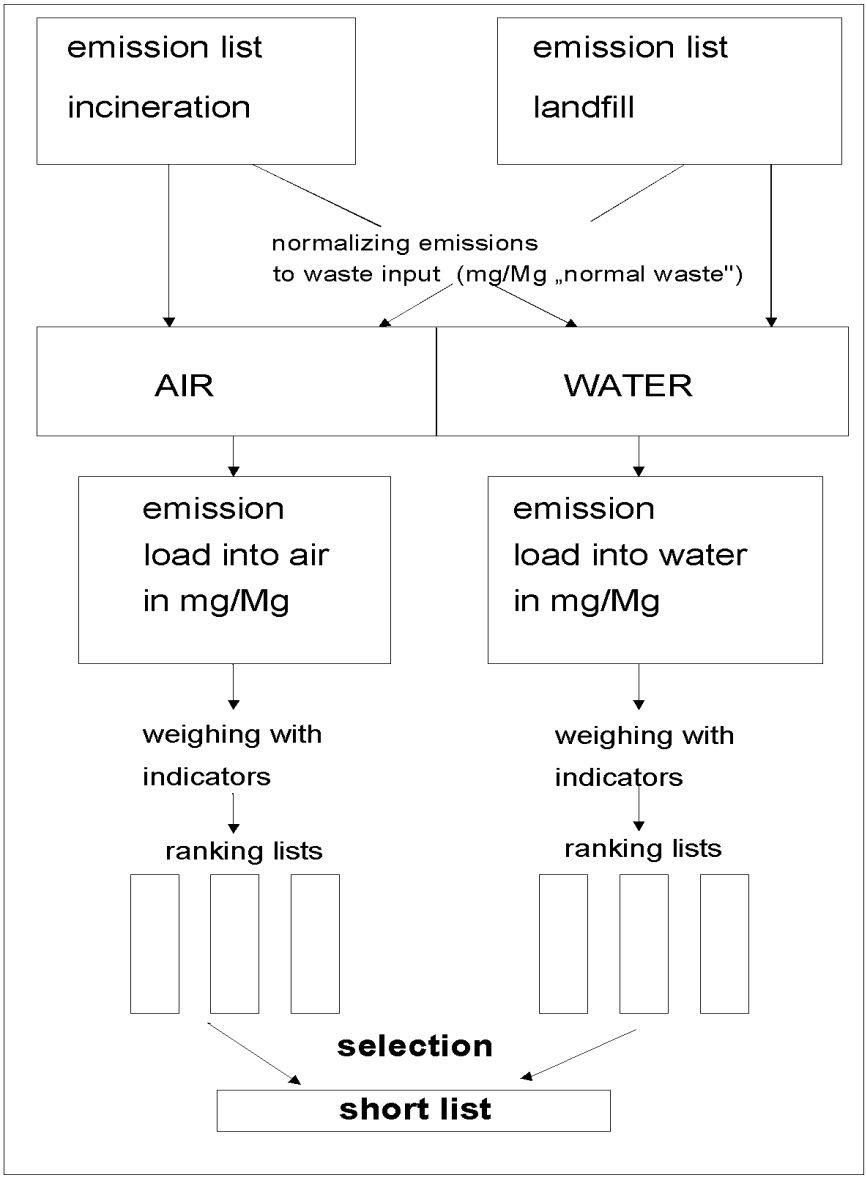

Figure 2.2 Emission load calculation and ranking system

All six ranking lists were combined to determine those twenty substances which together are representative for the quantifiable environmental impact from solid waste (Table 2.2).

Table 2.2 Hazard ranking of pollutants released into air and water (Giegrich *et al* 1993)

Substance	Inclusion in ranking list:					
	Carcinogenicity		Eco-toxicity	Climate impact	Chronic toxicity	
	Air	Water			Air	Water
Arsenic		✓				✓
Lead	Special inclusion because of very low effect threshold					
Cadmium	✓					
Chromium	✓					✓
Copper		✓				
Nickel	✓					
Manganese						✓
Mercury					✓	
Dichlorofluoromethane				✓		
Trichlorofluoromethane				✓		
PCDD/F	✓					
PCB		✓				
Benzene	✓	✓				
Tetrachloroethylene		✓			✓	
Trichloroethylene	✓	✓				
Vinyl chloride	✓					
1,1-Dichloroethylene		✓				
Dichloromethane		✓				
Trichloromethane	✓					
Tetrachloromethane		✓			✓	
Sodium cyanide			✓			
Hydrogen sulfide					✓	✓

The list presented in Table 2.2 is a good basis for determining the candidates HHW for further evaluation. The checkmarks indicate the reason for inclusion in the list. A substance was checked if it had contributed significantly to the impact category. Hence by inverse logic, though a substance may have impact in a category it is not checked if its contribution to the category was determined to be of low significance.

One should, however, regard the shortcomings of identifying the input of specific products in MSW on the basis of this ranking system:

- It does not address all the hazardous properties as established in Community legislation.
- Several substances are not introduced into the waste in this form but are the result of chemical degradation (e.g. vinyl chloride) or are formed in the combustion process (PCCD/F).
- The measurements upon which this evaluation is based do not necessarily reflect the composition of the current waste stream and may not be typical for all countries.
- Measurements are often performed at landfill sites and MSW incinerators where the input waste is derived from sources other than households.
- Household waste itself contains waste fractions that do not consist of products (such as dust, floor sweepings and the organic fraction).
- The study was carried out 10 years ago.
- The study did not address the risks for composting waste used on land.

Because some of the above limitations, the following substances from Table 2.2 are not further considered in this project:

- Vinyl chloride, because it is formed from precursor substances (tetrachloroethylene, trichloroethylene and 1,1,1-trichloroethane). The major input of these substances into landfills is from industrial applications and not from the household level.
- PCDD/F, because the emission rate has not been shown to be associated with specific input materials. It is a function of the waste combustion process and flue gas cleaning technology.
- Dichlorofluoromethane and trichlorofluoromethane, because they represent emissions from old stockpiles, mainly refrigerators.
- Hydrogen sulphide, because allocation to consumer products is not feasible, as it is mainly generated during the degradation of organic matter.
- In addition, the following substances needed to be included to fill the gaps due to the 10 years interval and the composting outlet.
- Zinc, as it is one of the heavy metals regulated under the Directive 86/278/EEC on the protection of the environment and in particular of the soil when sewage sludge is used in agriculture.

Based on these considerations, the initial list presented in Table 2.2 is reduced to priority substances proposed in Table 2.3 below.

Table 2.3 Priority hazardous substances

Inorganics:	Arsenic, lead, cadmium, chromium, copper, nickel, mercury, zinc
Organics:	PCB, benzene, tetrachloroethylene, trichloroethylene, tetrachloromethane, sodium cyanide

There are two ways to evaluate the relative contribution of those substances to the hazardous properties of MSW:

a) Determine products from solid waste analysis, or

b) Review the mass flow of the priority substances and determine which fractions will end up in household solid waste.

The problem with the first approach is that the results of solid waste analyses are usually limited to a selected number of pollutants (usually heavy metals); do not distinguish between waste fractions; are often quite old, and therefore may not be representative. While there are numerous datasets for detailed analysis of specific waste fractions (e.g. waste paper and plastics), data on the overall pollutants in waste is quite scarce.

The second approach requires an analysis of production schemes accounting for the complex flow of materials in the various steps (Figure 2.3). Hence, a precise answer requires substantial effort. As this type of analysis is not feasible, it is proposed to focus upon those household products, which are usually considered as hazardous because the product category is:

- labelled as hazardous (flammable substances, corrosive, toxic for environment, etc); **and**

- is likely to contribute significantly to the hazardous criteria of household waste due to the large quantities being discarded into solid waste streams, and the fact that the main disposal routes for these wastes are through solid waste streams rather then via disposal to sewer.

Table 2.4 presents information on household product groups including substances that have been identified as hazardous above. Further detail is provided in Appendix A. For each product group, the hazard status, the main risks and exposure routes (whether through usage, through discharge to sewer or through disposal via the dustbin) are identified. In addition, the table indicated whether controls are already in place at the European level to deal with the production, distribution or disposal of such hazardous compounds.

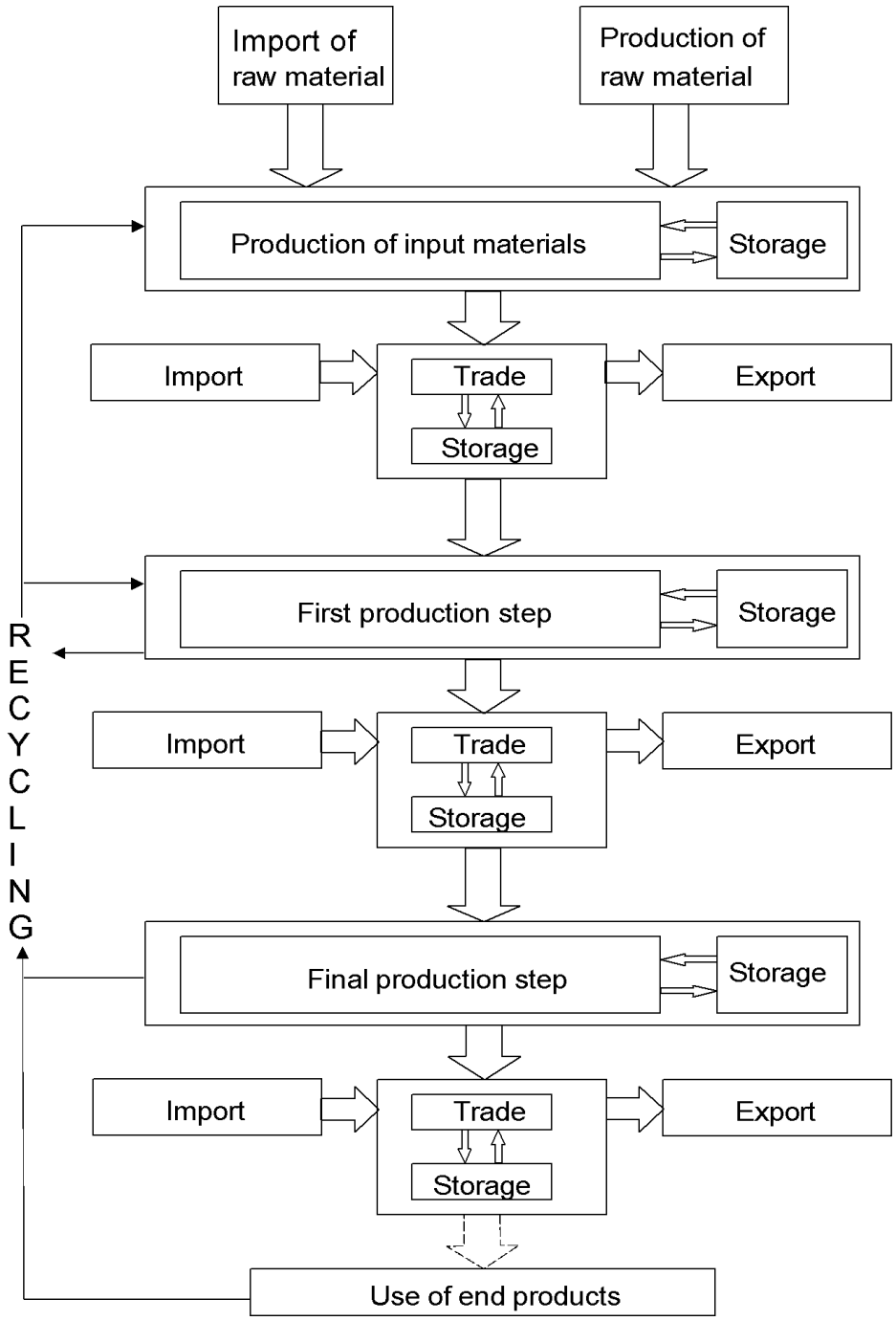

Figure 2.3 Simplified system of complex mass flows in production of consumer goods

The risks to health and environment associated with these substances during manufacture are controlled under health and safety regulations and industrial pollution control regulations.

The risks to health and environment during utilisation of these products depend very much on the compliance by consumers with manufacturer instructions, conditions during utilisation and on the relevance of these instructions themselves.

There are different risks to health during the utilisation of some household products. However, these risks are minimised for most consumer products by the type and content of hazardous substances authorised in consumer products. Manufacturers also recommend utilisation instructions for a safe use of these products.

The risks to health and environment during disposal of these products depend very much on the compliance by consumers with instructions for disposal and on the relevance of these instructions themselves as well as types of disposal treatment. For most hazardous household products, the quantities of waste produced are very small. However, for some categories of hazardous household chemicals e.g. pesticides and paints, quantities can be larger and present a real threat to the environment. For example consumers tend to stockpile paints and pesticides for a considerable number of years (up to 30 years) and in large quantities, and may discard large numbers of obsolete products as a single consignment. The one-off release of these obsolete or expired products into the waste streams can create high risks to health (during waste collection and treatment) and to the environment if not properly treated. The obsolete or expired products are often more hazardous than newer formulations and packaging may not be robust enough to satisfactorily contain the products. In addition, printed labels on the packaging may no longer be readable, preventing the identification of the active ingredient and the instructions for appropriate disposal.

Table 2.4 Household products containing hazardous substances

Product group	Examples	Major components	Hazardous status	Waste	Higher Exposure route	Existing control at EU level	Future action
Mineral oils (natural or synthetic)	Motor oil, lubricating oil, hydraulic oil, gearing oil, etc	Hydrocarbons, additives	Flammable Potential for water pollution Carcinogen	Waste oil Oil filter from car/trucks Empty bucket and dirty cloths	Waste	✓	✗
Asbestos products	Roofing, slab (Eternit), flower pots, insulating panels, heating blankets, electric heaters, brake pads, etc.	Asbestos fibre	Carcinogen	Old household appliances Construction waste	Usage/ Waste	✓	✗
Batteries and accumulators	Car batteries (Lead accumulators)	Lead, sulphuric acid	Toxic Corrosive	Waste car battery	Waste	✓	✗
	Zinc-carbon and Alkali-Manganese			Waste batteries	Waste		✗
	Mercury batteries	Hg	Toxic	Waste batteries	Waste	✓	✗
	Nickel-cadmium accumulator	Cadmium	Toxic	Waste batteries	Waste	✓	✗
	Lithium batteries			Waste batteries	Waste		✗
Paints and varnishes	Synthetic or natural varnishes	Pigments containing heavy metals (Cd, Pb) Solvents (ethylene glycol, methyl dipropoxol) Additives (formaldehyde, insecticides, fungicides, biocides, etc)	Toxic Flammable, VOC	Packaging waste Paint residues	Usage/ Water/ Waste		✓
	Gloss paint, Acrylic paint	Pigment, solvent	Toxic Flammable, VOC	Packaging waste Paint residues	Usage Waste		✓
	Latex based paint		Toxic	Packaging waste Paint residues	Usage Waste		✓

Product group	Examples	Major components	Hazardous status	Waste	Higher Exposure route	Existing control at EU level	Future action
	Thinner/paint remover	Petroleum distillates, white spirit, butanol, xylene, diacetone alcohol	Toxic Flammable, VOC	Packaging waste Product residues	Usage		✗
Wood preservatives		Solvent Salts (Fluorine salt, arseniates) Insecticides, Fungicides (pentachlorophenol, lindane)	Flammable, VOC, Toxic	Packaging waste Waste wood Product residues	Usage Waste		✓
Agents for care and cleaning	Floor polish	Diethylene glycol, petroleum distillates, nitrobenzene	Toxic Flammable Carcinogen	Product residues, old containers discarded during house clear outs	Usage		✗
	Furniture polish	Diethylene glycol, petroleum distillates, nitrobenzene	Toxic Flammable Carcinogen	Product residues, house clear outs	Usage		✗
	Leather care	Solvents	Flammable, VOC	Product residues, house clear outs	Usage		✗
	Shoe polish	Petroleum distillates, hydrocarbons		Product residues, house clear outs	Usage		✗
	Stain remover	Acetone, Toluene	Toxic Corrosive Flammable Carcinogen	Product residues, house clear outs	Usage		✗
	Ammonia based cleaner	Ammonia	Corrosive Toxic	Product residues, house clear outs	Usage		✗
	Scouring agents	Potassium hydroxide	Corrosive	Product residues, house clear outs	Usage		✗
	Disinfectant and bleach based products	Sodium & calcium hypochlorite, sodium hydroxide,	Corrosive Toxic if swallowed,	Product residues, house clear outs	Usage/ Water		✗

Product group	Examples	Major components	Hazardous status	Waste	Higher Exposure route	Existing control at EU level	Future action
		Antibacterial agents	irritant				
	Cleaning agent oven/grill	Sodium hydroxide	Toxic Corrosive Irritant	Product residues, house clear outs	Usage		✗
	Cleaning agent for pipes	Acid: Hydrochloric acid (HCl) Alkali: (NaOH, Na_2CO_3, KOH) Oxidising agents (NaOCl, H_2O_2), Sodium silicate, sodium sulphate, sodium triphosphate	Corrosive Toxic Reactive	Product residues, house clear outs	Usage/ Water		✗
	Descaler	Hydrochloric acid (HCl), phosphoric acid, oxalic acid		Product residues, house clear outs	Water/ Usage		✗
	Air freshener		Toxic Flammable		Usage		✗
	Bbq lighter fluid		Toxic Flammable		Usage		✗
Solvents	Stain remover, Cleaning products, Paint striper, Alcohol, Nail varnish, Polish remover, Thinner	Acetone, alcohol, chlorinated hydrocarbons, chloroform, white spirit, toluene, xylene, TRI, TETRA	Inflammable, VOC Toxic	Product residues, house clear outs, DIY waste	Usage/ Water		✓
Photo lab chemicals	Developer	Solvent (acetone, ethylene glycol) Alkaline solutions	Toxic, irritant	product residues	Usage/ Water		✗
	Stop bath	Acetic acid, Formaldehyde	Irritant, Carcinogen		Usage/ Water		✗

Product group	Examples	Major components	Hazardous status	Waste	Higher Exposure route	Existing control at EU level	Future action
	Whitening bath	Hexacyanoferate, bichromate	Carcinogen, toxic		Usage/ Water		✗
	Stopping bath	Acetic acid, formaldehyde	Allergen, Carcinogen		Usage/ Water		✗
	Whitening bath	Hexacyanoferrate, bichromate	Carcinogen		Usage/ Water		✗
Mercury containing products	Fluorescent tubes Low energy light bulbs	Hg	Toxic	End of life disposal	Waste	✓	✓
	Thermometer Barometer, etc	Hg	Toxic	Broken, or discarded	Waste		✓
Pesticides	Ant poison	Bendiocarb, pyrethroids	Very Toxic	Product residues, house clear outs	Usage/ Waste		✓
	Fungicides	Dichlofluanid, PCP	Very Toxic		Usage/ Waste		✓
	Herbicides	Atrazine, simazine, acid herbicides, OPs, organo chlorines, glyphosate	Very Toxic	Product residues, house clear outs	Usage/ Waste		✓
	Insecticides	Pyrethroids, OPs, arsenic, organo chlorines	Very Toxic	Product residues, house clear outs	Usage/ Waste		✓
	Rat poison	Warfrin, strychnine, Brodifacoum	Very Toxic	Product residues, house clear outs	Usage/ Waste		✓
	Moth balls	Naphthalene			Usage/ Waste		✓
Aerosols	Containing CFC	CFC	Greenhouse effect		Usage/ Waste	✓	✗
	Other	Propane, butane	Explosive Flammable Greenhouse effect	Product residues, house clear outs	Usage		✗

Product group	Examples	Major components	Hazardous status	Waste	Higher Exposure route	Existing control at EU level	Future action
		Residues from product (acid, alkali, pesticides, solvents, etc)	Toxic, flammable, corrosive, etc		Usage		✗
Medicines	Antibiotics, hormone replacing drugs, cancer medicines, depression medicines, etc		Toxic, endocrine disrupter Not all medicines are hazardous	Unused medicines	Water/ Waste		✓
Cosmetics	Hair dyes	Pigment, ammonia		Product residues, unused product	Water		✗
	Bath salts/bubble bath				Water		✗
	Skin creams	Heavy metal			Water		✗
	Nail varnish	Pigment, Solvent	Toxic Flammable		Usage		✗
	Nail polish remover	Acetone	Toxic Flammable	Product residues, house clear outs	Usage		✗
Chemical for craft and hobbies and car maintenance	Ink cartridge and toner	Alcohol Pigments including: Glycols (e.g. diethylene glycol, tetraethylene glycol) Nitrates Diols (e.g. 1-2 hexanediol, 1-5 pentanediol) Pyrrolidones (e.g. 2-pyrrolidone, N-methyl 2-pyrrolidone) Furans	Flammable Toxic	Waste cartridge, residues of ink and toner	Waste		✓
	Glue	Xylene, toluene, etc	Flammable, toxic		Usage		✗
	Text whitener	Solvents	Flammable, toxic		Usage		✗

Product group	Examples	Major components	Hazardous status	Waste	Higher Exposure route	Existing control at EU level	Future action
	Antifreeze, defroster	Ethylene glycol, methanol	Flammable, toxic		Usage		✗
	Rust inhibitor	Zn chloride, chromates	Toxic		Usage		(see paint)
	Sealing compounds	Solvent, PCB	Toxic, Flammable		Usage		✗

Notes:
Corrosive: can cause burn and destroy living tissues or other materials which come in contact
Explosive: can detonate or explode through exposure to heat, sudden shock, pressure or incompatible chemicals
Flammable: can be easily set on fire
Toxic: can cause injury or death through ingestion, inhalation or absorption through skin

2.4 Dutch system

The evaluation procedure presented below (IPA/AOO 2000) was used by the Dutch authorities to update a previous list of HHW which had be collected separately.

The Dutch list of HHW has been used to refine our own HHW selection. The Dutch system for HHW selection can serve as a good example for the rest of the European Union because of its detailed methodology, interesting use of the uniformity criteria and the comparability of waste management systems implemented within some other member states.

However, even if the Dutch methodology has limitations listed below, it is suitable for other Member States if properly adjusted to take the specific environmental conditions into account. One of the limitations is that it covers impacts from other disposal ways (i.e. discharge to sewer) than just solid waste disposal. In addition, it is based on Dutch waste disposal practices characterised by a high percentage of MSW incinerated and low level of landfilling. The same methodology applied in other Member States heavily relying on landfilling or with lower standards might presents different results and prioritise other household products. However, if applied to a situation with exclusive landfilling, the environmental impacts of organic pollutants will be higher for the landfill disposal; while there will be no impact from heavy metals in incinerator ash used for example in road construction.

a) Potential environmental damage

The potential environmental damage of every candidate product was evaluated using a worst-case scenario. To decide if a product did not require separate collection, a fraction of the pollutant content was assumed to be emitted into air, water, soil and incinerator residues prior to the treatment or disposal with the remaining waste stream. The product group qualifies as HHW if these emissions result in a significant increase (defined as 1% or more) in national emissions to air, soil or water.

For **emissions into air**, the volatile organic compounds (VOC) were considered. It was assumed that 50% of the potential emissions would occur prior to the arrival to the incinerator (small products were exempted because of the small 'breaking risk'). Table 2.5 shows the four main contributing products that were identified in the evaluation. Based on the emissions to air, none of the considered products should be collected separately because the contribution to national VOC emissions was less than 1% under the worst-case scenario.

Table 2.5 The four main products potentially contributing to VOC emissions in a situation without separated collection

Product	Contribution to national VOC emissions
Engine oil, used oil	up to 0,7 %
Turpentine	0,3 %
Paint	0,2 %
Miscellaneous solvents	0,03 %

Source: (IPA/AOO 2000)

For **emissions to water**, indirect discharge to surface water via wastewater stream were considered. Direct emissions to ground or surface water were assumed to be negligible. As a worst-case scenario it was assumed that all liquid products were poured down the sink and via the sewer system and wastewater treatment plants were emitted to the surface water. In the case of paints, heavy metal emissions were considered, in case of other products the pollutant content in the products themselves was taken into account. Table 2.6 shows the five main contributing products that were identified in the evaluation. Based on the emissions to water, paint, engine oil/used oil and turpentine should be collected separately as they would contribute to more than 1% to the national emissions to water.

Table 2.6 The five main products potentially contributing to emissions to water in a situation without separated collection

Product	Contribution to national emissions to waste water (%)
Paint	up to 32%
Engine oil, used oil	5%
Turpentine	2%
Etching agents	0,8%
Miscellaneous solvents	0,2%

Source: (IPA/AOO 2000)

For **emissions to soil** the impact from waste containers or refuse bags were assumed to be small and hard to quantify. Emissions from landfills were expected to be zero since all Dutch landfills comply with the so-called IBC-criteria (Isolate, Master and Control). An HDPE-layer will prevent leachates to leak to the soil or groundwater. Only very strong acids or bases or chlorinated hydrocarbons can potentially damage the HDPE-layer. It was assumed impossible to observe such a damage caused by HHW mixed with other waste. Based on the emissions to soil, none of the considered products should be collected separately.

For **waste incinerator residue materials** emphasis was placed on heavy metals. Of the three main residue materials of waste incinerators, flue gas cleaning residue was not considered because it is not re-used, but landfilled. The effect of a scenario without separated collection of the considered products on the reuse potential of bottom ash and fly ash was considered. To determine which components (metals) are most likely to influence the reuse potential two criteria were used. In the first place a metal should contribute to at least 0,1% of the input. Also the leachability in the current incinerator residual materials of one third of the maximum allowed value for reuse was supposed to label a component critical. Table 2.7 identifies the critical heavy metals for different incinerator residual materials. HHW containing these critical components in sufficient amounts are batteries, oil filters, energy-saving light bulbs, fluorescent light bulbs and paints. Based on the emissions to incinerator residual materials, these products should be collected separately.

Table 2.7 Critical components in incinerator residues

Component	Critical for bottom ash	Critical for fly ash	Critical for scrubber residues
Bromide	+	+	+
Cadmium	-	+	+
Chloride	-	+	+
Copper	+	-	+
Mercury	-	-	+
Molybdenum	+	+	+
Lead	-	+	+
Antimony	+	-	+
Selenium	-	+	+
Tin	-	-	+
Tungsten	-	+	-
Zinc	-	-	+

Source: (IPA/AOO 2000)

(b) Recycling potential

Out of all the products that were examined, a total of ten have a reuse potential (IPA/AOO 2000, AOO 2000). Thus, based on their reuse potential, the following products should be collected separately:

Car batteries: reuse of lead and sulphuric acid

Used oil: reuse as a substitution fuel

Batteries: reuse of metals (zinc in gutters, steel in nails and cadmium in new batteries)

Photographic fixer: reuse of silver

Photographic developer: reuse of silver

Mercury switches: reuse of mercury (there are plans for building a High Temperature Oxidation (HTO) installation in The Netherlands)

Mercury thermometers: reuse of mercury

Oil filters: reuse of oil and tinplate

Energy-saving light bulbs: reuse of metals and glass

Fluorescent light bulbs: reuse of metals and glass

(c) Safety risk

The products have been examined on their hazards to human health for both consumers and waste collectors (AOO 2000). Based on product properties (composition, packaging, and use) the probability of exposure or emission and the potential effect thereof has been quantified. Scores for probability between 1 and 5 and effect between 1 and 10 were given for situations of disposal through residual waste (consumer/collector), bulky waste (consumer/collector) or the sewer (inside/outside the house). An index of the potential risk of the products was determined by multiplying the scores, resulting in a number between 1 and 50. No further details about the methodology are available. It was difficult to quantify the probability of exposure/emission. The results of the evaluation with regard to safety are summarised in Table 2.8. In conclusion of the exercise, a total of nine products were put on the list for separate collection because of their safety risk.

(d) Uniformity

In order to avoid confusion among consumers, two similar products are made candidates for separate collection even though in fact one of the products is unlikely to cause an environmental or toxic risk. Table 2.8 contains a list of products that should be collected separately based on this demand for uniformity.

A final evaluation was made for those candidate products for which, based on the four aspects discussed above, separate collection was not considered necessary. Their cumulative environmental effect was assessed to ensure that this was no higher than 1% for emissions to air and water. None of the products exceeded this threshold.

Table 2.8 Scoring of candidate products for inclusion in the Dutch HHW list based on four criteria. Products considered HHW are bold-faced, products contained in the old "Yes/No"-List are marked with an asterix (*)

Product	Environmen-tal effects	Recycling potential	Safety risk	Uniformity
Acetone				
Anti-flea pet collar				
Batteries	+	+		
Break fluid				+
Brush cleaning agent				+
Brush softening agent				+
Car batteries	+	+	+	
Cleaning spirit				+
Correction liquid				
Degreasing agents				
Energy-saving light bulbs	+	+		
Engine oil, used oil	+	+		

Product	Environmental effects	Recycling potential	Safety risk	Uniformity
Etching agents			+	
Fluorescent light bulbs	+	+		
Furniture polishing oil				
Glue and adhesives				
Hydrochloric acid			+	
Hypodermic needles			+	
Ink				
Lamp oil				+
Lead wrap (wines)				
Liquid bases			+	
Liquid drain cleaner			+	
Lubricant grease				
Medicines			+	
Mercury switches		+		
Mercury thermometers		+		
Nail polish				
Nail polish remover				
Oil filters	+	+		
Paraffin				+
Paint	+			
Paint dilutant				+
Paint stripper			+	
Pesticides/insecticides			+	
Petrol			+	
Photographic fixer		+		
Photographic developer		+		
Stain remover				
Surfacer				
Thinner				+
Turpentine	+			
Wood preserving agent			+	

Source: (IPA/AOO 2000)

2.5 Prioritisation of hazardous household products

Household products which pose the highest risk to health and environment through solid waste disposal route have been identified based on the methodology and information presented above and have been classified into a three-tier priority list (Table 2.9);

- **Tier 1 products** are those where our preliminary analysis has determined a significant hazardous potential for the solid waste streams.
- **Tier 2 products** are those which are now banned or strictly controlled within the EU but for which adequate disposal practices might still not be in place or for which there are possible different controls within the Accession Countries.
- **Tier 3 products** are those for which concerns have been expressed about their potential negative impacts on health and environment but for which there is a lack of information to confirm their hazardous potential or which cannot be labelled as hazardous.

Tier 1 products have become the focus of the study for the selection of case studies and schemes which have helped reduce the potential risk and impacts for these compounds presented in Section below.

Table 2.9 Priority hazardous household chemicals

Tier 1 household products	**Associated hazardous chemicals**
Paints and associated products	Obsolete paint residues containing lead, chromium Modern paint containing solvents
Treated wood and wood preservatives	Mainly organic chemicals or arsenic/chromium
Fluorescent bulbs and other mercury domestic products (low-energy bulbs, thermometer)	Mainly mercury
Pesticides (insecticides, fungicides etc.)	Banned active ingredients such as DDT, aldrin, endrin etc. Authorised active ingredients
Degreasers and other household chemicals	Organic solvents and corrosive compounds
Tier 2 household products	**Associated hazardous chemicals**
Waste oils	PAHs, hydrocarbons
Batteries and accumulators	Cadmium, mercury, lead, nickel
Construction waste	Asbestos, lead, copper, arsenic
Tier 3 household products	**Associated hazardous chemicals**
Car oil filter	PAHs, hydrocarbons
Leather	Chromium
Pharmaceutical products	Antibiotics Synthetic steroids, cytotoxic medicines etc
Ink/toner cartridge	Pigments including glycols, etc.

3. CASE STUDIES

3.1 Introduction

The objective of the case studies is to identify interesting initiatives for reducing the risks during disposal of priority hazardous household products either by proposing environmentally friendly product replacement and/or the by considering separate collection.

The case studies have not only reviewed environmental issues in a LCA perspective whenever possible but also costs, financial and social incentives and obstacles to these initiatives.

During the research, it became apparent that there were interesting initiatives at various levels; i.e. local consumer groups with or without support from the industry, national separate collection schemes, industry and/or retailer initiatives, etc. These actions were not all targeted at our priority products but rather cover an ad-hoc range of products. These initiatives are listed below.

The most interesting case studies relevant to our priority products; namely paints, fluorescent tubes, arsenic treated wood, cleaning products and pesticides are reviewed and described in details in the following chapter. These are marked in bold in the list below. It was not possible to find interesting and well research case studies for separate collection of pesticides but rather there were initiatives to reduce the risks during the use of pesticides. Additional case studies were presented for car oil filter, even if these products were only identified as category 3 on our list.

- Voluntary replacement product for paint containing solvents by water-based paints and a more detailed labelling system
- **Re>Paint scheme in the UK (separate collection and redistribution of surplus paints)**
- Unused obsolete paint and amnesty
- Replacement of methylene chloride in paint striper
- Unused and obsolete pesticide amnesty
- Plan for introducing certificates for use of pesticides by domestic gardeners in Denmark
- **Separate collection of domestic pesticides**
- **Alternatives to arsenic treated wood**
- BEBAT system for batteries collection in Belgium
- Oil Care Campaign in the UK
- **Separate collection and recycling of car oil filters in the UK**

- Replaceable paper filter for car oil filters
- **Separate collection and treatment of mercury fluorescent tubes**
- Free mercury fluorescent tubes in Sweden
- UK retailer initiative for reducing chemicals in household products
- Product labelling in the Netherlands
- National Household Hazardous Waste Forum in the UK and their Good Practice Guide
- New nickel metal batteries in Sweden
- Rechargeable Ni/Cd batteries
- Pocket lamp without batteries
- SuperDrecksKescht fur Burger in Luxembourg
- Separate collection and alternatives for printer ink cartridges
- Recommendations on not using antibacterial cleaning agents in Denmark, Finland and Germany
- Taxes on chlorinated solvents, PVC and phtalates in Denmark
- **Alternatives to degreasers and other household chemicals**

3.2 Paint

Over 300 million litres of paints are sold annually in the UK to the DIY market and to trade operators. Approximately 37.5 million litres of DIY and 2.5 million litres of trade paint remain unused. This paint tends to be stored and then disposed to landfill. The collection and re-use of surplus paint is highly desirable as the disposal of such unused products is a loss of valuable resource and can create nuisance when mixed with MSW.

3.2.1 Presentation of the scheme

Information below has been supplied by Mr Mark Gregory, the full-time co-ordinator of the Re>Paint scheme in the UK. Launched in 1994, the Re>Paint initiative currently operates a total of 45 schemes across the UK, with a total number of 90 planned (Table 3.1). The scheme aims to divert paints from the waste stream, collecting unwanted or surplus paints from householders (and some trade groups) and redistributing free of charge among community groups, charities and voluntary organisations. Recipient groups usually pick up paint from the host organisation.

Table 3.1 Re>Paint schemes, operational and planned in 2001

Area	Schemes Operational	Schemes Planned
England	31(6)	70
N Ireland	1	5
Scotland	3 (1)	10
Wales	2 (1)	5
Total	**37 (8)**	**90**

NB: numbers in brackets had not been launched on June 1st 2001

Each scheme is run by a local community organisation (e.g. a charity). The scheme is supported by local councils, ICI Dulux (a paint manufacturer), Biffa Waste Services (a waste operator) and the National Lottery Charity fund. It is managed and co-ordinated by SWAP – Save Waste and Prosper Ltd. Groups hosting a Re>Paint scheme finance their operation through their existing activities.

The main sources of paint comes from the public but supplies also come from DIY retailers and in some cases professional painters. Paints are be collected either:

- Dedicated drop-off points at DIY retail stores;
- Skips at amenity centres;
- Kerbside collection in tandem with other e.g. furniture; and
- Direct delivery to a scheme base.

Restrictions apply to the material that is accepted (see Table 3.2), for example paints must be in their original containers, and should not have been mixed. Once collected, the paint is sorted by type and acceptable material is stored ready for collection. The unacceptable material is transferred for waste disposal.

Table 3.2 Acceptable materials in Re>Paint scheme

Acceptable material	Unacceptable material
Usable paint for domestic application	Paint thinners
Emulsion paint	Paint brush cleaners
Gloss paint	Paint stripper
Eggshell paint	Varnish and wood stains
Satin paint	Wood preservatives and treatments
Undercoat	Car paint
Primer	Specialist and industrial paints
Floor paint	Aerosol and spray paints
Masonry paint	Cellulose-based paints
Exterior paint	Paint not in its original container
	Paint over 10 years old
	Unusable paint

3.2.2 Limitations and obstacles

The volumes of paints redistributed is constantly increasing. In 2000/2001about 53,000 litres were re-distributed compared with 13,300 litres redistributed in 1998. On average each scheme received 1,500 tins of paint of which 77% was of acceptable quality. The number of containers per scheme ranges from 60 to 9,400 tins. The volume of paint varies from one scheme to the other; from 112 litres to 15,000 litres. The stock of surplus paint per year from DIY (domestic origin) has been estimated in the UK to amount to about 40 million litres. The current collection rate for 37 operational schemes amounts to 0.13% of the existing potential. The collection rate is thus very limited.

Redistributing the paint is generally not a problem. However, finding a consistent supply which matches demand is more problematic.

The quality and volume of donated paints varies depending on the method of collection:

- Paint collected through a civic amenity site ranged from 343 litres to 2,330 litres and normally rated as good paint;
- Paint collected from retailers ranged from 64 to 3,725 litres, classed as excellent;
- Paint collected through other methods (drop-off at council offices, parish halls, etc) generated lowest volumes ranging from 10 to 726 litres and classed as excellent quality.

3.2.3 Cost

As previously mentioned, these schemes are run by local community organisations and rely on voluntary support and the paint redistributed is done so free of charge. A typical scheme takes between 3 and 20 hours a week to operate depending on the scale of collections and re-distributions. The number of volunteers involved in a single scheme can range from one to fourteen. The annual cost of operating a scheme ranges from 31 to 9,300 euros depending on the scale and location. There are no detailed costs available for different collections. SWAP is currently undertaking a feasibility study for a potential paint collection scheme at the regional and/or national level.

3.2.4 Conclusions

It can be concluded that:

- This scheme can be replicated in other countries with different sources of funding than landfill tax support;
- It has environmental benefits of collecting separately and avoid mixing surplus and/or obsolete paints with MSW (i.e. spillage, coating of MSW, release of solvents, risk of pollution from obsolete paint tins, etc);
- It has also social benefits in generating voluntary works and supporting charities;

- More flexibility in quantities of paints being purchased is recommended – maybe initiative should be looked at for refill at DIY stores and cheaper price for small containers not to discourage consumer to buy smaller quantities;

- The Re>paint voluntary scheme is an interesting initiative supported by the paint and waste industries to collect and reuse these paints;

- It does not however currently retrieve a substantial amount of the surplus paints (less than 1%). Information and the increase number of such a scheme across a wider area might improve the rate of collection;

- The cost of such a scheme can be kept low due to the reliance on voluntary staff and public participation.

3.3 Fluorescent tubes and low energy light bulbs

The use of low energy light bulbs in household is to be supported due to overall beneficial impacts on energy and environment of mercury fluorescent tubes compared with conventional light bulbs, especially when spent lamps are collected separately and mercury recovered. However, there are some concerns due to the presence of mercury in these products and the risks associated with their improper disposal. The existing schemes presented below offer some alternatives to general disposal with MSW.

3.3.1 Energy and environmental aspects

It is reported that using fluorescent lighting helps reduce the net amount of mercury released into the environment because far more mercury is released during electricity generation than is present in the bulbs themselves. Using emissions data from IFEU database, a total of 2.2 t of mercury emitted to air annually is thus avoided in Germany (Table 3.3). The mercury content in FT in Germany based on 60 million FT disposed of annually, was estimated to range between 0.5 and 1 tpa which is 50% or less of the mercury saved through reduced energy consumption. Emissions of other metals such as nickel are also avoided, amounting to 10.6 tpa.

Although the energy demand for production of fluorescent tubes (FT) compared with conventional light bulbs is up to ten times higher, the consumption of energy by FT is one fifth of the energy consumption for traditional bulbs and they last 8 times longer. In Germany, it has been estimated that using FT rather than traditional bulbs can save 150,000 GWh per year of electricity.

A detailed life cycle analysis was carried out in 1994 (Öko-Institut 1994) comparing traditional light bulbs versus energy saving fluorescent lamps (Table 3.4). The data indicates the following:

- over an entire life cycle, fluorescent lamps (FL) save significant amounts of energy compared to the alternative traditional light bulbs;

- the amount of glass, aluminium, lead in solid waste fractions in FT is lower compared to traditional bulbs (TB);

- the amount of plastic, mercury and other metals in waste is higher in FT than for TB;
- the air emission by production and use of fluorescent lamps are significantly lower, only N_2O emissions were calculated to be nearly 50 times higher;
- the emissions into water are lower for AOX (adsorbed halogenated aromatics) and CSB (chemical oxygen demand); for mercury there was no load calculated for traditional bulbs;
- for radionuclides, fluorescent lamps account only 8% of the emissions compared to traditional bulbs.

Table 3.3 Heavy metal emissions into air from FT waste

Metal	Emission factor electricity production[a] (kg/kWh)	Load reduction by replacement of conventional bulbs by FT in Germany [b] (tpa)
Arsenic	1,06E-08	1,6
Lead	1,63E-08	2,4
Cadmium	1,48E-09	0,2
Chromium	4,41E-09	0,7
Mercury	1,47E-08	2,2
Nickel	7,04E-08	10,6

a) ifeu database Umberto (2002)
b) calculation for Germany, assuming energy conservation of $150x10^9$ kWh/year

Table 3.4 Emission into air, water and waste and resource and energy consumption by production, use and waste management of lamps (Öko-Institut 1994)

Criteria	Unit	Traditional bulb (TB)	Fluorescent lamps (FL)	Ratio FL/TB, %
Energy				
Production	MJ/10^6 Lh	0,8-3,1	0,6-2,1	
Use	MJ/10^6 Lh	1003	133-244	< 24
Waste				
Glass	g/10^6 Lh	37,3	7,7-24,6	< 66
Plastic	g/10^6 Lh	5,3	3,7-6,8	< 130
Aluminium	g/10^6 Lh	2,6	0,1-0,6	< 23
Mercury	g/10^6 Lh	-	1,9-2,1	
Lead	g/10^6 Lh	0,4	0,03-0,2	< 50
other metals	g/10^6 Lh	1,1	1,9-5,2	< 470
Emission in air				
Nox	mg/10^6 Lh	38.900	6.444-9.158	< 23
N_2O	mg/10^6 Lh	5,8	7.631-30.882	< 5300
SO_2	mg/10^6 Lh	32.710	5.435-7.985	< 24

Criteria	Unit	Traditional bulb (TB)	Fluorescent lamps (FL)	Ratio FL/TB, %
Mercury	mg/10^6 Lh	2,5	0,04-0,6	< 24
Lead	mg/10^6 Lh	0,3	0,07-0,2	< 67
Emission in water				
AOX	mg/10^6 Lh	0,002	0,001	50
CSB	mg/10^6 Lh	49,3	3,1-15,5	31
Mercury	mg/10^6 Lh	-	< 0,00001	
radionuclides	µCi/10^6 Lh	1.456.000	117.300	< 8

Note: Lh = lumen hour

Mercury is also released during disposal of spent lamps. It is estimated that over 600 million fluorescent tubes are discarded annually in the European Community equivalent to 120,000 tonnes of glass, metals and 4,5 to 9 tonnes mercury per year. In addition, switch devices of fluorescent tubes sometimes contain polychlorinated biphenyls (PCBs).

It is estimated that around 58% of MS waste are landfilled in European Union, this is the most common procedure of waste treatment in the EU. Disposal of spent fluorescent tubes will increase the loading of mercury in landfills. However, there is no report of significant mercury emissions to air through landfill gas and to water through leachate due to landfilling of spent fluorescent tubes. The incineration of fluorescent tubes is however not desirable.

As the treatment of spent fluorescent lights to recover mercury is reported to be very efficient, it is recommended to operate separate collection whenever possible. It is also recommended to encourage manufacturers to pursue the development of free mercury low energy light bulbs.

3.3.2 Evaluation of alternatives

Free-mercury light bulbs

It is reported that mercury free light bulbs are not currently technically feasible as the mercury levels affect the light-bulb life — generally the higher the mercury per lamp, the longer the life. However, a company based in Sweden (see www.lightlab.se) is developing mercury-free low energy lamps. It uses a new method of generating the necessary electron flow. It was not possible to receive detailed information on this new process and product to be able to ascertain whether these fluorescent tubes low in pollutants can be disposed of along with the household waste. However, when assessing the feasibility of this option, the current under-utilisation of the existing recycling facilities must also be taken into account.

Separate collection and treatment

Individual bulbs may be returned to the appropriate shop or brought for disposal to communal recycling facilities and special-waste collection points as they were established in many countries within the European Union. Germany, Austria, Belgium, Holland, and Switzerland for example have declared mercury-containing lamps hazardous waste, and have programs in place for their separate collection and treatment. Many fluorescent light bulbs are however still being disposed of with municipal waste. Both extensive recycling possibilities and the information to consumers can assure a high collection and recycling quota. The collection rate

varies from around 14 up to 80 % in the EU. For example, the cost for a bring-back system in Denmark ranges up to 0,8 Euro per household. According to EUROSTAT the number of households for these EU-States relevant for the study is nearly 180 Million, therefore the total cost for a general bring back system in the EU can be calculated to be more than 140 Million Euro.

Austria:

In 1994 the collection rate for fluorescent lights in Austria was over 50% (approximately 2.5 million lamps annually). Austria has a system where customers pay a deposit of about 1 euro and a recycling fee which subsidises a fluorescent lamp recycling program.

Germany:

With about 15 years of experience, Germany has the largest lamp collection infrastructure in the world. In 1994 there were about 220 locations where consumers could deposit old lamps, which were then transported to one of the country's 20 lamp mercury recovery plants. In 1994, 70%-80% of all used German lamps was taken to recovery plants, representing about 50-60 million lamps. The German Electronic Association (ZVEI) reported that recycling rate for fluorescent tubes is up to 100% with a very high level of reuse for all components except for the fluorescent powder after mercury extraction.

Sweden:

In Sweden, Kvicksilveråtervinning AB (Mercury Recycling Inc.) claims to recover 14% of the domestic fluorescent lamp waste in Sweden and 1% of mercury in other lamps. This corresponds to 1.5 million long fluorescent lamps and 42,000 compact fluorescent lights (CFL) plus other lamps each year. An additional 550,000 lamps each year are imported for processing from other Nordic countries.

Meanwhile a mercury-free low energy lamp has been developed by a subsidiary of an international electrical engineering company. The new lamp has won the European Better Environment Awards for Industry (EBEAFI) Ecodesign. Because of increased demand by consumers, the company hopes to replace 80% of the existing lamps with the new lamp (The Global Compact: C.S. (Unep) Ecodesign). Unfortunately, it was not possible to receive sufficient information to assess further within our study this new initiative.

UK:

In the UK, around 80 million fluorescent tubes are disposed of each year. The Department of Environment's guidance on their disposal makes a distinction between the occasional disposal of a few tubes and their disposal in bulk. If large quantities of tubes are being disposed of they should be treated as hazardous waste. However, the interpretation of 'large quantities' is not clearly defined, with a possible figure of over 20 suggested. Fewer tubes, such as might arise from households or small premises, are permitted to be disposed of as non-hazardous household or commercial waste.

The UK Ecolabelling Board has set standards for light bulbs and tubes under the EU ecolabelling scheme. Single and double ended light bulbs are judged on the following criteria: energy efficiency, mercury content, packaging, product information and lifetime. Life-cycle assessment of the environmental impacts of all light bulbs and tubes established that 90% of impacts occur during use, mainly due to emissions from power stations of carbon dioxide and

sulphur dioxide. It is considered that environmental performance will improve with increasingly energy efficient bulbs and by encouraging consumers to switch from traditional bulbs to more efficient, low energy fluorescent ones.

A pilot reuse and recycling scheme for fluorescent tubes are running in Ealing, London. The charity Ealing Community Transport Recycling (ECT) collect discarded but useable fluorescent tubes from supermarkets, banks, restaurants, chain stores and other businesses and give them to schools and non-profit organisations in exchange for spent lamps. This project, called Green Light Project, is now being introduced throughout London with the help of EU funding to develop it into a self-financing model for similar projects elsewhere in Europe (http://www.wastewatch. org.uk/informtn/fluores.htm).

Treatment of waste fluorescent tubes

The fractions are separated into fractions of glass, metal and mercury. The reuse of the disassembled raw materials is not always economically feasible. The decision on recycling or removal depends upon whether or not the reuse of the glass and the metal fraction is actually being proven.

Reprocessing fluorescent tubes occurs in two stages:

- Fluorescent tubes are dry-processed via crushing, sieving and magnetic separation. This procedure generates three fractions: Fluorescent powder, a glass scrap fraction and an aluminium/metal socket-end fraction.

- The fluorescent powder is heated under vacuum while simultaneously supplying oxygen to the afterburner. The vacuum pressure in this varies so that the mercury is ventilated off from the powder and collected in condensers, 99% of the mercury is recovered with a purity of 99.98%.

3.3.3 Costs and benefit

An analysis of available data shows that the feasibility of reuse depends on the costs of handling and processing old lamps, the purity of the resulting mercury, the competing disposal costs, and other factors. The German experience with the largest lamp-collection infrastructure in the world and 20 lamp mercury recovery plants demonstrates the economical benefit of mercury recovery of fluorescent lamp recycling.

It is difficult to determine the cost for collection and disposal of FT for all member states in the EU. Based on Danish data, the total cost for a general bring-back system in the EU has been estimated to be more than 140 million Euro. Based on data for Germany and assuming 120.000 t of FT waste, the cost for disposal is about 150 million €, equivalent to 1.25 €/kg.

Regarding the development of a “mercury-free” low energy lamps in combination with the expectation of the producing company that 80% of the existing lamps will be replaced by mercury-free ones, the market will have to show whether mercury recovery will still be economically feasible under such conditions. The ecological advantage of the “mercury-free” low energy lamp has still to be demonstrated on a life cycle analysis.

3.3.4 Conclusions

The collection rate of fluorescent lamps (FL) differs widely in the EU-member states and ranges from 14% to 80 %. A further expansion of collection efforts and more recovery plants for fluorescent lamp can likely be expected.

Under the current conditions, separate collection and recycling of FL is associated with a net environmental benefit. Life cycle analysis data shows that the use of fluorescent lamps saves energy and the avoided airborne emissions from energy production are significant including mercury emissions. Based on data from Germany, if all mercury in FL would be emitted into air, the resulting emissions would be a factor of 2 to 4 smaller than to the avoided mercury emissions due to reduction in electricity production. In reality, the net benefit is much larger since recycling of FL results in only a small fraction of the mercury inventory in FL being emitted into the atmosphere.

The mercury concentration in fluorescent lamps should not exceed more than 5 mg per lamp. The alternative of a “mercury-free” FL appears to have greater benefits. Before endorsing this new product, the net benefit should be demonstrated in a life cycle study.

The cost for separate collection and recovery of FL waste is acceptably small (about 1 € per person and year) and are a small fraction of the cost of the FL life cycle costs.

Information on FL use and appropriate waste management practice should be improved by providing better product information and by training sales personnel.

3.4 Arsenic treated wood

Arsenic treated wood (chromated copper arsenate - CCA) has been widely used for outdoor structures such as decking as well as for playground equipment. Throughout the early 1990s there was a steady decline in the world market for CCA wood preservative as they were replaced by alternatives.

CCA pressure-treating like any other treated wood can increase the wood’s serviceable life substantially, from perhaps 3-7 years for untreated wood, to as long as 60 years. Using treated wood reduces consumption of wood resources and reduces costs because of lower maintenance and less frequent replacement. The actual serviceability of a specific project using pressure-treated wood is dependent on factors including climate, site-specific conditions, type of use, and eventual removal owing to decomposition and or replacement.

Based on the risk assessment that resulted in the European Commission will soon propose an amendment of Directive 76/769/EEC to restrict very much the allowed uses of CCA treated wood. The proposed EU regulation would only permit the use of CCA treated wood for certain limited industrial uses and no consumer uses. The measures would have a significant effect on the CCA business. The Netherlands have effectively banned the import of CCA treated wood.

The upcoming ban on CAA treated wood in the EU will not resolve the issue of the existing inventory in the Member States which will end up in the waste stream over years to come. Given the fact that CAA treated wood was used in construction, a large amount will likely end up in construction waste, the fraction discarded at the household/homeowner level is likely to be found in bulky waste.

Since arsenic was identified as a priority pollutant in the waste stream in previous section of this report, the obvious question arises to the contribution of CAA treated waste wood to the overall arsenic inventory in MSW. The precise amount of arsenic entering the municipal solid waste stream is difficult to ascertain. Based on a literature review, the default value for municipal solid waste in the life cycle analysis tool UMBERTO® is given to be 5 g/t (Umberto, 2002). If this value is taken to be representative for the entire municipal solid waste in Europe of 163 million tonnes per year (COM, 1999), the total annual arsenic input into the solid waste in the EU is estimated to be 820 t. On the average, this is equivalent to about 2 g of arsenic per person and year that are contained in MSW.

In 1996, a total of about 2,400 tonnes of arsenic were contained in the CCA that was marketed in the EU. The amount of arsenic estimated in MSW is thus equivalent to about a quarter of the CCA sales. While there are other sources of arsenic in MSW (in waste metal and glass for TV screens), no other product is believed to be as relevant for the arsenic in MSW that is subject to easy leaching in landfills or may volatilise in the combustion process in MSW incinerators. This was also the result of a detailed study for the German Environmental Agency (Giegrich *et al*., 1993). That study further concluded that arsenic is the most important contributor to carcinogenic property of landfill leachate, given the relatively high concentration of 1.6 mg/l in MSW landfills. The study estimates that over a total of 100 years, a total of 1.2 g arsenic will be emitted per tonne of waste, that is equivalent to 24% of the arsenic content of MSW.

3.4.1 Evaluation of alternatives

There are alternative wood preservative treatments that do not use arsenic. Such alternatives are thought to include products based on:

- Copper and Boron;
- Chromium trioxide, Copper and phosphoric acid;
- Copper, Didecylpolyethoxyammoniumborate;
- Copper, Didecyldimethylammoniumchloride; as well as
- Heat-treated wood (reducing the rotting property of wood by prolonged exposure to about 200°C).

It should be noted that wood preservative treatment plants could easily switch to using the new arsenic-free treatment using their existing equipment. One of these is ACQ which stands for Ammoniacal Copper Quaternary. Instead of arsenic, a quaternary solution is used, which is a surfactant/cleaner. The heat treatment of wood is another suitable alternative with the probable disadvantage of the increased energy requirement.

A comprehensive life-cycle study comparing CCA treated wood with its alternatives was not available to the authors. Given the fact that the European Commission is considering the ban of CCA as wood preservative except for some industrial applications (European Commission 2001), this will result in the general reduction of CCA treated wood in MSW. This decision is driven by the direct health and environmental impacts from the use and disposal of CCA treated products. Because the general decision to phase out CCA is likely to be endorsed by member states, emphasis should be placed on the proper waste management of CCA treated

products. This situation leads to a predicament: with the upcoming decline of CCA treated wood in households of Member States, the inventory still poses a significant problem in solid waste management.

3.4.2 Conclusions

Arsenic is a major pollutant in MSW and ranks high on the list of carcinogens in leachate from landfills, in airborne emissions from incinerators and in ash from MSW incinerators. A major portion of arsenic in MSW (estimated to be in the order of 820 tonnes per year in the EU) is from arsenic in CCA (chromated copper arsenate) used in pressure-treatment of wood. While extending the lifetime of wood products such as house decks and playground equipment, the products will inevitably end up as waste at the end of their life cycle. Even if the majority of CCA wood present in MSW will not be generated from households, it is however relevant to minimise improper disposal of such materials even from households.

Alternatives to CCA such as copper-based compounds (mainly copper based) are readily available and are far less toxic. They are strongly favoured by the European Commission which is seeking a ban of CCA treated wood due to the hazards of CCA to human health and the environment.

Even if the upcoming ban of CAA treated wood for most applications in the EU is implemented, CCA treated wood will remain a problem in MSW management. While the majority of CCA wood present in MSW will not be generated from households, it is nevertheless a recommended action to minimise improper disposal of such materials also from households. The separate collection and adequate treatment would have the following beneficial effects:

- Identification of CCA treated wood as HHW would assist in proper treatment in the households (e.g. reduce the likelihood of incineration in small furnaces without proper pollution control);

- landfilling of CCA treated wood should be avoided because it increases the carcinogenic property of leachate; and

- separate collection as HHW will facilitate the incineration of CCA treated waste wood in incinerators with proper pollution control.

The proposed action is, however, hampered by an array of unresolved issues:

- The bulk of CAA treated waste wood is expected in demolition and construction waste. There is no established inventory of CCA treated wood with breakdown into usage sectors. This holds true for other treated wood as well. Without addressing the issue of the major part of the existing, separate collection on the in households has little merit.

- There is no established procedure to ensure that the consumer can identify CCA treated waste wood as compared to untreated wood and wood treated with other substances. There was no labelling requirement in the past. It may be advisable to define all waste wood with previous outdoor use as candidates.

- The preferred treatment method of CCA treated wood is incineration in MSW incinerators with state-of-the-art air pollution control given the volatility of arsenic in flue gas. Such

method may not be available in all places; incineration in regular furnaces or even use in compost is unacceptable.

3.5 Car oil filter

Car oil filters can originate in household waste when DIY motorists service their own car. It is reported to be an important issue in the UK where 7 million people are reported to service their car at home and are estimated to dispose, mixed with normal waste, 1,100 tonnes of oil in spent filters. This can pose a threat to the environment.

There have been initiatives in the UK for separate collection and recovery of the waste oil. Evaluation of alternatives for spent car oil filters from disposal with MSW are presented below:

3.5.1 Evaluation of alternatives

Recycling

Used oil filters are recyclable because they are made of steel. Any oil that is left in them can be recovered using oil filter presses. These squeeze out the oil and then flatten the remaining metal filter, which can then be recycled with other steel. In the UK some garages have their own filter presses but Unic International who use to sell such presses no longer do as the market for them was so small.

In the UK garages and the few civic amenity sites that do collect oil filters have drums that are supplied by a waste management company. One such company, Safetykleen supplies two different sizes of drum; 115l (160 car oil filters) and 205l (300 car oil filters). The smaller drum can take ready crushed filters but the large drum can only take uncrushed filters due to the weight. The filters are then transported to centres where they are pressed in an industrial crusher. It is claimed that this removes 99% of the oil. The oil then gets blended into fuel which is then used by companies such as Blue Circle in cement kilns. The metal from the filter then goes to Corus (formerly British Steel). It is reported that Safetykleen recycle 7 million oil filters a year.

Companies, who collect oil filters charge for the service. For example Safetykleen has two sizes for collection drums, the costs of which are shown below;

- 115l bin (160 filters): 70 euros (£43.50) per drum + VAT equivalent to 0.44 cent per filter
- 205l bin (300 filters): 100 euros (£62.55) +VAT equivalent to 0.33 cent per filter.

Re-useable filter

Re-useable filters are being designed where the outer steel part of the filter is left in the vehicle while the paper inner is being replaced. There is no scheme for recycling theses oil filter papers and thus there is a risk that this oily waste end up in the normal waste stream. It was reported that these filters were not readily available yet for DIY motorists.

3.5.2 Conclusions

Spent car oil filters are found in household waste as some people do their own oil change. This practice is probably on the decrease, as technology in new cars becomes more complex. Improper disposal of waste oil via the spent filter can pose real threat to the environment. The oil filter is a valuable material as it is made of steel which can be recycled and 99% oil can be recovered from filter and reused. It is recommended to inform DIY motorists and promote such separate collection though bring back scheme at local garages or local amenity centres.

3.6 Cleaner and care household products

Based on the analysis performed for the Dutch HHW list, some domestic cleaning products such as liquid drain cleaners (containing for example sodium hydroxide or hydrochloric acid), liquid bases (such as strong oven cleaners containing sodium hydroxide) are candidates for separate collection and disposal.

The cleaning and care domestic products identified as priority in our study are products containing chlorinated solvents such as paint striper, metal cleaning or stain remover. Other household cleaner and care products such as bleach, floor wax, furniture polish, etc have hazardous properties (corrosive, flammable, and toxic) which need to be handled with care during use, storage and disposal.

The liquid products identified in the Dutch list are mainly discarded through drains and pose a risk to the environment through that route rather than through solid waste disposal. However, they can also be potentially disposed into the dustbin as left over in containers and contribute to the environmental burden of waste disposal. The solid cleaner products have a higher risk to enter the waste solid stream if discarded.

3.6.1 Evaluation of alternatives

Separate collection and treatment

Schemes are in place to dispose of these products separately (i.e. Netherlands, Belgium, and Luxembourg) during special collection or drop off points. However, data to assess the impact and associated costs of such separate collection for these products in quantitative terms was not readily available.

The quantities collected through the SuperDrecksKëscht fir Biirger in Luxembourg from households of acids, alkaline products and solvents in 2000 amounted to about 0.3 kg/inh, 1.1 kg/inh and 1 kg/inh, respectively. These products are sorted and incinerated at high temperature in Belgium.

Restrictions on use and marketing

There are restrictions on use and replacement products for chlorinated solvents such methyl chloride, perchloroethylene and trichloroethylene. Alternatives such as aqueous based products and hydrocarbons solvents are however reported to be less efficient by the European Chlor Solvent Association. Aqueous products would tend to use more energy and produce contaminated water which need to be processed and hydrocarbon solvents would pose flammability problems and have health effects. The bulk of the information available was for industrial applications and not for consumer products.

These alternatives were thus not examined but instead the case study has focused on product replacement for a whole range of corrosive, irritant and toxic products.

Alternative more environmentally products

The alternatives listed below have been extracted from different sources (Recycling Council of British Columbia, Environmental Hazards Management Institute of Durham, New Hampshire, USA; University of Misoury web page, leaflet from SuperDrecksKëscht fir Biirger). These are reported to be as efficient as the more toxic products.

The alternative ingredients are non-dangerous substances which are not generally used for house cleaning but are common kitchen products and as food ingredients. The environmental and health negative impacts of these substances are very mild and their cost is minimal. A life-cycle approach to evaluate alternatives is not feasible for this heterogeneous group of products and is deemed unnecessary.

All-purposes cleaner: Baking soda.

Lime deposit remover: Vinegar

Drain cleaner: Baking soda and vinegar

Furniture polish: Olive oil and lemon juice

Metal cleaner/polish: Crème of tartar or Worcestershire sauce or Toothpaste

Stain remover: Crème of tartar and lemon juice

3.6.2 Conclusions

It is recommended to reduce the use of corrosive cleaning products and to rely on alternatives presented above as most of the environmental and health impact is in the usage period.

3.7 House and garden pesticides

There are a large number of domestic pesticides available on the market for different outdoor and indoor purposes; i.e. flea collars, to control ants, slugs, rodents or herbicides to control moss and weed. Even if they are formulated specifically for amateur uses, they still contain active ingredients which are toxic to other plants and animals than the targeted pests, some are persistent and can bioaccumulate, and can contaminate water resources used for drinking water, they can be harmful if swallowed, irritating to eyes and skin. The major hazards reported are poisoning incidents and the safe disposal of containers. Household pesticides ranked fourth in a statistical study of poisoning across Europe (Europlus 1996).

It is not unusual to find in houses obsolete pesticides containing active ingredients which have been banned for years (i.e. DDT) due to their high toxicity and persistence. Packaging is sometimes no longer readable or strong enough to hold the product. These products have to be imperatively collected separately and disposed of properly in authorised treatment plants.

New formulations also contain toxic active ingredients and thus the disposal the new pesticide formulations into the general solid waste stream is not recommended.

There has been a growth of the market over the last few years following the popularity of gardening programmes, especially in the UK. Public understanding/knowledge about pest control and pesticides is often limited (i.e. failure to identify the cause of a problem and to choose the suitable treatment, fly killer aerosols are not regarded as pesticides). Labelling gives some information on product use but little on storage or disposal. One study in the UK (Heaven and Kerrell 1993) estimated that as much as 20% of domestic pesticides are disposed of by householders directly down the sink or drain and that most people keep pesticides rather than dispose of them, usually in the garden shed or garage or in the kitchen and not under lock.

3.7.1 Evaluation of alternatives

The majority of the alternatives identified are on the use phase however, to comply with the scope of this study the case study has tried to focus on disposal and treatment aspects.

Policy and advices on pesticides usage

Due to the potential for misuse and problems of disposing safely pesticides, there is a growing trend in policy to minimise pesticide use across the Union with some countries promoting actively such minimisation. For example, in Denmark, there is plan to introduce a certificate for domestic gardeners. They would need to follow a 1 or 2 days course before being allowed to purchase pesticides. This plan was proposed in 2001 and is still in discussion. However, there have been initiatives to inform and train consumers through retailers, with limited results.

There are advices on organic gardening relying on non chemical methods such as using a specially designed burner instead of herbicides, natural pest controls by lady birds and the use of less toxic chemicals such as boric acid for ant control. Boric acid has however some toxicity and should not be applied to areas where small children and animal are likely to contact it.

Advices on disposal

There have been campaigns of information to the public mainly focussing on water pollution during usage and cleaning of equipment. For example, these recommended not to pour pesticides directly down the drain or sinks, into watercourses and ditches. It was advised that small quantities (less than 125 ml) be diluted and sprayed onto bar soil or gravel paths (Environment Agency, pers comm 1997). However this is against the Community policy to reduce the use of such products.

Amnesty campaigns

For banned pesticides, there are been in several countries, amnesty day when the public can bring their old stockpiles to be disposed of properly. This depends on the formulation. For example, pesticides containing arsenic or mercury, it is not advised to incinerated them while for most other pesticides, high temperature incineration is the best option.

Separate collection

Some countries collect pesticides through a nation-wide separate collection scheme. For example, in Belgium, quantities of pesticides/fertilisers collected amount to about 255 tonnes per annum, equivalent to 30 g per person and per year. These are treated in high temperature incineration. In Luxembourg, the SuperDrecksKëscht fir Biirger, collected about 14 tonnes and then sent it for destruction in a high temperature incinerator in Belgium. This also amounts to about 30 g per person and per year. The collection rate is estimated to amount to about 80%. The cost for separate collection is about 2.8 euros per kg and the cost for treatment is 1.2 euro per kg for solid pesticides and 2.18 euros per kg for liquid pesticides (Administration de l'Environnement, pers. comm. 2002).

In Belgium, a new committee has been put in place within the Belgian pesticide association, Phytofar, to deal specifically with domestic pesticides, mainly to inform and promote good practices. They have also organised information campaign on disposal of packaging. It was not possible to receive additional information on this initiative.

In the UK, separate collection of pesticides from the Suffolk county council is available to householders on a request basis. The council provides collection and disposal services for free for any household hazardous waste. The majority of waste collected is paint and oil while pesticide/herbicides account for about 5% of total collected. There were no restrictions placed on quantities or size of individual items to be collected.

In 1997, for example, a total of 36 collections were carried out between March 1996 and March 1997. The quantities collected amounted to:

- 247 l and 80 kg of pesticides including fungicides, weedkillers, wood preservatives, etc.
- 185 sachets of various weedkillers
- 16 garden chemical aerosols
- 8 l and 441 kg of fertiliser/feed
- 9 kg of rodent pesticides

The council could not provide an estimate of the collection rate compared with the total amount of waste pesticides/fertilisers.

The service is free to households but it is expensive to run and labour intensive as it requires a few collections over a wide area. An estimated cost to the council is about 75 euro per collection.

4. MANAGEMENT OF HAZARDOUS HOUSEHOLD WASTE

The relevant authorities and agencies responsible for waste management in each country were approached for information at the National level on quantities of hazardous household waste (HHW) arising and management systems for HHW. Results from local surveys and waste companies on the content of hazardous chemicals in MSW and costs were also collected. The review covered the fifteen Member States and two Accession Countries, Hungary and Romania. Information for each country is reported in detail in Appendix B and is summarised below.

4.1 Regulatory and administrative framework

Regulations are in place in some EU Member States for a statutory separate collection of a list of household products considered to be hazardous others than batteries and waste oils (Table 4.1).

In Austria, Denmark, Finland, Germany, Italy, Luxembourg, Netherlands, Flemish Region in Belgium, Sweden such regulations have been in place and for some countries as early as 1990. In the Walloon and Brussels Regions of Belgium while there are no specific regulations for HHW, there are policies and recommendations in their waste management plans for the encouragement and implementation of separate collection of HHW.

In France, Ireland, Spain and in the United Kingdom, there are recommendations in their National Waste Plan for HHW management but separate collection is not yet organised on a nation-wide scale.

In Greece, Portugal, there seems to be no national plans for any separate collection of HHW. However, in Greece, there are indications that HHW will be considered in a near future.

In Hungary and Romania, there is no legislation specific to HHW but there are some local initiatives in Hungary for separate collection of HHW.

In countries where HHW management is regulated and organised on a nation-wide basis, the municipalities/local authorities which are responsible for MSW management, are also responsible for HHW management. They usually delegate their duties or sub-contract to private companies.

Table 4.1 Regulatory framework for the management of HHW

Country	Regulatory and policy framework
Austria	1990 Waste Management Act – AWG List of HHW in the revised 1007 ONORM S2100
Belgium:	
Brussels Region	Brussels Waste Plan
Flemish Region	VLAREA of 17 December 1997 – Vlaams Reglement inzake afvalvoorkoming en – beheer
Walloon Region	Walloon Plan for Waste for 2010
Denmark	Waste Act 1991 Waste 21 – Danish National Waste plan for 1998-2001
Finland	Waste Act 1993
France	Decree of 18 November 1996 Departmental Waste Plans
Germany	Closed Substance Cycle and Waste Act (Krw-AbfG) TA Sonderabfall
Ireland	National Hazardous Waste Management Plan (1999)
Luxembourg	Waste Act of 17 June 1994
Netherlands	Small Chemical Waste (Logo) Decree 1995 New National Waste Policy 2002 National Waste Management Plan (LAP)
Sweden	1998 New Waste Collection and Disposal Ordinance (902)

4.2 Definition of HHW

Some of the terms used to refer to HHW differ from country to country as reported in Table 4.2. Most importantly, the list of identified HHW differs from one country to another. This affects the comparability of quantities of HHW collected, for example, if batteries, waste oils or equipment containing CFCs are or not included in the HHW statistics. In addition, some products not commonly refer to as hazardous such as vegetable oils are included in separate collection of problematic material in some Member States. The most common categories of household wastes referred as hazardous by Member States are reported in Table 4.2. These are usually also covered by the European Waste Catalogue.

Table 4.2 Definition for HHW

Country	Terminology
Austria	Problemstoffe
Belgium :	
Flemish Region	Klein gevaarlijk afval
Walloon Region	Petits déchets des ménages
France	Déchets dangereux des ménages
Germany	Problemabfälle
Luxembourg	Problematic waste
Netherlands	Klein chemische afval – KCA

Table 4.3 Commonly identified categories of HHW in European Member States

Paints, varnishes, inks, glues
Batteries and accumulators
Used oils
Fluorescent tubes and other equipment containing mercury
Pesticides
Medicines
Aerosols

4.3 Arising

Approximately 163 million tonnes of municipal solid wastes are generated every year in the European Union (1997 basis, CEC 1999). The quantities of hazardous wastes arising from households (HHW) represents only a very small percentage of the overall municipal waste stream, estimated to amount to 1% (by weight) of the total quantity of waste generated per household (Poll and Pendle, 1993). However, there are differences per country reported in quantities arising of HHW per capita due to different consumption patterns but also to different definitions applied to HHW as mentioned above. Data presented in Table 4.4 are a combination of estimates supplied by national authorities and estimates applying the 1% rule. The total quantities of HHW arising in the fifteen Member States have been estimated to amount to about 1.5 million tpa.

Table 4.4 Estimates of HHW quantities arising by country

Country	Year	Estimate of HHW arising (t)	Estimate of HHW arising per capita (kg pers^{-1} y^{-1})	Proportion (% of total MSW arising)
Austria	1999	23,000 – 26,000	2.8-3.2	0.8-0.9
Belgium	2000	46,300	3.8	1
Denmark	2000	13,600	2.5	0.8
Finland	1999	27,000	5.3	1.1
France	2000	260,000	4.5	1.2
Germany	1997	390,000	4.7	1
Greece	1999	4,500	0.4	0.12
Ireland	1998	6,800	1.8	0.5
Italy	1997	254,000	4.4	1
Luxembourg	2000	2,100	5.3	1
Netherlands	2000	35,200	2.3	0.4
Portugal	1998	39,000	3.9	1.1
Spain	1997	143,000	3.6	1
Sweden	1999	38,000	4.3	1
United Kingdom	1999	252,000	4.2	0.9
Total 15 Member States		**≈ 1,500,000**		
Hungary	1998	17,200	1.7	0.7
Romania	NI			

4.4 Hazardous Household Waste management

4.4.1 Implementation of HHW management

The differences in MSW management practices that can be observed among Member States are also reflected in the different options for HHW management;

- In countries such as Greece, Ireland, Portugal and Romania there is not yet any separate collection of HHW mainly due to lack of adequate infrastructures for waste collection and waste recycling in general.

- In countries such as France, Hungary, Italy, Spain, and UK, there is a limited number of local initiatives set up for separate collection of HHW usually a delivery point at the civic amenity centre. The records are poor and the percentage of collection is thought to be low.

- On the contrary, countries such as Austria, Belgium (all three Regions), Denmark, Finland, Germany, Luxembourg, Netherlands and Sweden have implemented separate collection of HHW on a national scale for a number of years. It is however reported that the standard for collection services varies between countries and between parts of a same country.

4.4.2 Type of selective collection

The countries with well-established selective collection for HHW usually rely on a combination of mobile collection by municipality or delegate company and free delivery by citizens. The types of collection implemented in the different countries are summarised below;

Delivery by the citizen:

- recycling sites (civic amenity sites)
- shop take back
- containers or van parked at public places at specific date

Collection by municipality:

- Special box collected as part of the general waste collection or by a special collection car on a regular basis
- Mobile collection a few times a year
- Call-in system (special collection on demand from householders)

Separate collection for HHW other than batteries and waste oils is often done on an ad hoc basis depending on the municipality or inter-municipal company organising the collection. Thus the proportion of HHW finally disposed of with MSW varies dramatically between both regions and countries.

In most cases, special containers are available at civic amenity centres for free deposition by the public of these wastes. This is the most common method reported to be used by households. It is reported that in the Netherlands and Luxembourg, up to 60% of HHW is collected via bring back systems while one third of HHW is usually collected via a pick-up van.

4.4.3 Type of Treatment

Treatment for these separate collected fractions of HHW generally consists in incineration in specialised hazardous waste plants and reprocessing for acid/alkali solutions. Some of these HHW can be recycled such as fluorescent lamps and batteries. Waste oils are reprocessed or co-incinerated in industrial plants. Surplus paint can be re-used.

A general comment was that there is a need for all countries for more and better information to the public on collection schemes. Information campaigns to promote separate collection of these difficult wastes are a key element to success.

4.5 Types and quantities of HHW

As previously mentioned, the categories of wastes classified as HHW vary between countries which explains some of the differences in quantities of HHW collected separately per country and per capita. Some wastes such as equipment containing CFC are not reported for all countries. Also the records for some countries were more detailed specifying some HHW categories such as fire extinguishers, packaging of hazardous chemicals, aerosols and asbestos waste. Some waste categories which can not be defined as hazardous were considered problematic by some Member States such as waste vegetable oil.

In addition, reliable detailed records on quantities collected are only available for Belgium, Luxembourg and Netherlands. There is no centralised record in Austria, Finland, Germany and Sweden where a selective collection for HHW is taking place. The information supplied for the other countries, where selective collection is reported, is patchy (i.e. Spain), based on gross estimates (Denmark, France, Ireland, United Kingdom) or could not be validated (i.e. Italy).

The quantities of HHW collected in Belgium, Luxembourg and Netherlands amount to about 42,500 tpa (Table 4.5). The largest proportion of HHW collected selectively in these three countries, apart from batteries and waste oil, includes paint residues ranging between 21% and 38% of HHW collected. The rate of collection varies between systems and between countries from 1.3 to 3.5 kg of HHW per person and per year (Table 4.5). This represents a collection rate varying between 56% up to 70% of estimated HHW quantities arising.

There are reports of well-established collection systems for HHW in Austria, Denmark, Finland, Germany and Sweden with high collection rate ranging between 2 kg to 5.3 kg per person and per year as presented in Table 4.6. The total quantities of HHW collected for these countries apart from Austria and Germany amount to about 350,000 tpa. There was no information available for Austria and Germany. However, figures presented in Table 4.6 below are to be used with caution, as they are only rough estimates.

Table 4.5 Quantities of hazardous household waste and other problematic household waste categories collected selectively in EU Member Countries with good records (x tonnes)

Products	BE	LU	NL
	(2000)	(1999)	(1993)
Waste Paints incl. Glue, ink, resin	4,823 (27%)	478 (31.1)	8,900 (38%)
Waste oils (mineral and vegetable oil)	5,932 (34%)	263 (17.1)	2,800 (12%)
Waste solvents	750 (4%)	15 (1)	2,300 (10%)
Waste cleaning products	244 (1%)		
Waste fluorescent tubes and other Hg containing waste	378 (2%)	23 (1.5%)	
Waste pesticides & fertilisers	254 (1%)	14 (0.9%)	500 (2%)
Waste batteries	2882 (16%)	361 (23.5%)	3500 (15%)
Waste pharmaceuticals	163 (1%)	75 (4.9%)	1000 (4%)
Waste acids	76 (>1%)	5 (0.3%)	
Waste alkalis	65 (>1%)	17 (1.1%)	
Lab chemicals		5 (0.3%)	
Packaging of hazardous products	1033 (6%)		
Aerosols	167 (1%)	43 (2.8%)	
X-rays/photo chemicals	93 (1%)	8 (0.5%)	500 (2%)
Flame extinguishers	173 (1%)		
Asbestos		107[LU1] (6.9%)	
Gas container		28 (1.8%)	
Other/unspecified	561 (3%)	30 (2%)	4,000 (17%)
Total (tonne)	**17,523**	**1,537**	**23,500**
Total per capita (kg pers^{-1})	**1.7**	**3.5**	**1.3**

Note:
LU1 Since November 1998 only small quantities (less than 30 kg) are accepted

Table 4.6 Quantities of hazardous household waste and other problematic household waste categories collected selectively in other EU Member and Accession Countries

Country	Total quantity (x tonnes)	Total per capita (kg pers^{-1})	Rate of collection (%)
Austria	NI	-	-
Denmark	6,500	1.2	48
Finland	27,000	5.2	100
France	147,500	2.5	50
Germany	NI	-	-
Greece	0	0	0
Ireland	50	0	0
Italy	9,400	0.16	4
Portugal	0	0	0
Spain	3,800	0.1	3
Sweden	20,000	2	53
United Kingdom	135,000	2.25	54
Hungary	0	0	0
Romania	0	0	0
Total	≈ **350,000**		

4.6 Cost evaluation

Recent information on costs for separate collection and treatment of HHW was available only for a limited number of local waste authorities or private contractors. In most cases, the organisations contacted either did not have the information as it was not possible to differentiate the costs for HHW from costs of running a civic amenity centre for example or the organisations were unwilling to provide figures as these costs can be very variable.

Information provided to the Commission by Member States in 1997 (Anon 1997b) and in a more recent study (Hogg 2002) is also presented below for comparison The figures presented in Tables below are thus to be used with caution as they do not refer to up to date information and/or are for local specific situations.

The costs for HHW collection provided in 1997 and during this survey are presented in Table 4.7. These costs vary according to the methods of collection, the quantities collected and the frequency of collection, between € 0.12 to € 121 per kg.

The set-up costs for a bring system at a civic amenity site is reported to be less than any other collection schemes as most of the infrastructure necessary is already be in place. It should require minimal additional staff training, a locked cupboard and potentially a revision of the site licensing. Total costs (including set up and running costs) for a bring system such as at a civic amenity (CA) centre depend on several factors such as population density and operating costs (i.e. opening hours). The cost ranges from € 0.12 to € 1.7 per kg.

The cost for a mobile collection is reported to be at least 50% higher per kg than CA collection as it requires the purchasing of a special vehicle (chemo-car). The costs range from € 3.2 to

€ 5 per kg for an annual collection via a container or for more frequent collection with a specialised vehicle between € 2 to € 10 per kg. The cost of a regular door to door collection ranges between € 1.7 to € 10 per kg.

The call-in system when a householder can have a specific consignment of HHW collect on demand is very expansive and is rarely used. The cost of such collection was reported to range between € 58 up to € 121 per kg.

A recent study commissioned by DG Environment on the costs for municipal waste management in the EU (Hogg 2002) attempted to collect costs for HHW collection (the definition of HHW and collection method is not specified). The costs for collection reported range between € 0.22 and € 2.8 per kg (Table 4.8).

The cost of HHW treatment (Table 4.9) varies widely depending on the method adopted and the standards to which the chosen method has to comply with. These costs are reported to range between €0.42– €2.2 per kg.

The total cost for managing HHW (Table 4.10) is reported to range between € 0.6 – 124 per kg. The extreme upper figure is for a call-in collection organised on demand which is rarely used. The most likely average cost for management of HHW is estimated to ranges between €1 and €2 per kg. Given a total HHW arising of 1.5 million tpa, the total cost for collection and proper treatment of all HHW in the EU would be in the order of €1.5 to €3 billion per annum.

Table 4.7 Cost estimates for HHW collection in selected EU Member States

	Cost (€ per kg)					
Country	**Civic amenity**	**Door to door**	**Take-back**	**Mobile container**	**Mobile van**	**Call-in**
Austria (1997 data)	1					
Belgium (Walloon Region – 1995 data)	0.12		2.3			
Belgium (Flemish Region – 1995 data)	1.5 – 1.68 BE1	1.8 – 8.8 BE2				
Denmark (1997 data)	1.6	1.7-10		3.2-5	8-10	
Luxembourg (1997 data)					2-7	
United Kingdom (1999 data)						58-121 UK1
Range	**0.12 – 1.7**	**1.7 – 10**	**2.3**	**3.2 – 5**	**2 - 10**	**58-121**

Notes:
BE1 depending on quantities collected per inh and per year ranging from 0.5 to 2 kg/inh/y
BE2 depending on frequency of collection ranging from 3 to 12 times a year
UK1 depending on number of sites visited ranging between 1 and 5

Table 4.8 Costs for HHW collection in some European Member States* (Hogg 2002)

Country	Cost (€ per kg)
Austria	0.22
Belgium	€ 0.22 per household
Germany	0.38-0.75 [a)]
Ireland	2.3
Luxembourg	2.8 [b)]
Range	**0.22-2.8**

Notes:
* Not clear which methods of collection were used
a) including transport and collection
b) including costs for information campaigns, sorting and logistic centre

Table 4.9 Cost for HHW treatment and disposal in some European Member States

Country	Cost (€ per kg)
Austria (1997 data)	0.42-1.45 *
Belgium (Walloon Region – 1995 data)	0.63 *
Belgium (Flemish Region – 1999 data)	0.64 [BE1]
Belgium (Flemish Region – 1995 data)	
Denmark (1995 data)	0.7 – 1.2 [DK1]
Luxembourg (1997 data)	1.8 *
Luxembourg (2002)	1.2-2.18 [LU1]
Netherlands (1997 data)	1.64 *
Netherlands (1999 data)	0.68-1.14
United Kingdom (2002 data)	2.24 *
Range	**0.42-2.2**

Note:
* No treatment or disposal methods specified
BE1 Including sorting, recycled or disposal by incineration or landfill
DK1 Treatment in high temperature incineration or recycling – no landfilling of HHW is permitted. This includes transport by rail to central treatment plant (without VAT)
LU1 Lower range is cost for treating solid pesticides while the higher figure is for liquid pesticides

Table 4.10 Cost for HHW management (collection and treatment/disposal) in some European Member States

Country	**Cost (€ per kg)**
Austria (1997 data)	
Belgium (Walloon Region – 2000 data)	0.68 BE1
Belgium (Walloon Region – 1995 data)	0.75 BE1 0.58 BE2 0.12 BE3
Belgium (Brussels Region – 1999 data)	2.5
United Kingdom (2002 data)	2.9 UK1 13-19 UK2 93- 124 UK3
Range	**0.6-124**

Notes:
BE1 for collection of HHW at civic amenity sites
BE2 for collection of medicines at civic amenity sites
BE3 for collection of waste oils
UK1 for CA collection
UK2 for kerbside collection
UK3 for a call-in for 1 to 5 households

5. CONCLUSIONS

The study focused on the identification of hazardous household chemicals (HHC) and hazardous household products that are posing a potential threat to health and environment that is increased if such products are disposed of by households, mixed with non-hazardous household waste rather than being subject to a specific treatment. The methodology adopted identified a priority list of substances in solid waste that pose the greatest risk to human health and the environment and to match the identified substances to specific HHC and other household products that are likely to result in household hazardous waste (HHW).

Fourteen hazardous substances were identified as priority substances of concerns for solid waste disposal based on an emission inventory from solid waste treatment and disposal facilities such as landfill and incineration. It was then possible to identify household products containing these hazardous substances.

Based on a prioritisation method, the following household products were identified as having a significant hazardous potential for the solid waste stream: obsolete paint and left over paints, banned and left over pesticides, fluorescent tubes and other mercury containing devices, as well as treated waste wood. Other household products identified which can not be labelled as hazardous but which could potentially pose a risk to health and environment during disposal were leather products and pharmaceuticals.

For most hazardous household products, the quantities disposed of into municipal solid waste are very small. Our estimate for the HHW generation by the average resident in the EU is about 4 kg per year. Nevertheless for some categories such as paints, the quantities can pose a threat to the health and environment.

The impacts will, however, depend on the solid waste management options in place. For example, incineration of products containing mercury may lead to a greater impact on the environment than landfilling while incineration is the best treatment option for pesticides.

Several initiatives were identified as improvement options for disposal of priority hazardous household products. The case studies examine in some details a reuse scheme for left over paints, the advantages of using low energy light bulbs combined with a separate collection, alternatives to cleaning household products, the separate collection for car oil filter, the separate collection of pesticides and separate collection of arsenic treated wood. Based on these five case studies, recommendations have been made:

- The paint collection and exchange facility established in the UK through the Re>Paint scheme for unused and leftover paints could be replicated in other countries. It has environmental and social benefits.

- Separate collection and recycling of low energy light bulbs and fluorescent tubes is beneficial and further improves the overall positive eco-balance at reasonable costs. This has been in place in numerous Member States.

- There are interesting initiatives to produce mercury-free fluorescent tubes which could not yet be fully reviewed due to lack of reliable data.

- Arsenic is a major pollutant in solid waste, a major portion of which is from pressure-treated wood with chromated copper arsenic (CAA). Alternatives are readily available, far less toxic and strongly favoured by the European Commission seeking a ban of arsenic treated wood. Even if the ban is implemented, arsenic treated wood will remain a problem in MSW management; hence separate collection on the household level (likely together with other treated wood) is a recommended action to minimise improper disposal. There are alternatives to corrosive/aggressive cleaning products based on substances of low toxicity commonly found in kitchen, which are reported to have good efficiency. These could be promoted rather than recommending separate collection for these waste packaging.

- Spent car oil filters are found in household waste when DIY motorists change their own oil. While there is separate collection promoted for waste oil, there is usually no information provided for oil filters. It is recommended to inform DIY motorists of the risks associated with spent oil filter as well as waste oil and to promote separate collection through bring back schemes at local garages or local civic amenity centres.

- Separate collection of domestic pesticides and fertilisers is recommended, especially for pesticides containing banned active substances. A combination of collection is advisable (amnesty day organised by pesticide retailers, bring back system at civic amenity centres, etc). Information campaign should stress the need for proper storage and disposal especially for old stocks in garages or garden sheds.

Most EU Member States have implemented separate collection for a list of HHW since early 1990's. Some countries have introduced separate collection through policy documents rather than through regulations. Different collection systems are in place for HHW but most countries rely on active public participation such as free deposit at a civic amenity centre. Information campaigns are key to the success of such separate collection.

Some countries have very good centralised information pertaining to HHW (i.e. Luxembourg, Belgium, Netherlands) while countries such as Austria and Germany were reported to be have no national record for HHW due to lack of reporting requirements.

The quantities of hazardous wastes arising from households represent only a very small percentage of the overall municipal waste stream. It is generally reported that the quantities of HHW represent between 1% (by weight) of MSW quantities. The total HHW for the European Union is estimated to amount to about 1.5 million tonnes.

The most reliable data was available for Belgium, The Netherlands and Luxembourg. The quantities separately collected for these three countries range between 1.3 to 3.5 kg per person and per year representing about 56 and 70% of HHW arising depending on country and method of collection. Collection efficiency in other Member States is usually

The cost for HHW collection varies according to the methods of collection, the quantities collected and the frequency of collection.

The set-up costs for a bring system at a civic amenity site is less than any other collection schemes as most of the infrastructure necessary would already be in place. It requires minimal additional staff training, a locked cupboard and potentially a revision of the site licensing. The cost for collection at civic amenity sites ranges from € 0.12 to € 1.7 per kg.

The cost for a mobile collection would be at least 50% higher per kg than CA collection and ranges from € 3.2 to € 5 per kg for an annual collection via a container or for more frequent collection with a specialised vehicle between € 2 to € 10 per kg. The cost of a regular door to door collection ranges between € 1.7 to €10 per kg.

The cost of HHW treatment varies widely and depends to the greatest extent on the method adopted and the standards to which the chosen method has to comply with. These costs range between € 0.42– € 2.2 per kg.

In its extreme, the reported total cost for managing HHW ranges between € 0.6 – €124 per kg. The upper end represents the call-in system, which is very unusual. The most likely average cost for collection and treatment is estimated to be between €1 and €2 per kg. Given an average HHW generation of about 4 kg per person and per year, the total cost for collection and proper treatment of all HHW in the EU would be in the order of € 1.5 to 3 billion per year.

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APPENDIX A HOUSEHOLD PRODUCT COMPOSITION, MARKET VOLUME AND RISK ASSESSMENT

The largest proportion of dangerous substances as defined by Directive 67/548/EEC in consumer products can be found in aerosols (gas) used in pressurised cans for a wide range of usually non hazardous products themselves. These products will carry the 'flammable' logo. Another common dangerous substance in domestic products is bleach in cleaning products which will carry the 'irritant' logo. Corrosive chemicals are also present in some domestic products such as oven cleaners. Solvents are another common group of dangerous substances present in a wide range of domestic products which carry the 'flammable' logo. Other products commonly found in households which contain dangerous substances and which can pose a threat to the environment if not properly disposed of are paints, pesticides, pet care products, car maintenance products (oil, tyres, etc), batteries, pharmaceuticals, photographic chemicals, asbestos, fluorescent tubes, etc.

A.1 PAINTS

Paint and ink are a mixture of solvents, pigments, minerals, resins, surfactants and additives. The components of main concerns for the environment and health are currently solvents. There are some issues of less importance with regard to some of the other components of paints which are also summarised below.

Composition and concerns

Solvents

The organic solvents make paints easier to apply by keeping it liquid but they release volatile organic compounds (VOC) and are responsible for the associated risk to health. VOCs are precursors of high ground ozone level, which has negative effects on health, buildings and crops/vegetation.

There are different types of organic solvents:

- Petroleum solvents (xylene, toluene, white spirit, etc)
- Chlorinated solvents (trichloroethylene, etc)
- Oxygenated solvents (acetone, alcohols, etc)
- Vegetable solvent (terpentine, etc)

The main solvent used in domestic paints is white spirit. There is an increasing use of water-based paints less damaging for health, where water partially replaces organic solvents however there are still 5 to 20% co-solvents mainly glycol ethers or alcohols.

A legislative framework for the progressive reduction of VOC emissions is being promoted, and the industry as a whole through their European Federation CEPE has already adopted an environmental policy aimed at achieving further reductions in the VOC content of products voluntarily. The Directorate General of Environment of the European Commission is currently working on measures to further reduce VOC emissions also in paints.

Pigments

Pigments give the colour to the paint and can be of mineral or vegetal origin. In non-specialist decorative paint, paints do not contain anymore heavy metals such as lead, cadmium, and chromium which have been banned or replaced. The main pigments contain in domestic paints are: clay, silicates, copper for blue, iron oxides for yellow and titanium dioxide as white pigment. Apart from copper these pigments are relatively non-hazardous.

Titanium dioxide is widely used as white pigment. It is an inert compound but its manufacture has environmental impacts, as it requires the use of sulphuric acid. Council Directive 92/112/EEC on procedures for harmonising the programmes for the reduction and eventual elimination of pollution caused by waste from the titanium dioxide industry addresses these impacts. Titanium dioxide is extracted from titanium ores using either the sulphate or chloride process. The chloride route is reported to be more economic and to produce less waste. Investigations carried out by the US EPA showed that waste from the chloride process contains high level of dioxins.

Resin

The resin is the binder and forms the paint film. It gives flexibility, hardness and durability to the coating. In DIY paint, there are two main types of resins: alkyd or acrylic. In production terms, alkyds are declining and acrylic resins are increasing. In general, water based paints contain acrylic resins and solvent-based paints contain alkyd resins but it is possible to have alkyd water based paints.

Alkyd resins are partly from vegetable sources (linseed soil) while acrylic resins are from crude oil.

In 1996, the share of acrylic gloss paints (water-based paints) across Europe ranged from less than 10% in the UK to about 40-50% in Germany.

Additives

The additives can help disperse the pigment in the resin, protect from biological attack or serve for other functions. It can be a cobalt salt catalyst for helping the hardening process, kitoxine chemicals to inhibit this hardening reaction in the can, thickeners (i.e. cellulose), surfactants, co-solvents. Some of these products can be hazardous and have a detrimental impact on the environment.

Quantities of product and waste

Households use different types of coating materials for a wide range of applications around the house, garden, hobbies, car repair, etc. By far the largest use of coatings is in the internal decoration of walls, ceilings and painting of woodwork inside and outside the house. A significant proportion of decorative coatings purchased remains unused and is eventually disposed of, often after a period of storage.

Primers for metal, coating for garage floors, masonry paints, varnishes, stains, wood care and timber protection products are also used. By contrast, a smaller volume is used for other applications such as repair and repainting of cars, boats or games. Brush cleaners, thinners and paint strippers are also used. Households generally purchase smaller quantities of these more specialised products and either use them up completely or generate little surplus.

In 1999, the total sales volumes of paints for the 15 Member countries was estimated at around 5.4 million tonnes (CEPE 2001) with the largest market being for Germany with more than 1.4 million tonnes, followed by Italy, UK, France and Spain (Table A.1.1). Sixty percent were for decorative purposes, 11% for industry, 8% for wood protection, and the rest for cars, can coating, marine etc. The decorative market includes both domestic and professional uses.

If we estimated that 50% of decorative paints are bought by households, the total quantities of paints bought per annum by households in Europe amount to about 1.6 million tonnes. Based on an UK study (see UK country report), 25% of DIY paints bought by households remained unused. The quantities of DIY paints discarded by households in the European Union would potentially amount 400,000 tonnes per annum.

Table A.1.1 Quantities of paints sold in Europe (CEPE 2001)

Country	Sales volumes (tonne/annum)
Austria	90,000
Belgium (Walloon region only)	80,000
Denmark	100,000
Finland	80,000
France	730,000
Germany	1,460,000
Greece	130,000
Ireland	40,000
Italy	820,000
Luxembourg	20,000
Netherlands	240,000
Portugal	110,000
Sweden	150,000
Spain	520,000
United Kingdom	800,000
Total	**5,370,000**

Risk associated to solid waste disposal

The biggest risk to the environment and health from modern paints is VOC emissions during painting due to the presence of solvents in paints. There is also a risk of pollution from paint when paint brushes and buckets are washed into the sink and flushing down the drain. The main risk to the environment during the disposal of surplus paint is the waste of valuable resource and the risk of spillage and fouling during waste collection and disposal due to its liquid nature. It could contribute to leachate production at landfill sites. Under the Landfill Directive 1999/31/EC, landfilling of liquids such as surplus paints has been banned.

There is also risks associated with paint disposal due to stockpiling of old paints (i.e. lead paint) which are no longer authorised. When these old stocks of paints are disposed of in normal MSW facilities, they can have a negative impact on emissions and contaminate waste being sent to composting plants.

Conclusions

It is thus recommended to promote separate collection of paint and re-use whenever possible to ensure that half-empty cans do not get discarded into the normal waste collection and treatment system. It is also recommended to collect stockpile of obsolete paints from households during a 'paint amnesty' to ensure that these hazardous materials are treated properly. A separate collection and redistribution scheme is presented in details in Section 3 - Case study.

A.2 AEROSOLS

There are around 200 different products sold in aerosol form covering a wide range of uses, formulations and properties. Propellants used in aerosols have hazardous properties (i.e. flammable, explosive) but there are no longer CFCs used in domestic aerosols.

Quantities of product and waste

The production figures published by the European Aerosol Federation for aerosols used in household and personal care products in Europe in 1997 amounted to around 3 billion units (FEA 1997) (Table A.2.1).

It is reported that used aerosol containers contain only 1.5% of the product and 1.5% of propellant after normal use. More than half of these residues will be volatile leaving a very small amount being disposed of. Aerosol cans are made of tin, aluminium and glass which can be recycled.

It was assessed by DG ENV in 1997 that about 194 tonnes by weight of the HHW were made up of aerosols. Waste aerosol containers account for about 5% of both tinplate and aluminium packaging waste streams.

Table A.2.1 Number of aerosol containers produced for personal care and household products (x10^6 units) in European Union (1997) (FEA 1997)

	AT	BE/ LU	DK	FI	FR	DE	GR	IT	NL	PO	ES	SW	UK	Total
Personal care:														
Antiperspirant	10	19	12	-	158	168	1	41	13	11	31	1	445	910
Hair mouse/sprays	18	59	7	-	104	315	4	56	5	7	61	6	313	955
Shaving mouse/gel	1	16	3	-	26	24	3	27	1	22	9	0.02	155	287
Other	0	0.01	0.4	-	15	6	0	8	2	0.05	2	0.2	30	64
Household:														
Insecticides/ PPP	1	11	1	-	25	5	6	28	30	2	42	1	16	168
Fabric care	0.5	4	0	-	-	11	0.3	18		0	0.4	0.1	-	34

	AT	BE/ LU	DK	FI	FR	DE	GR	IT	NL	PO	ES	SW	UK	Total
Air fresheners	1	6	0.03	-	38	13	1	16	66	0.4	7	0.006	105	253
Furniture/wax and polishes	0.2	1	0.02	-	-	1	0.3	12	-	2	8	0.008	41	66
Oven cleaners	0	0.2	0.07	-	-	-	0	3	-	0.1	-	0	2	5
Bathroom/ kitchen cleaning mousse	0	0.2	0.007	-	-	-	0	8	-	0	-	0.1	-	8
Shoe/leather care	0	10	0.03	-	-	14	0	1	-	0	-	0.03	-	25
Others	0	12	0.5	-	49	24	0	7	104	0.02	10	0.5	47	254
Total	31	139	25	-	416	581	17	225	221	44	170	9	1,154	3,032

Risk associated to waste disposal

The main potential hazards with aerosols disposed of into domestic waste arise from explosive/flammable and/or harmful residual propellant contained in aerosol cans. Some aerosols can also contain hazardous substances (i.e. pesticides) while other can contain neither hazardous propellant nor hazardous substances (i.e. aerosols containing cream).

It is argued by the aerosol industry that emptied aerosol containers bulked in a separate collection system are more hazardous than in the normal waste stream. It is reported by Linton and Smith (1998) that the risk of explosion or fires during collection or sorting is limited, but that the higher risk occurs during baling. There is limited information on the risks associated with shredding or flattening of waste aerosols as an alternative to baling. Further research is needed.

It is also reported by the waste industry that aerosols can cause explosion problems if incinerated without pre-treatment.

Conclusions

At the current stage of knowledge it is not recommended to collect waste aerosols separately but to leave the choice to the local authorities.

A.3 HOUSEHOLD CLEANING AND DIY PRODUCTS (DEGREASERS, STAIN REMOVERS, ETC)

Degreasers and other similar household chemicals such as oven cleaners are a significant fraction of HHC and thus of HHW. Precise figures as to the composition and composition of these products are difficult to come by due to the lack of uniform reporting within EU member states.

The following products are assumed to collected in this group:

- All purpose cleaners
- Drain cleaners
- Furniture polish
- Lime deposit removers
- Metal cleaner/polish
- Pesticides
- Stain removers
- Oven cleaners

These products can contain solvents, acids/bases, abrasive materials, surfactants, brighteners, perfumes, etc. which can be flammable, irritant, corrosive if in contact with skin and/or eyes, if inhaled or even harmful to health and some, which are, suspected to be carcinogens.

Quantities of products and waste

The European Chemical Federation - CEFIC, the European soap, detergent and cleaning product association – AISE and some manufacturers of household cleaning products as well as the Belgian federation for household chemicals, DETIC were contacted but were unable to supply specific information on quantities of domestic products marked with a hazardous labelling.

It was reported that the biggest market share for 15 Member States, Norway and Switzerland for AISE products is for household laundry detergents (40%). Hard surface household cleaners represent 14% of market volume including all purpose cleaners, scourers, etc. Domestic maintenance products such as leather, floor, wood maintenance, insecticides, disinfectants, room deodorisers, etc represent 10% of market volume. Domestic bleach products represent 4% (Table A.3.1) (AISE 2001).

Germany is the largest market in Europe followed by France, the United Kingdom, Italy and Spain. These largest markets cover about 80% of the Western European market for household products.

Risk associated to waste disposal

Household cleaner and care products contain corrosive and toxic compounds such as bleach, ammonia, sodium hydroxide, solvents, diethylene glycol, surfactants, sulphuric acid, etc which could potentially have a damaging impacts when discarded with municipal waste.

However, most of these products were not included in the Dutch HHW list (see Section 2.5 above) after evaluation of their environmental effects to air, soil and water. Only liquid drain cleaners, pesticides and liquid bases (such as oven cleaners) were included because they were considered a safety hazard and not for their environmental effects. It can be argued that the Dutch waste management system which relies heavily on incineration is not the most common in Europe and that some of these products could have some impacts in countries relying on landfilling or with poorer standards. However, due to the nature of these products (mainly liquid), it is expected that the biggest environmental risks from these products are their impacts on the aquatic environment indirectly through their uses and directly through final

disposal into sewers. It appears to be limited risks for the environment from cleaning products disposed of in solid waste streams. It was reported that in most cases, cleaning products would not be discarded but households would dispose of empty packaging. The impacts of residues in leftover containers which end in the solid waste stream are difficult to quantify because of the variability in composition and effects. The main concern for health is from exposure of consumers and waste collectors. Many of the above substances are harmful if ingested or inhaled even in small amounts.

Solvents

Solvents including chlorinated solvents are present in household cleaning products and maintenance products. There are different types of organic solvents in use for industrial purposes and in household products:

- Oxygenated solvents (alcohols, ketones, esters, glycol ethers);
- Hydrocarbons solvents (aliphatics and aromatics);
- Chlorinated solvents (methylene chloride, perchloroethylene, trichloroethylene).

The largest consumption of solvents is in paint production (about 2 million tpa in Western Europe), followed by the pharmaceutical sector. They are also used in cosmetics and toiletries, printing inks, adhesives, dry cleaning, rubber manufacturing, metal industrial cleaning and household car care.

The consumption of chlorinated solvents in Western Europe has been declining due to legislation and improved management systems (Eurochlor 2002). They are used in dry cleaning, metal cleaning, electronics, as chemical intermediate, etc.

It was not possible to assess the types and amount of solvents present in household products. The information was not available from the industry federation contacted. The web page of environmental organisations were also consulted (i.e. Friends of the Earth, Greenpeace) and they also reported the lack of available information on household products from producers.

The information reported on Greenpeace web page (www.greenpeace.org.uk) on kitchen chemicals focuses on artificial musks and chlorine while the occurrence of organic solvents in most kitchen products such as cleaners, detergents, fresheners except for some metal cleaners was reported not to be a real issue.

Other compounds

Other hazardous substances commonly used in domestic cleaning products are acids and bases such as bleach, ammonia, caustic soda which can all have a negative effect on the environment and on the health of people handling such left-over products.

Some disinfectants are corrosive and skin irritant, others are flammable (for example products containing alcohol). Oven cleaners based on caustic soda are corrosive, caustic and skin irritant.

Table A.3.1 Market share for AISE domestic detergent, cleaning and maintenance products in the 15 Member States, Norway and Switzerland* (AISE 2001)

Product	Percentage
Household laundry products	40
Household hard surface cleaning	14
Domestic maintenance products	10
Dishwashing household products	10
Soaps	4
Domestic bleach	4
Industry and institutional market	18

Note: * total population in 2000 amounted to 388 million inhabitants.

There is an increased tendency in countries such as Netherlands, Belgium for empty packaging of cleaning products to be collected separately for recycling as the containers are commonly made of plastic. In Denmark, a number of studies on contaminants in biologically treated organic fraction of MSW (i.e. compost and anaerobic digestion) has revealed problems of compliance with DEHP limit values for organic fertilisers. The DEHP levels were due to the non-compliance with guidelines for organic household waste separation (i.e. inclusion of plastic and packaging).

Conclusions

It is not recommended to collect separately discarded cleaning household products on environmental and health ground but such collection can be recommended for recycling packaging.

Countries such as Denmark, Finland and the Netherlands have policies to reduce the use of hazardous chemicals in household products and thus product replacement for some of these most harmful chemicals should be available in the next future. A reduction in use and use of alternatives is beneficial because of most of the environmental and health impact is in the usage period. Public education measures are deemed the proper avenue to reduce the use of these substances which have the major impact during their use. Some alternatives are presented in Section 3 – Case study.

A.4 FLUORESCENT TUBES/ENERGY EFFICIENT BULBS

Quantities of products and waste

In comparison to industrial and commercial usage, householders generate fewer fluorescent tubes. The average number of fluorescent tubes per household is 1.2, but this number is set to rise as increasingly people switch to the low energy bulbs which are made of fluorescent tubes.

The sale of traditional fluorescent lamps for domestic use have fallen over the last couple of years, however there has been a significant increase in the sales of halogen and compact

fluorescent lamps (CFL). As a consequence, the number of fluorescent lamps in the household waste stream will increase significantly as the first generation of low energy light bulbs are disposed of.

It is estimated that over 600 million fluorescent tubes are discarded annually in the European Community equivalent to 120,000 tonnes of glass, metals and 4,5 to 9 tonnes mercury per year. In addition, switch devices of fluorescent tubes sometimes contain polychlorinated biphenyls (PCBs).

Fluorescent lights contain potentially harmful substances such as toxic heavy metals, in particular mercury, cadmium and lead. The mercury content is the main concern of fluorescent lights. Other forms of lighting, such as high-pressure sodium lamps, also contain mercury.

The mass of mercury used in domestic lighting lamps has decreased considerably with technological advances over the last two decades.

The use of low energy light bulbs in household is however to be supported due to overall beneficial impacts on energy and environment as described below, especially when spent lamps are collected separately and mercury recovered.

Risk associated to waste disposal

Manufacturers are working to reduce the mercury content of fluorescent light bulbs to the lowest feasible level. Since 1976 the mercury content has been reduced by about 80% and is now about 10-15 mg mercury (Hg) per bulb.

There is a risk associated with the disposal of tubes and low energy lamps into the waste stream due to the presence of mercury for all disposal options; landfilling, incineration and mixed municipal waste composting due to the contamination of the organic fraction by mercury.

Conclusions

The level of mercury in these lights needs to be further reduced and separate collection is recommended. However, there is a net environmental benefit of using fluorescent lamps compared with traditional light bulbs. Detailed information on environmental benefit and separate collection is provided in a Case study – see section 3.

A.5 DOMESTIC PESTICIDES

Garden and households pesticides cover a wide range of products including:

- insecticides,
- molluscides,
- rodenticides,
- herbicides and
- fungicides,
- wood preservatives.

A number of pesticides are included in List I of the Dangerous substances Directive 76/464/EEC (CEC 1976), and are no longer approved for use in the fifteen Member States

such as aldrin, endrin and dieldrin. Other substances have been restricted or banned in the different Member States such as atrazine and simazine. Some pesticides no longer authorised may still be present in a house. These should be brought to the local waste centre for safe destruction.

Authorised domestic pesticides sold at present when use in a correct manner should not cause acute health and environment problems. However, a reduction in the use of pesticides are welcome and alternative pest controls should be encouraged especially for gardeners to reduce the impact on the environment of these substances.

Quantities of products and waste

The domestic/consumer market for pesticides in Europe is bigger in France, Germany and UK. It represents for these three countries around 324 million euros (1999 figures – ECPA, pers comm 2001) split between:

- Indoor insect controls (13%);
- Insect and fungicide controls (49%); and
- Weed controls (38%).

In addition, indoor plant care will include around 10% pesticide element and lawn fertilisers will contain around 50% of selective weed-killers and moss-killers.

There is no information for the other countries but it can be assumed that the usage is similar with less lawn products in the Southern European countries but more indoor usage. The European pesticide federation, ECPA was contacted and promised to provide more detailed information. Unfortunately, the Federation did not provide additional information.

Other partial information related to domestic pesticides is summarised below. In Sweden, the total amount of pesticides used in private gardens is around 33 g of active substances per person. The sale of active ingredients for domestic use in the UK in 2000 is reported to amount to 4,000 tonnes (approximately 70 g per person), including insecticides for more than 50%. This represents 10% of total pesticides market. In France, the quantities of active ingredients of domestic pesticides sold amount to 10,000 tonnes equivalent to 170 g per person, also equivalent to 10% of the agricultural market.

Risk associated to solid waste disposal

Before any new pesticide including garden chemical products can be sold in Europe, it must comply with an extensive regulated approval procedure. The regulation does guarantee in part that the most dangerous and toxic products are not authorised for use by amateur gardeners.

Garden pesticides however contain a wide range of active substances many of which have the potential to cause adverse health effects if ingested, inhaled or absorbed through skin and environmental impacts particularly if they enter a water course. They can be harmful to wildlife (bees, birds) and some can generate toxic fume if heated.

There are reports of pesticides commonly found in the environment such as atrazine, diuron, and lindane which are used in garden amateurs products (NHHWF 1997). There was no report of environment incidents when authorised pesticides from households had been

landfilled or incinerated. Many pesticides are only used partially and then consigned to the garden shed where they can be stored for considerable lengths of time. Ultimately these surpluses are disposed off with the usual household waste, either when moving house or during periodic clear-outs. These stockpiles can contain some pesticides which are no longer authorised.

Conclusions

There are potential risks during disposal with the improper disposal of older products no longer authorised. Packaging of old products are sometimes no longer readable or strong enough to hold the product. There is a real risk to the environment if such a waste is landfilled or is composted. These products have to be imperatively collected separately and disposed of properly in authorised treatment plants.

Another potential risk is with the inappropriate disposal of concentrated formulations. This is why the disposal the new pesticide formulations into the general solid waste stream is not recommended.

It is however recognised that the main sources of potential contamination is due to incorrect application (i.e. before rainfall, too close to a water course/drain) and improper disposal to surface water drains.

A.6 ARSENIC TREATED WOOD

Quantities of products and waste

Arsenic is contained in CCA (chromated copper arsenate) (22%) which has commonly been used in Europe and America as wood preservative for outdoor structures such as decking as well as for playground equipment. The principal uses for CCA treated wood are thought to include:

- Electricity and telephone poles;
- Railway sleepers;
- Industrial cooling towers;
- Bridge timber;
- Noise barriers;
- Jetties;
- Fencing;
- Stakes for agricultural growing;
- Playground equipment;
- Constructional timber.

Throughout the early 1990s there was a steady decline in the world market for CCA wood preservative as they were replaced by alternatives. In 1996, the EU market for CCA was estimated at 11,000 tonnes per year which represented a decline on the overall market of over 50% compared to that of 1989.

When CCA pressure-treated wood becomes waste, as trimmings during construction or when it has reached the end of its useful life, the wood is usually left on site, placed in a landfill for

construction and demolition waste, recycled or reused, placed in a municipal solid waste landfill, or incinerated.

The amount of arsenic entering the municipal solid waste stream is difficult to ascertain. Based on a literature review, the default value for municipal solid waste in the life cycle analysis tool UMBERTO® is given to be 5 g/t (Umberto, 2002). If this value is taken to be representative for the entire municipal solid waste in Europe of 163 million tonnes per year (COM, 1999), the total annual arsenic input into the solid waste in the EU is estimated to be 820 t. On the average, this is equivalent to about 2 g of arsenic per person and year that are contained in MSW.

In 1996, a total of about 2,400 tonnes of arsenic were contained in the CCA that was marketed in the EU. The amount of arsenic estimated in MSW is thus equivalent to about a quarter of the CCA sales.

Risk associated to waste disposal

Arsenic present in treated wood can leach easily from landfills or may volatilise in the combustion process in MSW incinerators. While there are other sources of arsenic in MSW (in waste metal and glass for TV screens), no other product is believed to be as relevant for the arsenic in MSW. This was also the result of a detailed study for the German Environmental Agency (Giegrich *et al*., 1993).

Arsenic is the most important contributor to carcinogenic property of landfill leachate, given the relatively high concentration of 1.6 mg/l in MSW landfills (Giegrich *et al*., 1993). The study estimates that over a total of 100 years, a total of 1.2 g arsenic will be emitted per tonne of waste, that is equivalent to 24% of the arsenic content of MSW. While arsenic is also emitted into the air from MSW incineration, it ranks lower on the list of carcinogens in incinerator emissions owing to the efforts in air pollution control. However, arsenic is a major pollutant in incinerator ash and flue gas cleaning residues.

Consequently, all steps to reduce the inventory of arsenic in MSW results will significantly reduce the emissions of carcinogens from landfills and incinerators and reduce the toxicity of incinerator ash.

In addition, CCA treated wood is a potential danger if discarded of improperly in households. This can be illustrated with a report on a family that burned CCA in a wood stove for winter heating (Peters H.A. *et al*, 1984). Family members lost hair, suffered severe and recurring nosebleeds, extreme fatigue, debilitating headaches, 'blacking out' for periods of several hours, and seizures. The symptoms were finally traced to breathing minute amounts of arsenic laden dust leaking from the furnace as fly ash.

Conclusions

It is recommended to take all steps to reduce the presence of arsenic in MSW to reduce the emissions of carcinogens from landfills and incinerators and reduce the toxicity of incinerator ash. As CCA treated wood has been identified as a major contributor to the presence of arsenic in MSW, it is recommended to consider alternative treatments and separate collection.

It is recognised that most of arsenic treated wood will be generated from demolition waste and not directly present in household waste. However, arsenic treated wood is also a potential

issue for households due to risks related to domestic household burning waste CCA-treated wood.

More information is provided in Section 3 – Case study.

A.7 CAR MAINTENANCE PRODUCTS

Quantities of products and waste

There are about 180 million of passenger cars in use in the European Union (Table A.7.1) (ACEA web page). The waste produced by servicing and maintenance of motor vehicles include lubricating oil, air and oil filters, brake fluids, batteries, tyres, paint, polish, antifreeze, clutch and brake pads. Most of these wastes arise at garages. However, a proportion of car owners (estimated to amount to 7 million people in the UK, about 12% of the population) do service their car themselves and generate motoring waste at home.

The largest quantities of motoring waste are waste oil and spent oil filters. It is estimated that between 30 to 40,000 t of waste oil arise from DIY motorists in the UK from a total fleet of 27 million cars in 2000, representing about 1 kg of waste oil per car. It can be roughly estimated that about 267,000 tonnes of waste oils are generated for the whole of Europe car fleet.

Car oil filters sift out contaminants to allow oil to flow to the engine easily. They become clogged with contaminants such as dust, metallic shavings and also may contain chemicals such as antifreeze and are supposed to be changed between 6 to 12,000 miles. When oil filter is discarded, it contains a certain amount of oil, estimated to amount to 0.25 to 1.1 litre of waste oil per filter (Morton industries 1994) while other publications refer to.0.16 l/filter. Oil filters are also made of steel and rubber which can be recycled.

While there are requirements for proper disposal of waste oil following an EC Directive on Waste oil, there are no such specifications for spent oil filters, also containing waste oil.

Table A.7.1 Number of passenger car in use in the European Union in 2000 (ACEA web page)

Country	**Number of car (x 10^6)**
Austria	4
Belgium	4.6
Denmark	1.8
Finland	2.1
France	28.1
Germany	43.8
Greece	3.2
Ireland	1.3
Italy	32.6
Netherlands	6.5
Portugal	3.6
Spain	17.5
Sweden	4
United Kingdom	27.2
Total EU	**180.3**

Risk associated to waste disposal

It is reported that waste oil is responsible for a numerous number of pollution incidents (25% of all pollution surface water incidents in 1996). A significant amount results from improper disposal of waste oil by DIY motorists. Improper disposal of waste oil by DIY motorists includes pouring waste oil down the drain, pouring into the soil, burning on bonfires or oil burners, disposal with general waste, etc.

One litre of oil can potentially pollute one million litres of water, if pour onto the soil it can render soil infertile or seek to groundwater and improper burning can cause air pollution. Waste oil contain contaminants such as chlorine, sulphur, zinc, phosphorus, dirt, dust, degradation products from oil (PAH) and additives, copper, nickel, chromium from engine wear.

Oil filters can retain large amounts of oil. They also contain contaminants that they have filtered out such as metallic shavings. In addition, some oil filters use terne, an alloy of tin and lead, as plating. Oil if spilled into a watercourse is particularly harmful to aquatic organisms.

Risk associated to waste disposal

Chromium VI is a known allergen if in contact with skin.

Conclusions

Separate collection of spent car oil filters should also be promoted. Initiatives in the UK are presented in Section 3 - Case study.

A.8 CHROMIUM IN LEATHER GOODS

Chromium tanning is the most important tanning method for the leather industry and represents over 80% of the leather production world-wide. The chemical used is trivalent chromium (Cr III) sulphate. The concentration of trivalent chromium in leather will normally be between 3-5% Cr_2O_3 and not be below 2.5% Cr_2O_3. Hexavalent chromium (Cr VI) is not used. However, leather products have been found to have traces of hexavalent chromium which is unexpected since Cr VI is unstable in the presence of high organic matter and is expected to be reduced to Cr III.

Although Cr VI is of concern, the quantity in leather products would not be sufficient to render the leather waste hazardous within the current legislation, therefore strictly speaking this waste stream would not be considered hazardous. Germany is the only country with legislation related to the content of Cr VI in leather in the revised Act on Food and Commodities of 8 July 1993 (art 30) which prohibits the presence of Cr VI compounds in detectable concentrations in leather. There are several eco-labelling schemes for Cr VI in leather such as the EU eco-label for footwear (Commission decision of 17 February 1999) which limit the content in leathers down to 10 mg Cr VI /kg.

However, it is mentioned here as leather has been identified as a major contributor to the presence of Cr VI in MSW (Griegrich *et al* 1993).

Quantities of products and waste

The Danish EPA investigated in 2001 (Danish EPA web page) the content of hexavalent and total chromium for 43 leather products such as watch-straps, shoes, gloves, baby-shoes, working gloves, leather jackets, trousers, tops, skirts and hats. Fifteen out the forty-three (35%) of leather goods contained hexavalent chromium in levels above the detection limit of 3 mg/kg (DIN 53314), ranging from 3.6 to 14.7 mg/kg.

Hexavalent chromium has been found in leather articles in Germany (Hauber and Germann 1999, Graf 2001) and in France (Martinetti 1994).

The presence of Cr VI in leather goods can be avoided by using the correct processes and this information is available from leading chemical suppliers to the leather industry and through publications.

Conclusions

Leather goods have been identified in a Germany study to be the main cause of presence of hexavalent chromium in landfill emissions (Griegrich *et al* 1993). However, within the current legislation, the quantity in leather products is not sufficient for this waste to be considered as hazardous. The presence of Cr VI can be avoided using the correct tanning processes.

APPENDIX B COUNTRY REPORT

B.1 AUSTRIA

Legal and administrative framework

In Austrian legislation, hazardous waste or waste oil which generally accumulate in households are referred to as "*Problemstoffe*". The legal basis for this waste category is the § 2 Abs. 6 of the 1990 Waste Management Act (*Abfallwirtschaftsgesetz AWG - Festsetzungsverordnung gefährliche Abfälle*). Under the terms of this paragraph, waste from other sources is also classified as "*Problemstoff*" when comparable with household waste.

The following products are commonly defined as hazardous household waste (HHW) in Austria (ÖNORM S 2101)

- Fats (also edible fats)
- Solid adhesives
- Oils (also edible oil) such as lubricating oil, oil cans, petrol oil, contaminated solid wastes
- Paints, varnishes, thinners, timber preservatives, nail polish, paint remover
- Aerosols (with unused content)
- Household chemicals
- Pesticides and fertilisers
- Household cleaning agents like drain pipe cleaner, disinfectants etc.
- Medicaments
- Fluorescent bulbs
- Solvents
- Cosmetics
- Adhesives (also including tubes and cans)
- Clinical thermometers
- Fire extinguisher
- Batteries (especially rechargeable ones)
- Gas containers
- Acids and bases

Under the prescriptions of the AWG, these wastes are not allowed to be disposed of together with non-hazardous municipal solid waste; they have to be brought to special collecting points. The regulation for the disposal of household waste is the responsibility of Austria Federal States and the collection of hazardous household waste is the responsibility of the municipalities which are obliged to collect HHW at no charge.

Collection and treatment facilities

Austria has established a nation-wide collection system for HHW. Normally, the system consists of collecting points where residents can deposit their HHW. In addition, special containers exist that are distributed over a municipality or a town. Vienna, for example, has 56 collection points for HHW with special equipped containers and 19 collection points so called "*Mistplätze*" where residents can deposit HHW such as batteries, medicines, paints and varnishes, thinners, disinfectants, pesticides, fluorescent tubes or oil residues (Wien web page).

The collection of the HHW is almost exclusively carried out by private waste collection companies, which are contracted to provide waste collection and treatment in authorised installations. The collection of HHW requires an accreditation from the responsible authority in the Federal State ("*Landeshauptmann*"). The companies are subject to monitoring and are required to record the type, quantity, source and final disposal of the collected HHW.

HHW that can only be incinerated is brought directly to hazardous waste incinerators. Recyclable materials such as rechargeable batteries are brought to central collecting points for hazardous waste and are sorted again for subsequent recycling. Hazardous materials which cannot be incinerated such fluorescent bulbs and other mercury containing waste, consumption batteries and chemicals are passed to authorised recycling companies or to specialised treatment plants. Austria has a large number of specialised waste treatment sites (Table B.1.1) for chemical and thermal treatment.

The collection of HHW in Austria is supplemented by take-back systems at retailer shops. For some products such as fluorescent bulbs, batteries and medicines, retailers are responsible to take back old products from the consumers.

Table B.1.1 Waste treatment plants and landfill sites in Austria (Umweltbundesamt 2001)

Type	Number	Capacity ($x10^6$ tpa)
Chemical-physical treatment plants	32	0,5
Thermal treatment and recovery plants	53	1,9
Specialised treatment and recycling plants	175	0,7
Biomechanical pre-treatment plants for residual waste	12	0,4
Biomechanical plants for separately collected biodegradable waste	526	1,1
Sorting plants for separately collected waste	86	1,1
Recycling plants	38	2,0
Internal thermal treatment plants	135	0,8
Construction waste and excavation landfills	752	Not reported
Solid waste landfills (capacity in m^3)	53	30

Quantity of hazardous household waste

In Austria, 3.1 million tpa of MSW are generated annually (Umweltbundesamt 2001), 50% are recycled, 43% are landfilled and the rest is incinerated. It is estimated that about 23,000 tonnes of HHW were generated in 1999 in Austria, representing 0.7% of the total household waste collected (Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft, 2000 and Bundes-Abfallwirtschaftsplan – Bundesabfallbericht, 2001). It was reported in a report from the European Topic Centre on Waste that in 1996, 26,000 tonnes of hazardous waste in Category 20 of the European Waste Catalogue (EWC) was generated in Austria (Brodersen *et al*, 2001).

A precise estimate of HHW quantities based on actual collection data was not possible. According to information provided by the authorities contacted, there is no detailed national/centralised database for HHW. Private waste companies that were contacted were unwilling to give their data to third parties.

B.2 BELGIUM

B2.1 Walloon Region

Legal and administrative framework

In the Walloon Region, the Ministry of Environment (*Direction Générale des Ressources Naturelles et de l'Environnement – DGRNE)* is responsible for regulation and policy development on environmental related issues. The regional waste office (*Office Wallon des Déchets - OWD*) collects information and keeps records on waste statistics.

The municipalities are responsible for collection and treatment of municipal solid waste (MSW). MSW management is usually organised by publicly owned companies working for several municipalities; inter-municipal companies (*Intercommunales*). They are also responsible for the collection of the HHW (Déchets Spéciaux des Ménages – DSM).

The Walloon Plan for Waste for 2010 sets different objectives for the Region including separate collection of HHW.

Collection and treatment facilities

The main collection method for HHW in the Walloon Region is free deposit by the public at the local civic amenity centre (*Parc à conteneurs*). In most of the Walloon municipalities, there is a special container provided and manned by a trained staff. The collected HHW are then collected by a private company (BIFFA) to be sorted and then directed towards the appropriate treatment centre, mostly incineration. The information campaign to promote separate collection by households is organised differently according to the '*Intercommunales*'. This has an influence on the quantities of HHW collected. In addition, there are specific collection schemes for batteries, waste oil and medicines.

Batteries

BEBAT collects batteries in the Walloon Region in boxes which are placed at several locations such as supermarkets, shops, schools, institutions and civic amenity parks. Batteries are collected by the WATCO company to be sorted and sent for recycling to specific treatment plants. More details are provided in section below.

Medicines

Citizens can deposit their expired medicines at the civic amenity parks or at bring-back systems at chemist shops.

Waste oils

Since 1992, there are special provisions for waste mineral oils to be collected separately. Households can deposited waste oils at the civic amenity centres or in special containers (*bulles à huiles*) at different locations or at their local garages. A new contract has been signed in July 2000 for 5 years for collection and treatment of these wastes.

Following the dioxin crisis in 1999, there are also special provisions for separate collection at the civic amenity centres of vegetable used oils. These wastes can originate from households but also from small enterprises.

Cost for collection and treatment

In 1995, it was reported (Anon 1997) that the cost for HHW management at civic amenity centres amounted to about 1.03 million euros including 0.16 million euros for collection and 0.87 million euros for treatment. This is equivalent to about 0.75 euros per kg of HHW (0.5 euros/inh/y) excluding cost for trained staff and containers.

The cost for two collection campaigns of discarded medicines at chemist shops amounted to about 2.3 euro per kg. The costs of collection and treatment for waste medicines from civic amenity centres were reported to amount to 0.58 euro per kg in 1995 compared with 1.4 euro per kg in 1994.

The costs for collection and treatment of waste oils were reported to amount to 94,200 euros in 1994 (Anon. 97) excluding VAT. The cost for waste oil management is so low because the oil can be sold as fuel which is not the case for other waste streams

In the 2000 Annual report of the Walloon Environment Ministry (DGRNE 2000), the costs for management of HHW collected at civic amenity centres excluding waste oils is reported to amount to 2.26 million euros including 1.4 million euros to BIFFA for the contract for collection and treatment of HHW. This is equivalent to 0.68 euros per kg (0.68 euros/inh/y).

The household tax for MSW management was 24.79 euros per household in 1999 amounting to a total of about 20 million euros.

Quantities of hazardous household waste

It is estimated that the quantities of HHW (excluding waste oil) arising in the Walloon Region amount to 1% (weight basis) of the MSW. This was reported to be equivalent to about 13,000 tonnes in 1994 (Anon. 1997). The quantities collected selectively in 2000 amounted to 3,300 tonnes, equivalent to 0.989 kg/inh/y. This represents a collection rate of 25% of the total quantities of HHW annually discarded. These figures were provided by the regional waste office (*Office Wallon des Déchets - OWD*) and were published in DGRNE 2000 (Table B.2.1). The quantities of HHW collected selectively have increased significantly from 183 tonnes in 1991 (Table B.2.2) equivalent to 0.05 kg per inhabitant (DGRNE 2000).

This does not include the volume of waste mineral oils collected which amounted to 1.6 million litres in 2000 (about 1,472 tonnes), equivalent to 0.5 litres per inhabitant (0.45 kg/inh/y) (Table B.2.3) compared with 0.38 million litres (0.16 litres per person) (340 tonnes equivalent to 0.14 kg/inh/y) in 1992 (DGRNE 2000). It is estimated that the total quantities of waste oils discarded by households amount to 2,650 tpa, about 0.8 kg/inh/y (Anon. 1997). The collection rate for waste motor oil appears to have reached 55% in 2000.

The most important types of HHW collected selectively (Table B.2.1) apart from waste oils in terms of volume are paints and batteries representing 41 and 26% respectively. The other categories of HHW usually represent less than 10% each.

Table B.2.1 Hazardous Household Waste selectively collected in the Walloon Region (2000) (DGRNE 2000)

	Quantity	
Types	**(kg)**	**%**
Paints, varnish, glue and resins	1369 994	41.47
Batteries and accumulators	877 008	26.55
Empty packaging of hazardous chemicals	211 092	6.39
Aerosols	166 994	5.05
Solvents, inks	115 599	3.5
Medicines, cosmetics	105 379	3.19
Cleaning products	75 173	2.28
Flame extinguishers	65 885	1.99
Fluorescent tubes	58 127	1.76
Pesticides, fertilisers	58 122	1.7
Miscellaneous	53 835	1.63
Chemical products	51 286	1.55
Oils, mineral oil	50 603	1.53
Photo products, x-rays	46 682	1.41
Total	**3 303 579**	

Table B.2.2 Trend in separate collection for HHW in the Walloon Region (DGRNE 2000)

Year	Quantity collected separately (kg)	Population (inh)	Quantity per inh (kg/inh)
1991	182 939	3 258 795	0.056
1992	313 675	3 275 923	0.096
1993	524 430	3293 352	0.159
1994	972 785	3 304 539	0.294
1995	1 378 990	3 312 888	0.416
1996	1 591 027	3 314 568	0.48
1997	2 092 323	3 320 805	0.63
1998	2 441 079	3 326 707	0.734
1999	3 179 694	3 332 454	0.954
2000	3 303 579	3 339 805	0.989

Table B.2.3 Trend in separate collection of waste oil in the Walloon Region (DGRNE 2000)

Year	Volume collected separately (l)	Population (inh)	Quantity per inh (l/inh)
1992	376 790	2 288 298	0.165
1993	752 730	3 184 221	0.236
1994	858 043	3 202 776	0.268
1995	1 75 117	3 200 429	0.336
1996	1 056 847	3 075 337	0.344
1997	1 519 076	3 162 494	0.48
1998	1 525 047	3 114 851	0.49
1999	1 754 861	3 161 194	0.555
2000	1 636 036	3 153 765	0.519

B.2.2 Flemish Region

Legal and administrative framework

The Flemish Act of 17 December 1997 - VLAREA (*Vlaams Reglement inzake afvalvoorkoming en -beheer*) imposes a separate collection for a list of Household Hazardous Waste referred to as *'Klein Gevaarlijk Afval* (KGA)'. The obligation for local authorities to organise a collection of HHW was already mentioned in the Decree of 2 July 1981 on waste minimisation and management. The KGA or HHWs include batteries, pesticides, photo chemicals, fluorescent tubes, paints, etc.

The Waste Flemish authority, OVAM is responsible for policy development and information reporting for waste management. The collection of HHW is organised by the local authorities, which delegate that task to inter- municipal companies ("*Intercommunales"*) or private firms. Both the *Intercommunales* and the private companies need to have a licence to collect HHW.

Collection and treatment facilities

HHW can be deposited at civic amenity centres or collected separately through door to door collection. The Bebat network for batteries also operates in Flanders.

The collected HHW is either sent for treatment in recycling plants (e.g. fluorescent lamps, car batteries, and small batteries) or to an incinerator capable of incinerating hazardous waste.

Costs of collection and treatment

The cost of collection and treatment depends on the category of HHW and the recycling possibility. It also depends on the quantities collected and the type of collection (i.e. centralised collection at a civic amenity centre or door to door collection).

The cost for collection of HHW in the Flemish Region provided by OVAM for 1995 was reported in an internal document presented to the Commission in 1997 (Anon 1997).

Unfortunately, the Waste Flemish authority, OVAM was not able to provide up-to-date cost figures.

The collection cost of HHW from civic amenity centres in 1995 was reported to range between 0.84 and 3 euros per inhabitant and per year depending on the quantity deposited at the civic amenity site (Table B.2.4) while the cost for door to door collection ranged between 1.4 and 3.7 euros per person and per year depending on the quantities of HHW per person and the frequency of collection (Table B.2.4).

Table B.2.4 Cost of HHW collection in the Flemish Region (1995) (Anon 1997)

	Collection cost (euros inh^{-1} y^{-1})		
Collection rate	**0.5 kg inh^{-1} y^{-1}**	**1 kg inh^{-1} y^{-1}**	**2 kg inh^{-1} y^{-1}**
Type of collection			
Civic amenity centre	0.84	1.6	3
Door to door collection	1.4[a] /1.6[b]/4.4[c]	1.9[a] /1.9[b] /2.5[c]	3.6[a] /3.7[b] /3.7[c]

Notes:
A = collection frequency 3 times a year
B = collection frequency 6 times a year
C = collection frequency 12 times a year

Examples of HHW collection in Antwerp

This following example is of a HHW collection in place in Antwerp operated by Biffa Waste Service (National Household Hazardous Waste Forum web site). Households are provided with a 30-l tamper-proof box. The boxes are emptied in the collection vehicle and transported to the treatment plant located in Antwerp. On arrival, each container is weighted and labelled before being processed before being recycled or disposed of by incineration or landfilling (Table B.2.5). The plant has a laboratory, a cryogenic facility including a shredder and a storage facility. In 1997, about 7,000 tonnes of hazardous waste from both commercial and household sources were processed.

It is estimated that HHW treatment costs about 0.64 euro/kg representing a cost per household ranging between 16 to 24 euros per household per year. This is partly covered by landfill and producer taxes.

Table B.2.5 Disposal and recycling routes for collected HHW

Recycling	**Incineration**	**Landfill**
Aerosols	Acids/alkalis	Asbestos
Batteries-lead acid	Batteries- primary	Smoke alarms
Batteries-secondary	Clinical waste	
Cooking oils	Garden chemicals	
Fire extinguishers	Motoring products	
Fluorescent tubes	Pharmaceuticals	
Mercury	Tyres	

Recycling	Incineration	Landfill
Motor oil		
Oil filters		
Paint related products		
Petcare products		
Photo-chemicals		
Refrigerants		
Solvents		
X ray plates		

Quantities of hazardous household waste

Flanders is a densely populated region with 5.9 million inhabitants in 2000, estimated to rise to 6.03 million by 2010. The quantities of MSW generated in Flanders were estimated to amount to 3.3 million tpa. Data on HHW quantities were provided by OVAM (Mrs Putseys, pers comm 2002). The total HHW quantities arising were not provided by OVAM. However, if we estimated a total HHW quantity equivalent to 1% of MSW arising, this amounts to 33,000 tpa.

The quantities of HHW collected separately in Flanders were estimated to amount to 13,900 tonnes in 2000, equivalent to about 2.3 kg of HHW per inhabitant and per year (OVAM, pers. Comm. 2002) (Table B.2.6). This represents a 42% collection rate for HHW arising.

The quantities of HHW collected have doubled since 1995. Vegetable oils (26%) which are not hazardous waste but which are collected separately, paints (24%), motor oils (16%) and car batteries (11%) account for the largest quantities.

Table B.2.6 Evolution of quantities of HHW collected in the Flemish Region (kg)

Waste category	1995	1996	1997	1998	1999	2000
Vegetable oils / cooking oils	1,149,312	1,438,527	1,839,305	2,151,118	2,723,206	3,597,259
Mineral oils / motor-oil	1,606,525	1,778,199	2,010,363	2,162,190	2,316,224	2,194,695
Paints, inks, glues, resins (not separated)	671,935	933,257	1,082,914	1,028,179	1,847,168	1,797,405
Car batteries	965,102	1,158,221	1,349,303	1,335,476	1,493,768	1,637,135
Paint, varnish	502,010	641,869	1,013,071	1,603,598	1,313,773	1,499,841
Packaging of hazardous products	395,243	431,615	525,654	699,106	788,927	822,422
Solvents	392,995	426,951	480,568	513,177	581,971	624,154
Batteries	337,407	344,116	278,286	306,035	311,073	335,490
Fluorescent tubes and other Hg lamps	169,543	230,994	269,902	330,547	375,148	313,139
HHW of mixed composition	242,821	276,239	334,834	268,489	437,029	312,924
Pesticides, cosmetics	166,861	169,475	145,767	201,309	197,331	196,155
Cleaning products	56,678	74,367	94,318	115,522	166,142	158,130
Fire extinguisher	40,436	46,920	60,150	73,910	91,349	106,735
Acids	34,098	40,272	41,469	39,232	42,829	73,809
Alkalis	31,614	34,061	38,561	47,833	42,328	61,872
Photo chemicals	20,149	26,135	25,162	35,382	43,358	46,570

Waste category	1995	1996	1997	1998	1999	2000
Out-of-date chemicals	15,942	20,578	20,247	36,082	46,851	46,124
Other oils (petrol….)	1,230	5,372	6,092	11,000	11,274	31,668
Toner, ink	7,883	7,678	11,551	13,741	17,985	26,239
Glue, inks, resins	12,321	26,614	14,743	18,131	27,191	22,210
Hg thermometer	1,753	896	1,210	1,332	1,298	1,667
TOTAL	**6,821,858**	**8,112,356**	**9,643,470**	**10,991,389**	**12,876,224**	**13,905,642**
Number of inhabitants	5,881,357	5,898,833	5,912,382	5,926,839	5,940,251	5,952,552
Quantity per inhabitant (kg per inh)	1.2	1.4	1.6	1.8	2.2	2.3

B.2.3 Brussels Region

Legal and administrative framework

Waste management is regulated in the Brussels Region by the Ordinance of the 7 March 1991. The Waste Plan describes the actions and objectives for prevention and management of waste in the Region. It has a statutory status. The separate collection of HHW and suitable treatment is part of the Plan.

The Brussels Environment Institute (*Institut Bruxellois de Gestion de l'Environnement – IBGE*) is responsible for policy development and information reporting for waste management. The collection of HHW is organised by the local authority, *ARP/Bruxelles Propreté* which has contracted the collection and treatment to a private company.

Collection and treatment facilities

A separate collection network for HHW has been set up since 1989. In each of the 19 municipalities of Brussels Region, there is a public collection point (*Point Vert*) for hazardous domestic waste located in photo shops, chemist shops or civic amenity centres. At the civic amenity centre, a trained staff deals with these wastes which are then dispatched to be treated. There are also some mobile collections organised for these wastes and the BEBAT network of collection points for batteries located in shops, civic amenity, schools, etc as in the other 3 Regions.

The cost for the management of HHW was reported to amount to 2.5 euros per kg in the Brussels Region in 1999 compared with 0.25 euros per kg for non hazardous household waste (IBGE 2000).

Quantities of hazardous household waste

There are around 954 500 inhabitants in the Brussels region and the quantities of MSW generated in the Brussels Region were estimated to amount to 344 000 tonnes. The total quantities of HHW arising in MSW can be estimated to amount to 344 tpa based on a 1% arising.

Data supplied by the Brussels Institute for Environment (IBGE, pers. Comm. 2001) is presented in Table B.2.7 below. Information provided presented in the State of the environment published by IBGE in 2000 was also reviewed.

About 300 tonnes of HHW were collected separately in 1999 in the Brussels Region representing around 1% of the total domestic waste and equivalent to 0.33 kg per person and per year and representing a potential 90% collection rate.

Paints (34%), oils and fats (19%), medicines (18%), batteries (10%) are the main HHW collected in the Region. The quantities of HHW collected have increased since 1991 from 117 tonnes per annum but seem stable since 1994 (Table B.2.8). Since 1998, only the batteries collected via civic amenity centres are accounted for in the Table below. The quantities collected separately through schools or shops via the BEBAT network are no longer accounted for in households hazardous waste statistics.

The largest quantities of HHW is collected through civic amenity centres (52%), followed by mobile collection (26%) and other 'green point' deposit (21%).

Table B.2.7 Hazardous household waste collected in the Brussels region (1999) (IBGE, pers. comm. 2001)

Types	Quantity		
	(kg)	(%)	(kg/inh)
Paints, inks, glue and resins	107 570	34.5	0.113
Oils and fats	58 186	19	0.061
Solvents	10 797	3.5	0.011
Acids	2 177	0.7	0.0023
Alkalis	3 420	1	0.0036
Cleaning products	10 264	3	0.011
Batteries*	32 809	10.5	0.034
Hg products	4 767	1.5	0.005
Products with variable composition	24 730	8	0.026
Medicines	57 459	18	0.06
Total	**312 178**	**100**	**0.327**

* Only batteries collected via civic amenity centres. In addition, batteries are also collected through the BEBAT network.

Table B.2.8 Evolution of quantities of HHW collected in the Brussels Region (kg)

Year	Quantity collected separately (t)
1991	117
1992	179
1993	257
1994	308
1995	342
1996	NI
1997	274
1998	240
1999	312

B.2.4 Batteries

Legal and administrative framework

The Belgian Law on Ecotaxes from 16/07/1993 specifies a range of products sold in Belgium which should be subject to a tax to reduce their consumption. One of these product categories is batteries on which a tax of 0.50 euro per battery + VAT is imposed. Following discussions with the industry, this tax was never implemented but in place, a voluntary agreement was signed in 1997 between the industry and the Federal Government to set up a collection and recycling scheme financed by the battery industry. The Battery Collection Fund, BEBAT (*Fonds pour la Collecte des Piles*) was set up in 1995. An agreement was signed in 1997 between the three Regions and BEBAT to organise and carry out separate collection and treatment of batteries and accumulators. There are more than 2000 collection points for batteries in the BEBAT network. Any company liable for ecotax can join the network, today there are more than 500 members.

Collection and treatment facilities

BEBAT, the non profit organisation collects batteries for the three Regions in boxes which are placed at more than 20,000 locations such as supermarkets, shops, schools, institutions and civic amenity parks.

Batteries are then collected by specialised firms to be processed; WATCO company for the Walloon and Flemish Regions and Bruxelles Propreté for the Brussels Region. The batteries are sorted into four categories;

- Button batteries
- Rechargeable batteries (Ni/Cd batteries)
- Lead batteries
- Others (alkaline and saline batteries).

The batteries are then processed for recycling in specialised companies based in Belgium or in France (for Ni/Cd batteries). It is reported that about 70% of materials are recycling.

The quantities of batteries collected have increased from 1,248 tonnes in 1996 to 2,105 tonnes in 2000. It is reported that the collection rate is currently about 60% (Bebat web site). The majority of batteries collected (80% of total weight collected) is represented by non-hazardous alkaline and saline batteries.

Cost

The BEBAT collection and treatment scheme is financed by consumers through a collection and recycling contribution of about 0.124 euro per battery. In 1997, it was reported that the total income of BEBAT amounted to 6.45 million euros compared to a total costs for running the scheme of 5.82 million euros while in 1998, BEBAT incurred a net loss of 1.22 million euros (Hogg *et al* 2002).

Contacts

Walloon Region:

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Mr Quinchon – BIFFA – waste operator

Flemish Region:

Mrs Lydia Putseys – Openbare Afvalstoffenmaatschappij voor het Vlaamse Gewest – OVAM

Brussels Region:

Mrs Christine Koczab – Institut Bruxellois de Gestion de l'Environnement – IBGE

Mrs Eline Jansegers – ARP/Bruxelles Propreté

B.3 DENMARK

Legal and administrative framework

Since January 1991, regulations are in place in Denmark for a statutory separate collection of HHW. The Danish definition of HHW covers oil and chemical waste, motor fuel, paints, stain removers/solvents, wood preservatives, photochemicals, mercury, pesticides, fertilisers and medicines.

MSW management including HHW is regulated in the Statutory Order on waste No 299 of 30 April 1997. Management of household waste is operated at the local council level either by the council or by contracted inter-municipal companies or private waste companies, with the collection typically contracted to private companies. Similarly hazardous waste management is also organised differently from one local authority to another.

Under the latest Danish national waste management plan for 1998-2001 - Waste 21 (MEE 1999), an increasing number of waste fractions which were previously landfilled or incinerated have to be collected and treated separately, for example end-of-life vehicles, waste electrical and electronic equipment, and impregnated wood. The Plan Waste 21 recognises that for successful separation of hazardous household waste the public need to be aware of the issues of concern and the products involved. Local councils are therefore required to increase information to citizens on existing schemes. As a support to local councils a guideline on hazardous waste was to be issued in 1999.

In addition, Denmark has an extensive policy and legislation concerning chemicals. Denmark has a programme called ‘Generation goal – no problematic substances by 2020’ which goal is to reduce the consumption of dangerous chemicals by banning or restricting uses of certain chemicals, imposing taxes or entering into agreement with industry as well as promoting development of cleaner alternatives to the substances which impact on the environment (i.e. Cleaner Products Support programme).

Eco-labels are a high-priority in the Danish environmental policy. There are around 1,300 ecolabelled products in Denmark (Nordic Swan and EU flower logo). The ecolabel products have increased their market share in recent years especially washing powders.

Collection and treatment facilities

Across Denmark, two collection systems operate for HHW; delivery by the citizen or collection by the municipality. Studies have shown that kerbside collection was collecting the largest amount of HHW. There are separate collection schemes for batteries and accumulators, waste oil and hazardous household waste. Schemes will be put into place for waste electrical electronic equipment, PVC and impregnated wood.

All municipalities in Denmark (275 in total) have a least one recycling site where households can come and deliver their waste. In 1995, these sites received about 1 kg of HHW per household and per year. The cost of operating this system is about 1.6 euro per household (1995 basis), equivalent to 1.6 euro per kg (Anon. 1997b).

Certain schemes involve retailers (take back) or containers at different locations. Agreements have been made with certain shops for take back system for example photography shops, paint retailers, pharmacies, construction material merchants and some institutions. This

collection system receives between 0.2 and 0.4 kg of HHW per person and per year. The cost of operating this system is about 0.016 euro to 0.8 euro per household.

Some local authorities have introduced collection vehicles to collect HHW on sporadic dates while other authorities have kerbside collection schemes using special containers.

A mobile container is put once a year (or more) near shopping centres or at other public places often timed to coincide with a festival or other public event. This system usually collects between 0.35 to 3 kg per household and per year. The costs are high between 3.2 and 13 euros per household or 3.2 and 5 euros per kg of HHW collected.

A specially equipped and designed vehicle collects HHW on a pre-announced schedule. The amount of HHW collected via this system varies between 1 and 10 kg HHW per household. The cost ranges between 10 to 22 euros per household and per year or 8 and 10 euros per kg.

Households rarely use the call-in system.

The household box received between 1.7 and 5.3 kg of HHW per household and per year. The system is more expensive to operate than the other systems and cost ranges between 6 and 35 euros per household and per year estimated to amount to 1.7 and 10 euros per kg for an average 3.5 kg collected per household.

HHW in Denmark is treated in specialised treatment plants. The treatment options include high temperature incineration as well as recycling and re-use. The largest treatment plant in Denmark is Kommunekemi. No landfilling of HHW is permitted in Denmark since 1972. It was reported that in 1995, treatment cost of HHW ranged between 0.685 and 1.164 euros per kg including transport by rail to the central treatment plant but excluding VAT (25%).

Taxes on landfills and incinerators provide the general funds for operating HHW collection schemes and local taxes also contribute towards collection costs. The annual fee paid by households for management of domestic waste amounted in 1995 to 171 euro per households including VAT.

Information campaign will be carried out in co-operation between the Danish EPA and the National Consumer Agency to inform consumer of types of HHW and collection schemes in their area.

Quantities of hazardous household waste

Around 2.96 million tonnes of municipal solid wastes were produced in 1999 in Denmark including domestic waste (56%), bulky waste (23%), garden waste (16%) and other (5%). In 1997, a ban was introduced on landfilling of waste suitable for incineration. In 1999, 78 percent of municipal waste was incinerated, 7% landfilled and 15 % recycled. Hazardous waste from households is found in domestic and bulky waste (i.e. impregnated wood) (MEE 1999).

The total amount of hazardous waste generated from municipal and similar commercial, industrial and institutional wastes including separately collected fractions is reported to amount to about 3,000 tpa in 1995/96 (Table B.3.1) (ETC/W 1999) increasing to 12,100 tpa by 1998 (ETC/W 2001). There were no explanations provided for such a sharp increase and no detail on the HHW composition for 1998. In addition, about 1,500 tpa of batteries are

discarded from households and collected every year (see below). This amounts to a total of 13,600 tpa of HHW, equivalent to about 2.5 kg HHW/inh/y and representing about 0.8% of total domestic waste arising (1.66 million tpa).

There was no national record on quantities of HHW collected. The Danish EPA Waste Division was contacted but did not provide information. Information is only available from a scheme for HHW separate collection in Aarhus. It was reported that 1.2 kg of HHW was collected per person and per year through a combination of methods including deposits at civic amenity centres (76%), retailer take back and mobile collection (13%) (Anon 1997). If we applied the same rate of collection for the whole of Denmark, it can be estimated that the quantities of HHW collected amount to 6,500 tpa for a population of 5.4 million.

Batteries and accumulators

In 1998, 14,900 t of lead accumulators were sold in Denmark and thus the same amount was discarded. The collection rate for spent lead accumulators is 98%. Ten percent originate from households. There is an agreement between the Ministry of Environment and Energy and the battery industry (Returbat) for the separate collection of lead accumulators (MEE 1999).

In 1998, about 2,500 t of batteries were used in Denmark of which 260 t were rechargeable. It is estimated that about 120 t of Ni/Cd batteries were discarded in 1997 of which 95 t were collected for recycling/reprocessing in Sweden or France. Ni/Cd batteries are the only batteries sent for recycling, the rest of collected batteries are landfilled. Mercury single-use batteries are normally landfilled at the Kommunekemi special landfill sites. Since 1995, a fee is levied on Ni/Cd batteries which funds the collection of spent batteries (MEE 1999).

Experience of batteries collection has shown that it is difficult for consumer to distinguish between different types of battery (even when recyclable batteries carry a special logo). As a result, about half the discarded batteries are collected as a mixed of single-use and rechargeable batteries and the other half is disposed of in domestic waste (MEE 1999).

Table B.3.1 Hazardous household waste and similar commercial and industrial waste (ETC/W 2001)

Waste category	1995	1996	1998
Oil and fat	5	1	NI
Paint, inks, adhesives and resins	1,842	2,029	5731
Solvents	202	165	NI
Acids	135	58	NI
Alkalines	147	97	NI
Detergents	109	115	NI
Photo chemicals	191	176	NI
Medicines	297	252	NI
Pesticides	182	75	NI
Fluorescent tubes and other mercury containing waste	109	105	NI
Total	**3,219**	**3,073**	**12,106**

NI no information provided

Contacts

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Danish Environment Protection Agency (DEPA), Household waste division

B.4 FINLAND

Legal and administrative framework

Under Finnish Regulation (Waste Act 1993, No 1072, section 13), municipalities have to organise collection of HHW from households. Municipalities are also obliged to receive hazardous waste from agriculture and forestry unless the amounts are excessive. They also receive small quantities of hazardous waste from institutions and small-scale industry.

The Finnish regulation exempt household from the requirements on keeping records, labelling and consignment notes on hazardous waste.

It is common practice among the municipalities to form joint venture companies (Inter-municipal companies) with other local authorities to manage their waste management duties.

Collection and treatment facilities

A combination of mobile collection vans and delivery points are operating for HHW collection. Return to retailer/take back systems are in place for the collection of medicines and batteries while centralised collection points are provided for all types of HHW. Mobile collection units for HHW operate once or twice a year. The main difficulty is organising a total coverage of the country with its 450 municipalities. It is reported that the level of collection varies in different part of the country. There is also a need for better information to the public.

The municipal waste management companies organise management of hazardous MSW from various origins including retail shops, car servicing stations and light industries. In addition, private waste management companies also collect hazardous waste from corporate customers and households. The largest quantities of HHW are collected through municipal companies.

Hazardous MSW referred to categories 20 01 of EWC codes including batteries, fluorescent tubes, acids, alkalines, equipment containing CFC, etc. as well as code 13 (brake fluids), code 15 (packaging containing hazardous chemicals), code 16 (hazardous chemicals in containers) and 17 (asbestos based construction materials) are collected separately. HHW are then sent for processing to specialised companies approved by the authorities.

Municipalities finance the collection and treatment scheme through municipal waste charges. A waste tax of 15,5 euros per tonne is charged on waste deposited at landfills.

Quantities of hazardous household waste

The total quantities of municipal solid waste generated annually in Finland was reported to amount to 2.4 million tonnes in 1999 of which 62 % were disposed of in landfill, 30 % recycled and 8 % incinerated. If we assume that MSW contain 1% of HHW, this is equivalent to about 24,000 tpa. However, it was reported (Mrs Rainio, SYKE, pers comm 2002) that about 27,000 tpa of HHW (1994 figure) were collected separately. Based on a total population of 5.17 million, it is equivalent to 5.2 kg/inh/y. This represents 1.1% of the total MSW arising and we can assume that the percentage of collection of HHW is maximal.

HHW are treated by specialised companies. The design capacity for treatment of HHW in Finland is presented in Table B.4.1.

Table B.4.1 Design capacity for HHW treatment in Finland (SYKE 2002, pers comm.)

Type of waste/EWC code	Design capacity		Method of disposal or recovery
	Tpa	Number per annum	
Oils and fats excluding edible oils and fats	31		D14
Oils and fats but excluding edible oils and fats and other non domestic waste	400		D09
Paint, varnish, inks, adhesives and resins	16		D14
Acids/alkalines	4000		D14
Batteries	10		R04
Batteries	24		D14
Batteries	2		D15
Including batteries	2000		D15
Fluorescent tubes	10		R04
Fluorescent tubes	1250		R05
Fluorescent tubes		1,000000	R05
Fluorescent tubes	750		R13
Fluorescent tubes	603		D14
Fluorescent tubes	40.5		D15
Fluorescent tubes and other non domestic wastes	10000		D15
Equipment containing CFC		200	D09
Equipment containing CFC and without CFC		2000	D09/R04
Solvents	4		D14
Total	**19,109**	**1,002,200**	

Notes:

D09 Physico-chemical treatment not specified
D14 repackaging prior to submission to any of the operations
D15 storage pending any of the operations
R04 recycling/reclamation of other inorganic materials (vacuum distilling)
R05 regeneration of acids or bases
R13 storage of materials intended for submission to any operation

Examples of local and regional schemes are presented below:

Helsinki Metropolitan Area Council

YTV is an inter-municipal company for Helsinki, Espoo, Vantaa and Kauniainen. It is responsible for regional waste management, regional public transport, air pollution control and planning. A mobile collection for HHW is organised twice a year, in spring and autumn. This covers about 390 shops and more than 23,500 people. The amount collected in spring and autumn 1999 amounted to 136 tonnes of HHW, equivalent to 5.8 kg/inh/y. In addition there are about 170 permanent collection points for HHW (i.e. at petrol stations and chemist shops for medicines, syringes/needles). There is also a separate reception point at the regional landfill and at the waste transfer station where household can deposit free of charge HHW

such as batteries, thermometers, fluorescent tubes, paints, flues, car batteries and waste oil. HHW are sorted and sent for processing mainly at Ekokem company. The total amount of HHW collected in the YTV area in 1999 amounted to 1,531 tonnes which was slightly less than in the previous year. The waste collection and transport is entirely covered by consumer fees. The average fee for waste is 2.5 euros per month and per person; 65% covers transport.

Rosk'n Roll

A Southern Finish regional waste company, Rosk'n Roll of West Uusimaa is reported to have collected separately 500 tonnes of HHW at their 9 manned civic amenity centres and 20 collection points (i.e. at petrol stations) as well as 100 tonnes of HHW via a mobile collection in summer 2001. The total amount of HHW collected amounted to 5.5 kg/inh/y which was reported to be very high compared with the Finnish mean value for HHW (Rosknroll web site).

Ekokem processing company

Ekokem company supplied information (Tommila, Ekokem, pers. Comm 2002) on hazardous waste quantities that they process for two regional waste management companies; Kiertokapula municipal company and Turku municipality. It was not possible for them to provide contract details, as this is confidential information.

The quantities of hazardous MSW from households and corporate customers collected separately in 2001 range between 0.8 and 6.3 kg per inhabitant and per year (average 3.5 kg/inh/y) according to the municipalities located in the Kiertokapula Region while the quantities range between 1.8 to 6.2 kg per inhabitant and per year (average 3 kg/inh/y) in the Turku Region.

The categories of waste collected and annual quantities are presented in Table B.4.2 below. A large proportion of HHW is composed of batteries, paint, waste oil and other oil mixture/solid waste, solvents, fluorescent tubes, medicines and pesticides, radiator fluid and of unidentified waste requiring sorting. In Kiertokapula Region, a large quantity of WEEE is also collected.

Table B.4.2 Quantities of HHW collected in 2001 from two regions in Finland (Ekokem, pers comm 2002)

	Quantities (kg)	
Type	**Kiertokapula Region**	**Turku Region**
Batteries	290,774	640,804
Paint	107,142	212,062
Waste oil (incl. lubricating oil and oily mixture)	249,797	100,294
Solid oily waste	24,267	37,385
Solvent	10,814	22,464
Fluorescent tubes/Hg containing lamps/other Hg waste	9,462	19,426
Medicines	7,254	26,539
Radiator fluid	4,742	1,615
Pesticides	2,850	8,121
Bases	472	283

Type	Quantities (kg)	
	Kiertokapula Region	**Turku Region**
Acids	277	1028
Ammonia	122	-
Asbestos	7	-
Toner cartridges	5	-
PCBs	-	702
CFCs	53	133
Electronic waste	6,953	-
Waste requiring sorting	6,720	4,604
Biological waste/infectious waste	64	327
Other	427	2,726
Total	**722,189**	**1,074,243**
Quantity per person (kg/inh/y)	**3**	**3**

Contacts

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Mr J Puolanne - Finish Environment Institute (SYKE), environmental management division

Mrs K. Rainio - Finish Environment Institute (SYKE), environmental management division

Mr Lassi Räsänen – Waste Industry Federation

Mrs E Tommila – Ekokem, managing director

YTV web page: www.ytv.fi/english.html

Rosknroll web page: www.rosknroll.fi/english/summary.html

B.5 FRANCE

Legal and administrative framework

The Act 75-633 of 15 July 1975 modified in 1992 and its application Decree of 18 November 1996 defines the responsibilities of municipalities in ensuring the collection and disposal of household waste. It sets targets for 2002 to accept only in landfill stabilised waste ('*déchets ultime*'). The regulation requires that municipalities draft Departmental Plan for household waste and specify management options for HHW. The Circular of 24 April 1998 clarified the objectives of the regulations.

The revised Plans in 2001 have put emphasis on civic amenity centres to deal with HHW and on information to the public to encourage the use of these centres. There are also well-established take-back systems and separate collection for batteries, used oils, and packaging waste.

The municipalities are responsible for waste management. They often work together in inter-municipal companies for collection and for treatment.

Collection and treatment facilities

Municipalities have organised separate collection for HHW, either as bring banks at a civic amenity centre (*Décheterrie*) or through collection with special vehicles. There are also take-back systems for unused medicines as well as their packaging at chemist shops. It was reported that in 1998 there were around 2,100 civic amenity centres and that between 300 and 400 municipalities were covered at least once a month by a mobile collection unit for HHW, representing 7 to 8 million people (Anon 2000). In addition, special collections are organised occasionally in university labs, high schools, garages, etc.

HHW is either incinerated (paints, solvents, oil) or is submitted to a physicochemical process (acids, bases, etc) (Anon 2000). The only information on costs was reported by Ademe (1997) for a two-day collection scheme where 114 kg of chemical products, 169 kg of paint, 12kg of aerosols, 27 kg of solvents and 29 kg of pesticides were collected and dispatched separately for treatment at a cost of 2,000 euros. It is equivalent to 5.7 euros per kg.

It was reported that it was more efficient to equip appropriately civic amenity centres for handling HHW rather than organising random collection days.

Quantities of hazardous household waste

The total quantities of MSW (domestic and waste from commercial and industrial sectors of similar composition) generated in France in 1998 amounted to about 41.4 million tpa. It reported that the percentage of hazardous waste in MSW is about 0.5%, ranging from 0.7% in urban areas and 0.4% in semi-urban areas, reported to amount to 189,406 t. The quantities of hazardous waste in MSW sent to landfills represents 0.2% of 24 million tonnes, equivalent to 59,126 tonnes while 130,280 t are incinerated. In addition, abound 5% of waste received at the civic amenity centres (*Décheterrie*) are hazardous, equivalent to 190,000 tpa. These include mainly waste oil, accumulators, batteries and DIY products (Ademe 2000).

In France, total quantities of waste from domestic origin only amounted to 22 million tonnes (Ademe 2000). This includes 19.5 million tonnes of household wastes collected in bulk through kerbside collection, 2.2 million tonnes collected separately (i.e. paper, plastic, glass,

metals) and an estimated 0.3 million tonnes directly eliminated by household (home composting, home burning).

It was reported that around 4.5 kg of HHW are generated per inhabitant and per year in France which amount to about 260,000 tonnes. These include mainly batteries and accumulators, striper, solvents and Hg thermometer (Anon 2000). It is estimated that around 50% of the HHW are discarded annually in France through the normal waste collection system namely around 2 kg per inhabitant and per year while the rest is collected via civic amenity centres.

Batteries

There are 750 millions of batteries and accumulators sold every year in France. About 90% of lead batteries are collected and recycled, namely around 109 tonnes and 10% of the other batteries and accumulators are recycled. It was reported that around 600 million battery units are discarded per year in France; 50 million are button type and 550 million of stick type. For accumulators, 7 million lead acid batteries are discarded each year (Anon 2000).

From 1 January 2001, the collection of batteries and accumulators is statutory. Retailers and distributors have to accept to take back waste batteries and accumulators. Collection points are implemented at the distributors. The manufacturers and importers have to take back these batteries and these wastes must be treated in authorised plants.

Waste oils

One third of waste oils are recycled and 2/3 are used as fuel substitutes mainly in cement plants. There was no information specifically related to waste oil generated from households.

Pesticides

There are 13 millions of gardeners in France and about half of gardeners use pesticides. There are more than 13,000 places where pesticides are sold. The quantities of active ingredient sold per year in France of domestic pesticides are 10,000 tonnes (equivalent to 169 g per person), which is a tenth of agricultural uses. Domestic use would be responsible for a quarter of pollution incidents in surface water and groundwater. Around three-quarters of the applications would be lost due to inappropriate conditions of use (climatic conditions, etc) and would be released into the atmosphere.

Recommendations have been issued to the public for a safer disposal of pesticides residues and unused products such as to take unused products to civic amenity centres.

Contacts

Mme Pirou - Ministry of Environment (Ministère de l'Environnement, Direction de la Prévention des Pollutions et des Risques, sous-direction des produits et déchets)

Mr Philippe Bajeat, Mr Jean-Louis Bergey – ADEME – Angers – Direction des déchets municipaux.

B.6 GERMANY

Legal and administrative framework

The management of hazardous wastes from households ("*Probemabfälle"*) is regulated in German States laws by the stipulation that solid waste authorities have to provide separate collection of wastes which have hazardous properties specified in § 41 of the "Closed Substance Cycle and Waste Management Act*" (Kreislaufwirtschafts- und Abfallgesetz - Krw-/AbfG*). Accordingly, a product becomes HHW when it is harmful, hazardous to water or air, explosive or flammable because of its type, quantity or texture.

Thus the following products are commonly defined as HHW:

- Pesticides
- Old Paints and varnishes
- Solvent based wastes such as gasoline, thinner, adhesives etc.
- Accumulators and batteries
- Chemicals like: acids, bases, salts, wood stain, photo chemicals etc.
- Cleaning agents such as disinfectants, cleaning agents with a symbol for dangerous substances, etc.
- Mercury containing products such as fluorescent tubes, clinical thermometers
- Fire extinguishers
- PCB-condensers
- Containers with a symbol for dangerous substances

The Technical Regulation for Municipal Waste (*TA Siedlungsabfall*) provides enforcing authorities with statutory guidance on waste management planning, recycling and treatment of household waste in Germany. The disposal of hazardous household waste is regulated through the "*Technische Anleitung (TA) Sonderabfall*". According to this guidance HHW have to be treated and disposed of under the terms of best available techniques.

Each municipality is responsible for solid waste collection and treatment. The collection of HHW is the responsibility of the municipalities so that the collecting systems can vary between municipalities (ISWA, 2000). The collection and the treatment of HHW are carried out by waste collection companies which are contracted by the municipalities. These companies are obligated to record the collected HHW according to type, quantity, source and destination of the waste. These companies have to be accredited by the responsible authority and are subject to monitoring (Schnurer, 2001).

Collection and treatment facilities

With regard to HHW, three main collection systems are established in German municipalities:

1. Collection points distributed all over the municipality where the inhabitants can dispose of their HHW free of charge,
2. Collection vehicles ("*Schadstoffmobile*") where HHW can be handed in at a fixed time at a fixed place; and
3. A combination of the two.

At the same time, an increasing number of waste materials are being subjected to separate collection and recycling (ISWA, 2000):

- Under Germany's Batteries Ordinance for example, effective since April 1998, battery manufacturers assume total responsibility for their end-of-life products. Numerous manufacturers have joined forces in a common take-back system wherein waste disposal companies are commissioned to collect spent batteries from retailers and public waste disposal services, to sort them at a number of facilities around Germany, and to pass the individual battery parts on to disposal companies. Under the ordinance, retailers and public waste disposal services must accept used batteries from consumers without charge. Consumers are obliged to return all batteries regardless of type, manufacturer, or retailer. The ordinance also restricts the heavy metal content of certain batteries and requires that battery manufacturers label all hazardous batteries as such and produce long-life, reusable batteries.

- According to the German Oil Ordinance every store which sells oil is obliged to take-back the same quantity of old oil free of charge when a consumer buys new oil at the same store and submitted the receipt for the old oil. It is the responsibility of the owner of the store to dispose this waste oils according to the legislation.

- A similar take-back system is also valid for photo chemicals and fluorescent bulbs.

HHW that have to be incinerated such as paints and varnishes, thinners, pesticides are directly brought to hazardous waste incineration plants. Recyclable materials such as rechargeable batteries are delivered to the respective recycling companies. Hazardous materials which cannot be treated in incineration plants such fluorescent bulbs and other mercury containing waste, batteries, and chemicals are passed to authorised recycling companies or to chemical-physical treatment plants (ISWA, 2000).

Quantity of hazardous household waste

According to the German Federal Environmental Agency (Umweltbundesamt, pers comm) there is no national or federal statistics available regarding the quantities of HHW and the cost of collection. Even the data for other household waste fractions are limited and very old. Because of the fact that HHW is managed on the local level and reporting requirements are not uniform, it was not possible to derive a reliable estimate for Germany.

Private waste companies that were contacted were unwilling to give their data to third parties. According to estimates provided from some municipal authorities and from the Federal Environmental Agency, approximately 1% of the total household waste is considered to be HHW which would amount to 390,000 tpa of HHW.

The current method of HHW management is shown in two examples for two large municipalities (Munich and Ulm) for which detailed data with regard to quantities of HHW were available.

Example Munich:

In 2000, approximately 197 tonnes of HHW were collected in Munich. The largest quantities of HHW collected were for paints (58%), followed by solvents (14%) and batteries (7.1%) (Table B.6.1). Additionally, a total of 47,521 fluorescent bulbs were collected from private households (Anon 2000b).

Table B.6.1 Collection of HHW in the city of Munich in the year 2000 (Anon 2000b)

HHW products	Fraction of waste collected (% by mass)
Old paints	58
Solvents	14.1
Batteries	7.1
Aerosols	5.0
Surfactants	5.0
Photo chemicals	2.6
Acids	2.1
Fertiliser	1.4
Plant protective agents	1.4
Bases	1.4
Ammonia dilution	0.4
Lead	0.4
Oil filter	0.4
Metal salts	0.3
PCB-condenser	0.2
Mercury	0.1

Example Ulm:

According to the Waste Management Report of the City of Ulm for the year 2000 (Anon 2000c), approximately 89 tonnes of HHW were collected in Ulm. The largest quantities of HHW collected were paints (60%) and car batteries (22.5%) (Table B.6.2). Additionally, 5.36 tonnes of fluorescent bulbs were collected from private households.

Table B.6.2 Collection of HHW in the city of Ulm in the year 2000 (Anon 2000c)

HHW categories	Fraction of waste collected (% by mass)
Old paints	60
Car batteries	22.5
Miscellaneous	7.3
Plant protective agents	2
Aerosols	2
Dry-batteries	2
Old Medicaments	1.6
Acids	1.3
Bases	1.3

B.7 GREECE

Legal and administrative framework

Hazardous waste management in Greece is controlled under national legislation CMD 19396/824/1996 (Hatzichristidi, Ministry of Environment, Department of waste management, pers comm, 2002). There is no specific regulations or guidelines dealing with HHW collection and disposal in Greece.

Collection and treatment facilities

The separate collection of hazardous household waste (e.g. batteries, paints, solvents etc.) is not yet implemented in Greece mainly because a suitable system for MSW collection is not yet implemented. This should change in the future with the implementation of the 'National Plan and Technical Specifications for Hazardous Waste Management' by the Athens Technical University on behalf of the Ministry (Hatzichristidi, Ministry of Environment, Department of waste management, pers comm, 2002).

Poor organisation of the collection system, empirical routing, long distances to disposal sites and lack of transfer stations, means that waste collection costs in Greece are high. Waste disposal on the other hand is practically available free of charge, since uncontrolled dumping is the most common method. There are about 4,850 disposal sites, almost one for every local authority, 70% of which are uncontrolled. Approximately 35% of the MSW produced are disposed of at these sites. It is expected that the recent merging of municipalities and communities will lead to more rational approaches for waste management resulting in the closure of many uncontrolled disposal sites (Lasaridi 1999).

The Municipality of Athens has begun a recycling programme for paper and aluminium and will soon introduce, on a pilot scale, the first programme in Greece for the separate collection of hazardous household waste (Lasaridi, 1999; http://www.northampton.ac.uk/aps/env/Wasteresource/1999/Apr99/99april30.htm).

Quantity of hazardous household waste

It has been estimated by the Ministry of Environment, Department of waste management (MoE 1999) that hazardous waste originating from households as well as commercial stores and offices in Greece amounted in 1999 to 4,525 tpa equivalent to 0.12 % of MSW and not to the 0.5% previously reported in the National Plan for the Integrated and Alternative Management of Solid Waste. Based on 10.9 million population, this is equivalent to 0.4 kg per person and per year. This is far lower than the European average. The quantities of HHW produced per category of population are presented in Table B.7.1 below. These are currently collected with the residual MSW.

Further information may be available in the near future from a study by the Technical University of Athens on the "Waste Management in Greece" that will be completed in June 2002.

Table B.7.1 Quantities of HHW generated in Greece per population category (1999) (MoE 1999)

Population	Quantity	
	(tonnes per annum)	%
Urban	2,417	53.4
Semi-urban	661	14.6
Rural	1,447	32
Total	**4,525**	

Contact

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Mr Isaakidis - Ministry of Environment Physical Planning and Public Works, Waste Department (Director)

Mr K Hatzichristi, Ministry of Environment Physical Planning and Public Works, Waste Department.

Mrs M Loizidou – National Technical University of Athens, Chemical Engineering Department

B.8 IRELAND

Legal and administrative framework

The principle legislation in Ireland concerning waste management is the 1996 Act on Waste Management. It empowers the Minister for the Environment and Local Authorities to regulate waste. The Ireland Environmental Protection Agency (EPA) role is to regulate the import of wastes into Ireland and the granting of licences to significant waste disposal.

Recently the EPA has published its National Hazardous Waste Management Plan (EPA, 1999). Local Authorities are required to take account of recommendations made by the EPA for the management of hazardous waste in their areas as part of their Waste Management Plans. The National Hazardous Waste Plan (1999) includes specific references to household hazardous waste (HHW). The principle recommendations and aims concerning HHW in the plan are that:

- Hazardous household waste should be segregated from non-hazardous household refuse.
- Local authorities should plan and make provisions for waste collection facilities to householders. Such services should be available to other small-scale generators of hazardous waste.
- Information campaigns should be conducted initially focused on households by local authorities and national government in order to ensure the success of the separate collection initiatives.

The plan contains a priority's list for the period 1999 – 2004. This includes:

- Establishment of an improved collection infrastructure for hazardous household, agricultural and SME wastes.
- Improved public awareness of the impacts of hazardous waste.

Collection and treatment facilities for HHW

A few companies collect hazardous wastes mainly from industry and commercial enterprises and have not been generally available to smaller generators of hazardous waste although they take some household hazardous waste.

The National Waste Management Plan has considered and reviewed many schemes for the separate collection of HHW from the point of view of cost and degree of uptake by the general public. These schemes include:

- Bring banks for specific hazardous wastes at civic amenities.
- Kerbside boxes.
- Separation of HHW in the home into special bins that are then collected by mobile units at certain times per year.

- Returning specific items to retailers for collection, e.g. unused medicines returned to chemists.

In Ireland one route available for separate collection of HHW is via bring banks at civic amenities. The number of bring banks has increased from 426 in 1995 to 837 in 1998. However most of these are for non-hazardous materials such as glass, cans, textiles, and paper.

The number of bring banks for hazardous waste banks is small (14 for waste oil and 6 for batteries) but is expected to increase further due to implementation of Waste Management Plans by local authorities. A significant amount of collected hazardous waste is exported for treatment in other EU countries.

Quantity of hazardous household waste

In 1998 the estimated amount of unreported HHW that was effectively included in municipal waste sent to landfill was 6,831 t. This represents about 0.55% of total household waste generated and is equivalent to about 1.8 kg/inh/y. It is reported that about 50 t of HHW including fluorescent tubes, accumulators and batteries are collected separately from households in Ireland.

Estimation of the amounts of specific hazardous items as presented in Table B.8.3 below is reported in the National Waste Database for 1998 (published by EPA in 2000). However, the data has certain limitations for does not allow the identification of what material is collected specifically from households:

- Total reported quantities given include all industrial and municipal sources. Differentiation of what material is collected specifically from households is not possible.

- Some information on municipal waste is available but does not differentiate between household, commercial or street cleaning components of the waste. The data does not show what estimates are based on separate collection.

- The database gives estimates of total wastes generated and from reported recovery estimates the unreported waste. This again does not differentiate as to how much can be described as HHW and contributes to the estimated total HHW of 6,831 t.

A survey of home storage of hazardous materials was undertaken to indicate the main items that might end up in household refuse. The results identified household cleaning agents, paints and solvents and medicines as being the main potential sources of hazardous components (Table B.8.1) in household wastes.

Table B.8.1 Main products identified as hazardous in household waste in Ireland

Product category	Percentage (%)
Cleaning agents	30-40
Paints and solvents	36-44
Pesticides and herbicides	3-8
Medicines	14-22
Other	1-2

A survey has also been carried out in County Wicklow on the composition of MSW identified as hazardous. The results (Table B.8.2) indicated that medicines, aerosols and drain cleaners make up most of the HHW. This survey however included the containers of HHW as it was not possible to estimate amounts of unused product in the containers in the survey.

Table B.8.2 Main components of MSW identified as hazardous in County Wicklow

	Percentage (%)
Medicines	27.5-36
Aerosols	11.6-26.9
Drain cleaners	4.4-18.5
Solvents	4.3-6.3
Bleaches	5.9
Polishes	1-3.3
Ni-Cd batteries	0-1.8
Adhesives	0-9.6
Others	13.7-24.3

Information is provided below for some categories of HHW and summarised in Table B.8.3:

Fluorescent tubes (Hg)

The estimated fluorescent tube consumption in Ireland from household and commercial/institutions sources was 554 t of which only 30 t were collected separately and recovered (1998 figure).

Paints, Varnishes and thinners.

In Ireland many paint manufactures provide recycling services to retailers for damaged or out of date stock and waste household paints could be recycled by the same system via the retailers or collection at civic amenities. No collection is in operation at present.

The estimated quantity of paints, inks, adhesives and resins in municipal waste was 1,805 t in 1998.

Waste oils

It is estimated that 17,346 tonnes waste oil was generated in Ireland in 1998 of which 2,255 t were unreported. It is unlikely that much of this unreported material will be present in HHW. The separately collected oil from households through bring back banks was 17 tonnes. Most waste oil is recovered from industrial/commercial sources.

Batteries

The total estimated quantity of lead acid batteries discarded in 1998 was 14,213 t of which 5,175 t were collected separately (36% collection rate) leaving 9,038 t unrecovered. The estimated quantity of small Ni/Cd batteries discarded in Ireland in 1998 was 2,932 t of which only 61 t are originating from households. Only 18 t were collected separately (less than 1%

collection rate). The collection rate of batteries from households in Ireland is estimated to be very poor with an estimate of only 2 t of lead and small batteries collected separately.

Table B.8.3 Hazardous waste generated in MSW including quantities collected separately in Ireland (1998)

Type	Hazardous waste arising from household, commercial and industrial sources (tpa)	Of which separately collected (tpa)	Remaining in MSW (tpa)
Fluorescent tubes	554	30	524
Paints	1,805	0	1,805
Oils	17,346	15,091	2,255
Lead batteries	14,213	5,175	9,038
Ni/Cd batteries	2,932	18	2,914
Total	**36,850**	**20,314**	**16,536**

Cost for collection and treatment

The estimated costs for implementing and operating a nation-wide separate collection of hazardous household waste according to collection method are presented in Table B.8.4 below.

Table B.8.4 Estimated costs for a nation-wide HHW collection in Ireland (EPA 1999)

Facility	Number of units	Investment cost (€ x 10^6)	Operational cost (€ x 10^6 per year)
Civic amenity site	36	2.28	3.43
Take-back system	20,000	0. 33	0.63
Mobile collection	32	1.62	3.55
Storage boxes (collected twice per annum)	500,000	2.54	0.19

Contacts

Gerry Carty – Environment Protection Agency - EPA

B.9 ITALY

Legal and administrative framework

HHW is defined in the Gazzetta Ufficiale No 253 of 13 September 1984 as including batteries and accumulators, products labelled 'T' for toxic and/or 'F' for flammable' as well as pharmaceutical products.

Collection and treatment facilities for HHW

HHW are collected separately by municipal authorities through deposit at Eco-Center (*ecocentri*), equivalent to civic amenity centres or via special HHW containers/boxes installed near chemist shops for expired medicines and at electrical suppliers for batteries.

It is reported (Dr Ricci, pers comm 2002) that in 1999, about 9,438 tonnes of HHW were collected representing 0.165 kg/inh/y. The quantities are on the increase from 8,900 tonnes collected in 1998 for 57.6 million residents. Despite numerous requests to ANPA, no additional information was provided.

In some cities such as Torino, special containers marked with 'T' or 'F' are provided for any household products which is labelled toxic, flammable or corrosive including small household batteries and expired medicines. It is reported that about 0.18 kg/inh/y of HHW were collected (ACRR web site). Other hazardous materials such as brake and transmission fluid have to be taken to one of the Eco-Center (*ecocentri*).

Contacts

Dr Marco Ricci, Scuola Agraria del Parco di Monza

Mrs R Laraia, ANPA

Dr Massimo Guerra, ANPA

ACRR website : Association of Cities and Regions for Recycling
(www.acrr.org/members/turin/torino%20proj1a.htm)

B.10 LUXEMBOURG

Legal and administrative framework

The Law of 17 June 1994 defines 'problematic wastes' as being wastes generating potential nuisances and which because of their nature require a specific treatment for their collection, transport, elimination or valorisation. It includes hazardous household chemicals, domestic appliances containing CFCs and other wastes such as electronic and electrical equipment (Table B.10.1). Data on these wastes is collected by the Administration for the Environment.

A big effort is spent on information campaign emphasising prevention and reduction of HHW. It is planned to ban marketing of toxic household products which have a high toxicity and for which there are less toxic alternatives (i.e. mercury thermometer). An official list will be drawn and be kept up to date.

The activities of these collection schemes are financed by a Fund for the Protection of Environment according to the specifications of the Law of 31 May 1999. The collection and treatment of problematic waste is under the responsibility of municipalities and are financed by the municipal taxes.

Table B.10.1 List of HHW as defined in Luxembourg

Accumulator
Acid
Asbestos-cement
Electrical bulb
Base
Aerosol container
Ink cartridge
Packaging contaminated with dangerous substances
Electrical equipment containing CFCs
Fire extinguisher
Oil filter
Fat and food oil
Waste oil
Medicine
Paints
Batteries and chemical lab products
Pesticides
Photographic products
Cleaning products
Products or equipment containing mercury, oils or PCBs
Gas container
Solvents, syringes
Computer disks
Fluorescent tubes
Other waste including or contaminated by dangerous substances

Collection and treatment facilities

In Luxembourg, the collection of HHW is well implemented at the National level through specific a scheme called '*SuperDrecksKëscht fir Biirger'*. HHW are collected through mobile vans, drop off at civic amenity centres, special door collection, some take-back schemes at the retailers (batteries, medicines) or through specific actions. Municipalities have to supply space for containers and qualified staff. It is organised by a company called OEKO-SERVICE-Luxembourg.

There are 4 mobile collections organised per year in each municipality. For the mobile collections, municipalities have to work in collaboration with the '*SuperDrecksKëscht fir Biirger'* scheme to inform the population on time and location of collection.

Waste freezers containing CFC are also collected though another scheme called '*SuperFreonsKëscht*'. It is organised as a voluntary bringing points – there are around 20 of them in Luxembourg. There are also collection schemes organised by most municipalities for waste of electric and electronical equipment, tyres, either through door to door collection or civic amenity centres. This is the responsibility of municipalities.

The HHW and waste freezers are then transported towards a central sorting and pre-treatment centre before their final disposal often abroad.

The 2004/5 objective is to collect separately up to 70% of problematic wastes including HHW.

Quantities of hazardous household waste

The quantities of HHW arising are estimated to amount to 5 kg per inhabitant and per year (excluding asbestos waste), namely a total of 2,120 tonnes per year in Luxembourg (equivalent to 1% of total MSW arising).

The quantities of HHW collected separately through the '*SuperDrecksKëscht fir Biirger'* scheme have increased over the years from 800 tonnes in 1993 to more than 1,500 tonnes in 2000 (Tables B10.2) mainly through greater awareness of public to deposit HHW at the civic amenity centres. This is equivalent to 3.5 kg of HHW collected per person and a collection percentage of 66% of HHW arising. The main contributors to HHW are waste paints and accumulators accounting together for up to 50% of the quantities of HHW collected.

The majority of HHW is collected via amenity centres (63%) followed by mobile collection (28%) (Table B.10.3).

The cost for collection for the years 1998 and 1999 were estimated to be about 2.84 euros per kg of HHW including public relation, information, collection, sorting and analysis (Stark *et al* 2002).

Table B.10.2 HHW quantities collected separately per types of waste and per year (kg) in Luxembourg (MoE 1999b)

Type	Quantity (kg)					
	1995	**1996**	**1997**	**1998**	**1999**	**2000**
Accumulator	314073 (33.6%)	270164 (25.2%)	275683 (22 %)	271029 (19.5%)	286377 (20.5%)	(19.1%)
Acid	4861 (0.5%)	5675 (0.5%)	6118 (0.5%)	5097 (0.4%)	5510 (0.4%)	(0.3%)
Asbestos-cement1	4393 (0.5%)	26984 (2.5%)	85056 (6.8%)	160131 (11.5%)	56838 (4.1%)	(6.9%)
Electric light bulb	4393 (0.5%)	4926 (0.5%)	5230 (0.4%)	6014 (0.4%)	6953 (0.5%)	(0.5%)
Alkaline	10189 (1.1%)	12957 (1.2%)	15052 (1.2%)	12361 (0.9%)	14913 (1.1%)	(1.1%)
Aerosols	23929 (2.6%)	26770 (2.5%)	33388 (2.7%)	37193 (2.7%)	39230 (2.8%)	(2.8%)
Oil filter	4954 (0.5%)	4926 (0.5%)	8668 (0.6%)	13638 (1%)	9129 (0.7%)	(0.6%)
Frying oil	47765 (5.1%)	60822 (5.7%)	75365 (6%)	86260 (6.2%)	108145 (7.7%)	(9.3%)
Waste oil	92165 (9.9%)	96908 (9.1%)	116554 (9.3%)	123786 (8.9%)	124026 (8.9%)	(7.8%)
Medicine	53093 (5.7%)	62214 (5.8%)	61395 (4.9%)	70441 (5.1%)	74329 (5.3%)	(4.9%)
Paint	245369 (26.3%)	346406 (32.4%)	419620 (33.4%)	432799 (31.2%)	455540 (32.6%)	(31.1%)
Batteries	59543 (6.4%)	59537 (5.6%)	57822 (4.6%)	61511 (4.4%)	61881 (4.4%)	(4.4%)
Chemical lab product	3552 (0.4%)	3105 (0.3%)	3917 (0.3%)	4764 (0.4)	4935 (0.4%)	(0.3%)
Non-identified product	1776 (0.2%)	2891 (0.3%)	2625 (0.2%)	0	1278 (0.1%)	(0.1%)
Pesticide	10750 (1.2%)	11886 (1.1%)	12773 (1%)	12749 (0.9%)	13866 (1%)	(0.9%)
Photo product	8506 (0.9%)	8031 (0.8%)	8501 (0.7%)	7475 (0.5%)	7437 (0.5%)	(0.5%)
Gas container	0[2]	0[2]	585 (0.05%)	2750 (0.2%)	25486 (1.8%)	(1.8%)
Roofing	0[2]	0[2]	6856 (0.5%)	14999 (1.1%)	23374 (1.7%)	0[2]
Solvent	4113 (0.4%)	9637 (0.9%)	8012 (0.6%)	4480 (0.3%)	6735 (0.5%)	(1%)
Fluorescent tube	17760 (1.9%)	18846 (1.8%)	20574 (1.6%)	21870 (1.6%)	24099 (1.7%)	(1.5%)
PC support products, ink cartridge	0[2]	0[2]	5915 (0.5%)	8166 (0.6%)	11649 (0.8%)	0[2]
Miscellaneous	22247 (2.4%)	37050 (3.4%)	26225 (2.1%)	32030 (2.3%)	36959 (2.6%)	(2%)
Total	**933435**	**1069739**	**1255934**	**1389543**	**1398689**	**1537000**

Notes:
1 Since November 1998, only small quantities (less than 30 kg) are accepted
2 Included in miscellaneous

Table B.10.2 Quantities of HHW collected through the SuperDrecksKëscht fir Biirger scheme and according to different systems of collection (t) (MoE 1999)

Collection system	**1993**	**1999**
Mobile collection	363	396
Civic amenity centres	345	882
Specific actions	16	10
Door to door collection	68	110
Total quantities	**792**	**1 398**
Quantity (kg/inh)	**1.9**	**3.2**

Contact

Mr Serge Less - Division des Déchets - Administration de l'Environnement

Mr Thomas Hoffmann – Superdreckskëscht – HHW collection scheme

B.11 NETHERLANDS

Legal and administrative framework

In the Netherlands, separate collection of 'Small Chemical Waste' (KCA) generated by households has been implemented since 1987/88. A Decree on labelling of products susceptible of becoming HHW was introduced in 1994 to identify those household products, which should be collected separately and disposed of as 'small chemical waste'.

A new national waste policy was published in January 2002 and is to be adopted in May 2002. It is documented in the National Waste Management Plan (*Landelijk Afvalbeheersplan, LAP*) (VROM and AOO 2002). One of the objectives of the LAP is the centralisation of waste regulations.

There is a programme for separate collection of HHW *(Gescheiden inzameling van Klein Chemisch Afval' (GIKCA*) (AOO 2000) and guideline for municipalities and waste collectors (*Handreiking voor gemeenten en inzamelaars*) (IPA/AOO 2000).

In the GIKCA programme new targets for the collection of HHW are set. Municipalities have to collect separately 90% of the produced HHW by 2006. Collection methods are not prescribed. In the guideline (IPA/AOO 2000) advices are given concerning collection methods and communication strategies.

Every four years, the Ministry of Environment will publish a new National Waste Management Plan (LAP), including a revised list for HHW if necessary. In 1992, a first HHW list was published; the Yes/No list. Due to improvements of waste disposal sites and waste incinerators the list was subsequently revised and a new list has been in force since January 2001. The screening of the products used four criteria: (a) potential environmental damage, (b) recycling potential, (c) safety risk, and (d) uniformity. Any product that scored on one of the mentioned criteria was added to the new list.

In the Netherlands products belonging to HHW can be identified in two ways: either by being on the HHW list, or by the being marked with the HHW logo shown in Figure B.11.1 below. All products on the HHW list or marked with the logo should be kept separately by the consumers and collected separately by the municipalities. Currently, the list contains the products shown in the Table B.11.1 below. Products recognised by a logo on the packaging are HHW and have to be collected separately. Empty containers of hazardous liquids are to be collected in the residual waste and not separately.

Table B.11.1 The new Dutch HHW list

Category	Products
General	Batteries Energy-saving light bulbs Fluorescent light bulbs Liquid drain cleaner Lamp oil Paraffin Pesticides/insecticides
Medicines etc.	Medicines Mercury thermometers Hypodermic needles
DIY	Paint, varnish, stain, and wood preserving agent Products used in painting, such as turpentine, thinner, paint stripper, brush cleaning agent, brush softening agent, and cleaning spirit Mercury switches (such as non-digital heating thermostats)
Hobbies	Photographic fixer Photographic developer Etching agents such as nitric acid and sulphuric acid Hydrochloric acid
Transport	Batteries Petrol Engine oil, waste oil, and brake fluid Oil filters

Figure B.11.1 HHW logo

Collection and treatment facilities

In the Netherlands, municipalities are responsible for the collection of HHW. A municipal service or a private collector does the actual collection. In general the following collection systems can be distinguished (DSMa 2000):

- HHW collection point – a depot especially designed to handle and store hazardous substances. Consumers can deliver their HHW for free. It is often located at a bulky waste station (civic amenity centre);

- Chemokar – a mobile HHW collection unit, a specially designed truck with the following collection options;

    a) Door to door – the chemokar drives slowly through a district and halts. Consumers can deliver their HHW;

    b) On demand – only those addresses that reported HHW are served;

    c) Stationary – the chemokar stands at fixed stations according to a fixed time table, e.g. ever second Saturday morning at a supermarket;

- Retail take-back system – some HHW products can be collected by retailers. Examples of products: batteries (common), car batteries (common), medicines (not well arranged yet), needles (not well arranged yet), mercury containing light bulbs and tubes (when a new product is bought), paint (needs to be started up).

Most municipalities have a combination of the above mentioned collection systems. Roughly one-third of the HHW is collected via a pick up system and two thirds via a bring-back system (DSMa 2000). CBS (2002) reports however a decline of the quantities collected via a pick up system from almost 40% in the years 1993-1994 to about 20% in 2000 (Figure B.11.2).

The collection and transportation of industrial waste and hazardous waste is not in the responsibility of the municipalities and is only possible via persons and companies that are registered on a nation-wide list. Additionally an authorisation is necessary for certain waste types: used oil, wastes from shipping and small hazardous waste.

Quantities of hazardous household waste

Figure B.11.2 summarises the amounts of HHW in the Netherlands based on published data (IPA/AOO 2000, CBS 1995, 1996, 1997 1998, 1999, 2000, 2001, 2002a 2002b, RIVM/CBS 2001). For the years after the introduction of the Yes/No list, the amount that is not collected separately is indicated as well.

The quantities of HHW collected in the Netherlands have been rather constant since the introduction of the old Yes/No list in 1992, with about 1.6 kg of HHW collected separately per person and per year. Although the results seem to decrease in the most recent years (1999-2000) down to 1.3 kg of HHW per person and per year. The quantities discarded in the residual waste are reported to amount to about 1 kg per person and per year. The target for 2006 of 90% collection of the HHW corresponds with an absolute value of 2.1 kg of HHW collected per person and year (DSMa 2000). The total quantities of HHW collected currently amount to 19,890 tpa (for a population estimated to be about 15.3 millions inhabitants).

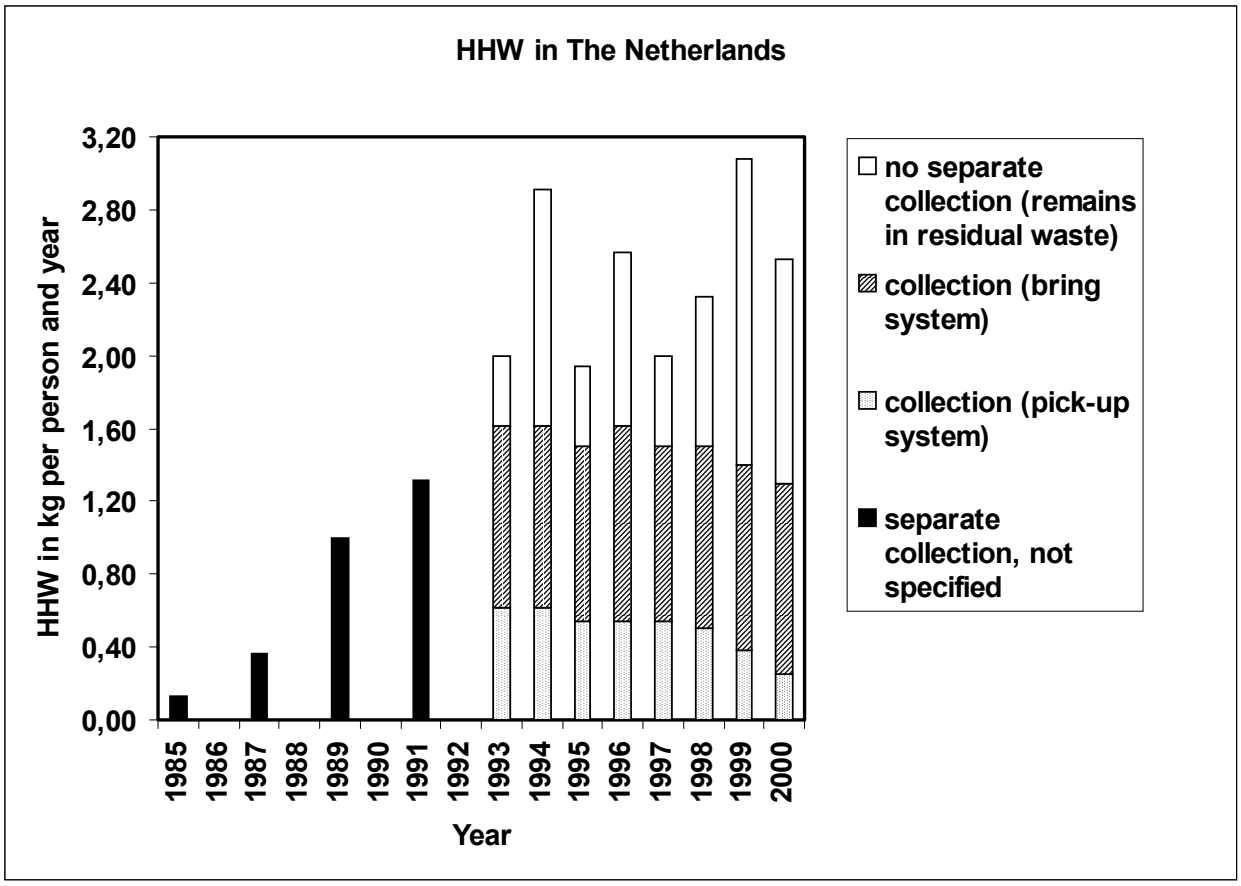

Figure B.11.2 HHW collection in The Netherlands from 1985 to 2000

Batteries

Since 1995 producers and importers of batteries are obliged to assure collection and reuse of their products (Stibat 2002). A part of the collection already takes place through the municipal collection of HHW. To improve the collection results, Stibat (an organisation of producers and importers of batteries) has set up an extra collection structure. Consumers can bring their batteries to retailers, schools etc., from where Stibat takes care of further transport and treatment of the waste batteries.

Also for car batteries there are two collection schemes: through the HHW and through industrial collection (AOO 2000). Most old car batteries are generated in garages and car destruction companies. Consumers can bring their car batteries to garages for free. Private collectors accept car batteries from garages for free as they have a positive value when recovered.

Asbestos

Because of the danger to human health, for asbestos a separate collection structure is in place in the Netherlands. It should be registered as a separate waste stream. It is not unlikely however, that municipalities add the amounts to the HHW collection results.

Composition

The composition of the collected HHW is not well known. The most recent data is from 1993 and is summarised in Figure B.11.3 (Rijpkema and Mulder, 1996). The data indicated that about half of the collected HHW by weight consisted of paint (38%) and waste oil and oil containing products (12%).

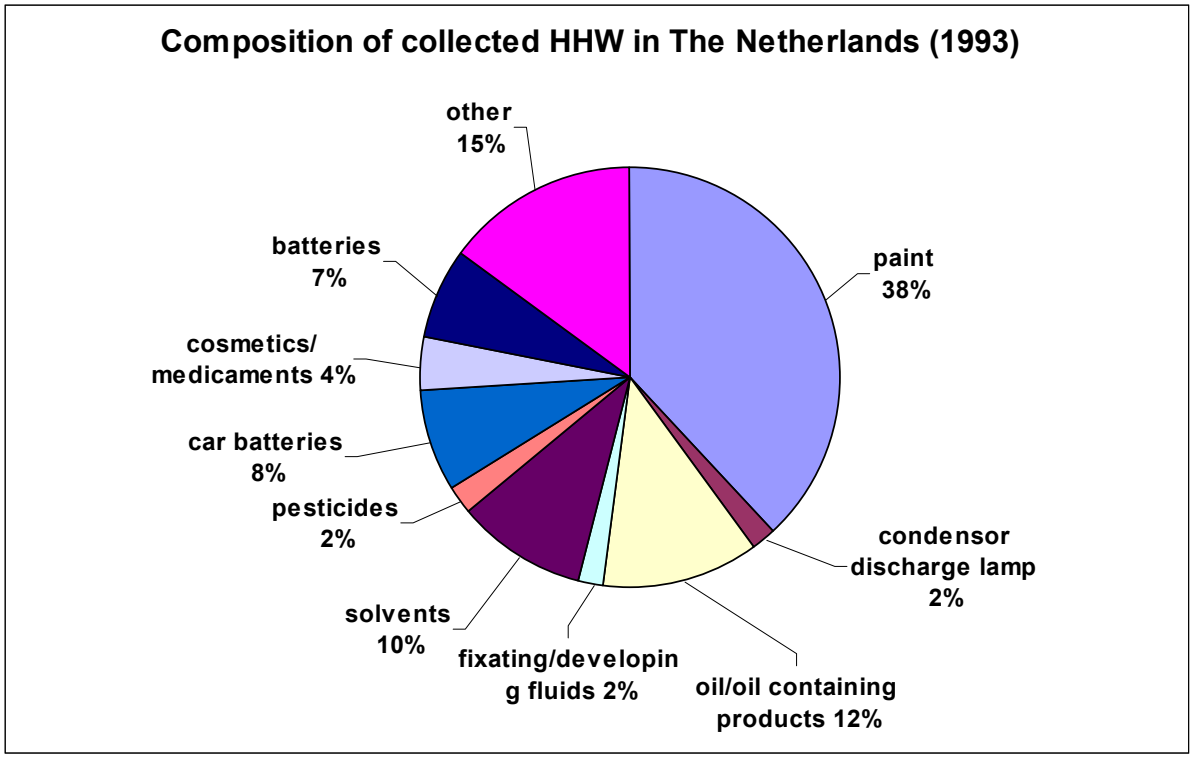

Figure B.11.3 Composition of the collected HHW in the Netherlands

Treatment

Quantitative data on the amounts of HHW that is recycled is not available. Based on the composition of the collected HHW and the reuse potential of the products mentioned above, the potential recycling of the collected HHW can be estimated to be at least 31%. Since the composition data are rather old and based on the old Yes/No list this number can only be considered as a rough estimation.

The batteries and light bulbs collected separately through a retailer bring-back system are being recycled: metal, heavy metals, silver etc. are recovered. According to the Dutch Battery Foundation (Stibat 2002), 71% of the discarded batteries was collected separately and recycled in the year 2000.

The HHW that cannot be recycled are being treated in special high temperature incineration plants (DSMa 2000). The residual waste is also mostly incinerated. Used oils are used as fuel e.g. in cement kilns.

Cost for collection and treatment

The costs for separate collection of HHW in the Netherlands are not well known. For municipalities it is hard to present cost figures for collection and treatment of HHW as often cost accounting is too general. Nevertheless the CBS (2002) presents some figures for the combined costs of collection and treatment/disposal of HHW in the Netherlands (Figure B.11.4) based on surveys of municipalities.

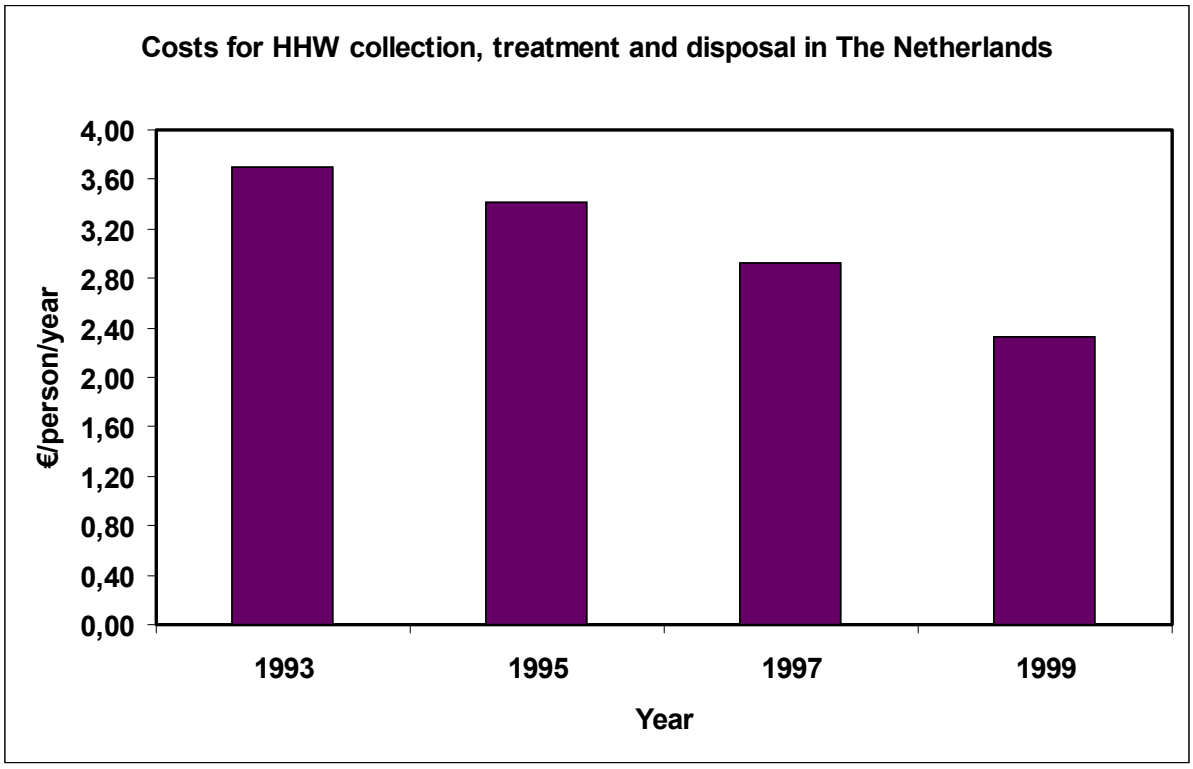

Figure B.11.4 Costs for collection and treatment of HHW in the Netherlands

The combined cost for collection and treatment of HHW is reported to amount to 3.7 euros per person and per year in 1993 down to 2.4 euros per person and per year in 1999. All possible inaccuracies of municipal financial registration will therefore also be present in the given figures. The decline in cost is due to a combination of two factors: the decrease in the amount collected (hence lower costs for treatment) and the tendency that collection of HHW is increasingly done by the bring-back system which is cheaper than a pick-up system.

If we take as the estimate of 1.3 kg of HHW collected per person and per year, the combined costs for HHW management amount to 1.8 euros per kg.

When the 90% target for separate collection of HHW is achieved, total costs will be higher (AOO 2000). Assuming the collection costs to be stable and not incorporating the extra costs for communication campaigns, the treatment/disposal costs will rise to 0.53 € per person and year (corrected for batteries). Thus the total costs will increase to 2.85 € per person and year.

Figures were also provided by waste operators; Sita, one of the market leaders in hazardous waste collection and treatment and DSMa. The figures reported below are summarised in Table B.11.2. Based on 2 pick-up rounds per year for door to door collection of HHW, Sita estimates (Sita 2002) that collection cost amounts to 0.44 Euro/inh/year. DSMa has based its information on a recent tender in a city with 90,000 inhabitants and estimates the cost of collection to be 0.38 Euro/inh/year for a stationary system. The difference between the two sources can be explained from the smaller need of personnel for a stationary system. A realistic estimation for the costs of separate collection system is 0.40 Euro/inh/year.

For the cost of treatment and disposal of HHW, Sita reports an amount of 0.8 Euro/kg while DSMa indicates a range of 0.68 -1.14 Euros/kg, depending on the contract with the municipality. Assuming an average cost of 0.95 Euro/kg, the cost for treatment and disposal of HHW can be estimated at 1.15 Euro/inh/year for the year 2000. This does not include the cost for battery recycling which is provided by the Dutch Battery Foundation at no cost for municipalities (Stibat, 2002).

Table B.11.2 Costs of collection, treatment and disposal of HHW in the Netherlands

	Costs		Reference year
	(€/inh/year)	(€/kg)*	
Kerbside collection (twice yearly)	0.44	0.34	2000
Stationary collection	0.38	0.29	2000
Treatment and disposal	0.8	0.61	2000
Treatment and disposal	0.68-1.15	0.52-0.88	2000
Collection, treatment and disposal	2.4	1.8	1999

* assuming 1.3 kg of HHW per person and per year

The collection costs for a depot system at civic amenity centres are not known, since these depots are combined with a bulky waste station in general, which makes it impossible to account the costs separately. It must be stressed that the pick-up and the depot collection system are generally used complementary. Therefore the costs are supposed to be added up in the total costs. Costs for communication and overhead are assumed not to be part of the total costs.

B.12 PORTUGAL

Legal and administrative Framework

There is no regulations or guidelines dealing with HHW in Portugal. Portugal has lacked proper urban and industrial waste management for many years. The collection and treatment of solid waste has recently improved. A strategic plan was finalised by the government at the end of 1996 with the goal of eliminating all uncontrolled landfill sites, of constructing proper treatment and disposal sites and of promote nation-wide waste recycling by the year 2000. The target was set to provide 98% of the population with waste collection systems by the year 2000.

Investment includes the implementation of separate collection schemes, the construction of sorting and transfer stations, the closing of existing waste dumps and construction of landfill sites and complementary treatment units such as anaerobic digesters and composting plants. Two incinerators are being built in Lisbon (Valorsul) and Oporto (Lipor). One additional incinerator is planned in Madeira, and 51 new landfill sites are planned. It is planned to install 7,500 recycling banks and 200 recycling centres.

The Ministry of the Environment (*Ministerio do Ambiente*) is the government body responsible for Portugal policy on waste. It acts at a central level through the newly formed Wastes Institute (*Instituto Nacional dos Residuos*) and regionally via the five Regional Directorates for the Environment. Also recently created are the General Inspectorates for the Environment *(Inspeccao Geral do Ambiente*) and the Water and the Waste Industry Regulatory Agency *(Institute Regulador das Aguas e Residuos*).

Responsibility for waste collection and treatment lies traditionally with individual municipalities. However, the successful implementation of the plan required the creation of bodies to tackle waste at a regional level. More than forty associations of municipalities are now in place and operational, ten of which have become multi-municipal companies with the state company EGF (*Empresa Geral de Fomento*) as major shareholder (51%), and the regional municipalities share the remaining 49%. EGF has been set up by the Portuguese government to assist associations of municipalities with expertise and funding in establishing waste systems.

Collection and treatment facilities

There is no specific separate collection of HHW in Portugal.

Quantity of Hazardous Household Waste

With a population of around 10 million, Portugal produces about 3,4 million tonnes of municipal solid waste annually. The data on quantity and types of hazardous household waste and associated treatment costs for Portugal is not available. Despite multiple requests no collaboration could be established with the responsible environmental authorities. The only suitable reference was found in a study submitted by the European Topic Centre on Waste and Material Flows (EEA 2001) which reported that in 1998 around 39,000 tonnes of hazardous waste originated from municipal and commercial waste producers.

Contacts

http://www.dra-n.pt/legislacao/Legis_residuos.htm

http://www.incineracao.online.pt/gtresiduos/rportugal.htm

http://www.ccr-n.pt/cse/habquavida/rdtresur.html

http://www.quercus.pt/cir/comunicados/ParecerOCDE.htm

http://www.un.org/esa/agenda21/natlinfo/countr/portugal/natur.htm

B.13 SPAIN

Legal and administrative framework

There are three different laws in Spain related to solid waste management: Law 42/1975 for municipal solid waste (MSW), Law 11/1997 of 24 April of 1997 for packaging and waste packaging and Law 10/1998 of 21 April 1998 for hazardous waste. There is no special national legislation for hazardous household waste and the development of programs for HHW management is limited.

Collection and treatment facilities

In the last few years, different pilot projects have been implemented for separate HHW collection. The most important are the civic amenity centres (*Ecoparques*) and the clean points (*Puntos limpios*). At *the 'Puntos limpios*' selected types of household waste are being returned, but industrial waste is also accepted. Every region has its own administrative plan for household waste and takes care of all their '*Puntos limpios*'.

Quantity of Hazardous Household Waste

Data provided by the Ministry of Environment (MoE 2001) on waste recovered in '*Puntos limpios*' in 1997, expressed in tonnes, is shown in Table B.13.1.

Table B.13.1 Hazardous household waste collected in Spain (MoE 2001)

Region	Number of centres	Metal (tonnes/y)	Disposable batteries (tonnes/y)	Rechargeable batteries (tonnes/y)
Asturias	7	65		525
Cantabria	1	40	11	604
Castilla y Leon	2	59	2	795
Cataluna	21	1030		
Comunidad Valenciana	3	34	1	165
Madrid	11	400	136	1369
Pais Vasco	6	334		211
Total	**51**	**1,962**	**150**	**3,669**

As a particular example the cases of the autonomic community of Madrid and Seville can be analysed in more details.

Madrid

According to the data gathered in the Autonomic Plan of Management of MSW of the Community of Madrid, the population of the community in 1995 was 5.2 million inhabitants distributed in 5 territorial units of management and with a total production of 2 million tonnes of MSW a year.

Between 8% and 10% of these wastes were hazardous material including oils, fluorescent tubes, batteries, medicines, solvents, paints, pesticides, fertilisers. A small part of these dangerous wastes from domestic origin were collected separately at 'Clean points' and containers for collection of batteries, but the majority was thrown away with general household waste. There are limitations on the types and quantities of hazardous materials accepted at the clean points (Table B.13.2) (Lopez 2001). There was no explanation regarding the very high percentage of HHW in MSW in the Madrid municipality compared with the normally referred percentage of 1%.

Table B.13.2 Types of household hazardous waste accepted at 'Clean points' in the community of Madrid (Municipality of Madrid, 2001)

Waste category	Maximum amount accepted per person
Motor oil	10 l
Vegetal oil	10 l
Aerosol cans	10 units
Accumulators	2 units
Household electrics	2 units
Refrigerators	1 unit
Fluorescent bulbs	3 units
Pharmaceuticals	5 Kg
Computers	1 unit
Batteries	No data
Paint	5 Kg
X-rays	No data
Thermometers	2 units

Seville

The Association of the Alcores in Seville (Andalusia) may also serve as an example of local management, where the collection and recycling of diverse waste in 6 districts of the region Seville are managed (Table B.13.3) (Alcores, 2001).

Table B.13.3 Potential household hazardous waste in the district of the Association of the Alcores in Seville (in percent)

Type	1997	1998	1999	2000
Batteries	0.04	0.04	0.05	0.04
Electronic scrap iron	0.22	0.18	0.95	0.69
Pharmaceuticals	0.05	0.36	0.91	0.37
Non-ferrous metals	0.48	0.54	0.57	0.22

More information in terms of quantities of hazardous household waste and treatment costs in Spain was not available. In spite of multiple requests, there was no collaboration with the responsible environmental authorities. The request for information to the German-Spanish Chamber of Industry and Commerce was also not successful.

Contacts

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B.14 SWEDEN

Legal and administrative Framework

A completely new Waste Collection and Disposal Ordinance SFS 1998:902 was adopted in 1998 replacing the Waste Collection and Disposal Act which has ceased to apply. The disposal of HHW is regulated by the Waste Ordinance which gives specific prescriptions for certain type of waste.

The definition of HHW can be defined by local regulation but in practice it covers the following categories:

- Waste oils
- Solvent waste
- Paint and varnish waste
- Glue waste
- Strongly acidic or alkaline waste
- Waste containing cadmium
- Waste containing mercury
- Waste containing antimony, arsenic, barium, beryllium, lead, cobalt, copper, chromium, nickel, selenium, silver, thallium, tin, vanadium or zinc
- Waste containing cyanide
- Waste containing PCBs
- Pesticide waste
- Laboratory waste

Parliament and the government decided in spring 1999 on a national strategy for waste management, which serves as guidance for the municipalities in their work with the waste plans.

Different Ordinances deal with specific waste streams to be collected separately such as for batteries and for waste oils. The Battery Ordinance, SFS 1997:645 regulates labelling, collection, and reporting obligations for batteries. The Waste Oil Ordinance, SFS 1993:1268 contains a definition of waste oil and regulates how it is handled.

Each municipality decides how waste management is to be organised within its own boundaries and also sets the charge that is to be paid by households for waste management. The MSW collection is organised by private contractors (60 per cent of waste) in dustbins and sacks on behalf of municipalities or by the municipalities themselves as in-house service or in company form. The disposal of HHW (collection and treatment) is also the responsibility of each municipality and covers also the collection of CFCs from refrigerators and the collection of small batteries. The municipalities also collect electronic waste and sent them for dismantling to specialised companies.

Collection and treatment facilities

In Sweden, the most common system for HHW collection is free deposit from the public to ‘environmental stations’. These are usually situated at waste disposal sites and manned civic amenity centres, but they can also be located at filling stations, country shops, and shopping malls. There are other systems in place to collect HHW including special boxes which can be

collected or delivered at special sites and 'environmental lorries' which operates at specific time and locations where citizens can deliver their HHW.

Quantities of hazardous household waste

In 1999 the total quantity of household waste amounted to 3,794,000 tonnes (3,865,000 tonnes in 1998) (RVF 2000). The main disposal route for MSW is incineration (38%), recycling (29%), landfilling (24%) and biological treatment (8%).

Spot checks show that the proportion of hazardous household waste ending up in the dustbins is small. In 2000, spot checks were to be conducted in a project covering several municipalities (RVF 2000). No results were available to date.

There is no detailed information on the amount of HHW in Sweden, however it is estimated that, on average, 2 kg of hazardous waste per person is collected separately (RVF 2000). Assuming a population of about 9 million, this amounts to roughly 20,000 tonnes of HHW collected annually from households (0.5% of total municipal solid waste) including car batteries and other batteries (RVF 2000).

A nation-wide information campaign about HHW was started in spring 2000 by RVF (the Swedish Association of Waste Management), together with authorities and other organisations. The aim is to inform households, via the municipalities, about what hazardous waste is and where it can be handed in.

In some areas, for example Västerås, advice is also published on the internet by the Environmental Protection Bureau on what waste is hazardous, how it should be handled, where it should be disposed and how the waste is recycled or neutralised.

Households can hand in their hazardous waste free of charge. The cost of collection and treatment of HHW is included in the municipal refuse tax paid by citizens. In 2000, on average the tax per household is 155 euros per annum (1,400 SEF/y) (including 20% VAT) for a weekly collection.

Batteries

In Sweden, 90 million batteries are sold each year. Most are "green" batteries, which means they are saline or alkaline batteries, but 30% however, are a threat to the environment (Table B.14.1) such as lead containing batteries, small batteries used in, for example, watches, contain mercury or rechargeable batteries of which many contain cadmium.

The sale of batteries containing mercuric oxide has, in principle, ceased in Sweden. The selling of Ni/Cd batteries, however, has decreased fast in Sweden due to new and more efficient nickel-metal hydride batteries or lithium-ion batteries. The government has stated that the use of lead and cadmium batteries should cease within the next 10 to 15 years. The regulation also states that stores selling batteries should inform the customer about where used batteries can be delivered. A national information campaign "Battery Collection" has been running for a few years.

All batteries have to be collected, and the municipalities are responsible for having specific collection systems for them, as stated in Regulation (1997:645). The set target for collection of accumulators/car batteries containing lead is 95 percent and for nickel-cadmium is 90 percent. The collection of lead batteries is administered by a company specially formed for this

purpose, namely “Returbatt AB”, which is financed by charges levied on lead batteries. Hazardous batteries (batteries containing lead, mercury and Ni/Cd) are sent for special treatment. Discarded batteries can be handed in at civic amenity centres, recycling stations, environmental stations and in many shops that sell batteries. The levels of collection achieved in 1998 are presented in Table B.14.1.

Table B.14.1 Quantities of hazardous batteries sold and collected in Sweden in 1998 (SNV, Returbat, SCB and Batteriforeningen)

Type	Battery sold (tonnes)	Battery collected (tonnes)	Battery collected/ Battery sold (tonnes)
Small size mercury (Hg)	18	11	61 %
Nickel cadmium (NiCd)	480	144	30 %*
Lead (Pb)	30,000	28,500	95 %
Total	**30,498**	**28,655**	

* The collection rate for NiCd batteries is not reliable as it is hard to compare figures for rechargeable batteries of quantities sold during one year with the one collected at the same year.

Fridges and Freezers

It is also the responsibility of the municipality to ensure that discarded refrigerators and freezers are collected separately for treatment. There are around 275,000 refrigerators and freezers discarded annually (RVF 2000).

Electric and electronic waste

The municipalities are responsible for the collection of household electronic waste. The most common method in Sweden is deposit at manned civic amenity centres. From 1997 to 1999 the quantity of WEEE collected from households in Sweden doubled. In 1999 the municipalities received 10,800 tonnes of WEEE from households. This corresponds to 1.2 kg of collected material per inhabitant.

New rules have been approved by the government which have entered into force on 1 July 2001 putting more responsibility on the producers for taking care of electric and electronic waste to allow consumers to return discarded appliances free of charge when they buy new ones. The new rules also give greater responsibility for the municipalities for increased separate collection from households. The new rules will affect more kinds of electric and electronic waste than what is handled today. They will include, for example, products used in the household: cookers, washing machines, dishwashers, hand tools, garden tools, IT equipment, telecom equipment, TV, audio and video equipment, cameras, clocks, games, toys, lights; they will not include refrigerators and freezers.

Pesticides

The use of pesticides in private gardens in Sweden is low due to the cold climate and information from authorities about other alternatives. The National Chemicals Inspectorate is even discussing a total ban on the use of weed-killers in private gardens. The total amount of pesticides used in private gardens is 33 gram of active substance per person per year.

Regulation (1998:947) concerning pesticides stipulates that any pesticides/biocides used in individual households must belong to category 3 stipulated by the National Chemicals Inspectorate and must be applied according to instructions. Biocides/pesticides not used must be transported to, and handled by, an approved organisation.

Contacts

RVF - Swedish Association of Waste Management

B.15 UNITED KINGDOM

Legal and administrative framework

In the UK, waste management is regulated under the Environmental Protection Act 1990 and Waste Management Regulations 1994. Hazardous household waste, with the exception of asbestos, are not considered as 'special' under the 1996 Special Waste Regulations and thus householders have no legal responsibility to dispose of HHW in a certain way. However, in the case of certain products, such as registered pesticides and oil, disposal of these products by householders by methods which would contaminate watercourses or the environment is a criminal offence. The product label provides specific information on disposal.

Special Waste Regulations 1996 as amended however impinge on the management of HHW especially on collection schemes. The HHW collection schemes may be subject to legislation if there is a collection round and HHW is mixed with waste from other sources.

An industry-led forum, the National Household Hazardous Waste Forum, has defined HHW as 'any material discarded by a household which is difficult to dispose of, or which puts human health or the environment at risk because of its chemical or biological nature'. Four main types of HHW have been identified:

- Decorative paints, coatings and related products;
- Garden chemicals and pet-care products;
- Motoring products;
- Household chemicals, materials and appliances.

Collection and treatment facilities for HHW

Local authorities are responsible for organising collection and disposal of MSW. Collection and treatment is operating by private companies. There is no national scheme for separate collection of HHW. Each local authority has its own arrangement. Separate collection of HHW is organised under different systems either through ad hoc house collection for oils, fridge and household clinical waste, or through delivery to chemical banks at some civic amenity (CA) sites for waste oils, asbestos sheeting (in small volumes), car batteries, paints, chemicals, and fluorescent tubes, or some bring-back facilities in some shops.

When delivered to the civic amenity sites these wastes are stored in a special container or locked cupboard. These sites have to be manned by staff trained to handle such wastes. The CA licence will require a working plan to be approved by the Environment Agency in England and Wales and by the Scottish Environmental Protection Agency (SEPA) in Scotland. The working plan will detail procedures to store, handle and dispose of hazardous wastes on the site, and the Environment Agency will conduct site inspections to ensure that such procedures are complied with.

The majority of CA sites have oil bank facilities. It is reported that about 1,610 CA sites in the UK accept engine oil (DETR 1999). Oil recovery is well established and the volumes of oils collected are increasing. Many local authorities also work in partnership with other organisation such as shops and local garages. In addition, there are 65 oil collecting banks in

the UK at the cost of 2,400 euros per bank. Each bank has a capacity of 2,700 litres and is emptied on average once a month.

There are drop-off facilities for lead-acid batteries at most CA sites and some sites also offer facilities for Ni-Cd batteries which are shipped for reprocessing in France. No figures were available.

None of the CA sites offer specialised facilities for fluorescent tubes or other mercury containing waste but quantities being dropped off by the public are increasing. These wastes are treated with other hazardous chemicals.

Enclosed skips for cement bonded asbestos are available at CA sites and the sites accepting asbestos have to have a specific site license which is more expensive.

Unused paints is collected at CA sites for reuse by community groups through the Re>Paint scheme. If there is no such a scheme, unused paint or unsuitable paints for redistribution is either disposed of with the general refuse or placed in the special container.

There are collection rounds operated by waste collection authorities for sharps and syringes from households (i.e. diabetics). There are about 370,000 people needing insulin in the UK. They generate potentially up to 1.1 million syringes a day (3 injections a day).

Over 800 million aerosols are consumed per year in the UK (about 35 per household). There is no separate scheme for waste aerosols from householders. The Waste authorities do not encourage people to dispose of aerosols through the dry recyclable collection.

The majority of waste collection authorities offer a collection service for bulky items including fridges and freezers. There are schemes run by charity collecting unwanted items and whenever possible refurbishing them for low-income households.

There is no specialist take back scheme for photochemicals from households.

Treatment

HHW are bulked with industrial wastes before being disposed of or treated. Pesticides are incinerated. Solvents are used to produce a secondary fuel for cement industry and paints are mostly landfilled. Oil is used as fuel. Lead acid batteries are shredded and sent for recycling. NiCd batteries are sent to France for recycling.

To overcome some of problems associated with HHW in general MSW, a number of initiatives have and/or are being developed in the UK:

- The National Household Hazardous Waste Forum, formed in 1993 is an industry-led initiative. The forum aims to find practical solutions to the many problems associated with the collection, recycling and safe disposal of HHW. To promote consistent advice the Forum has research teams and produced a Good Practice Guide.

- Re>Paint scheme was set up in 1992 locally and is now involving 90 schemes across the UK. The scheme redistribute free of charge unused paint (see case study in Section 3).

- The Oil Care Campaign (OCC) set up in 1995 is a national information and advise campaign for DIY motorists to use a network of oil recycling banks at local civic amenity

sites. It is sponsored by the Environment Agency and SEPA and oil banks are financed by some retailer shops such as Halfords.

- In 2001, Do It Yourselves (DIY) main stores in the UK have published their strategy to improve the management of toxic compounds in both branded and non-branded products such as garden and houseplant chemicals; paints and related products; ceramic glazes; batteries, electrical appliances and metal coatings; CCA wood treatment; polycarbonates, epoxy resins and plastic water pipes (bisphenol A), PVC products (some phthalate softeners, heavy metal stabilisers and dioxins/furans if combusted).

Cost of collection and treatment

Cost estimates for HHW management were obtained from some waste operators. These figures are presented below and summarised in Table B.15.1. It is reported that the annual budget for a monthly HHW collection and disposal from 250,000 households (622,000 inhabitants) ranged between 9,600 to 11,200 euros. However, the monthly collection covered only between 8 to 10 households, which is equivalent to 80 – 93 euros per household per year. There were no estimates of the quantities of HHW collected. If we assumed 5 kg per household and per year, the costs for collection and treatment amount to 16 to 19 euro per kg.

Anther source reported that the costs for a collection and treatment of HHW from 10 households ranged between 64 and 96 euros per household. If we estimate that a maximum 5 kg of HHW is collected annually per household, the costs for collection amount to 12.8 – 19.2 euros per kg of HHW.

The cost for HHW collection on request (call-in from household for special one-off collections such as garden pesticides, asbestos or photographic materials) was reported to amount to a minimum of 608 euro for one household increasing to 928 euros for 5 households and 2.24 euros per kg for disposal (Rushmoor web site). Assuming a 5 kg HHW collected per household, the costs for collection would range between 37 and 121.6 euros per kg depending on the number of sites visited. This service is very expensive and is rarely used.

Another waste operator reported that the cost for collecting and treating HHW from a civic amenity site would amount to 2.9 euros per kg.

Table B.15.1 Cost estimates for HHW collection and disposal in the UK

Collection scheme	Collection cost		Treatment/disposal cost	Total
	Euro/household	Euro/kg*	Euro/kg	Euro/kg
Door to door	80-93	16-19	NI	
Door to door	64-96	12.8-19.2	NI	
Call-in	185-608	37- 121.6	2.4	39.4-124
Civic amenity	NI	NI	NI	2.9

* assuming 5kg of HHW collected per household

A study was carried out in 1999 for the Department of Environment (DETR 1999) to evaluate the cost implications of implementing a nation-wide separate collection of HHW in the UK. It reported that the set-up costs for schemes such as door-to-door collection are much greater than for bring schemes at CA or bring back schemes at retailers. The annual costs for operating a door to door collection would be much higher than for the other systems. The

reasons are that for CA sites, the infrastructure is already in place, minimal additional staff training and site licensing are required. The costs are given in Table B.15.2 for three different groups of HHW;

- Group A: bleaches, batteries, solvents, fluorescent tubes, waste oils, pesticides, asbestos
- Group B: paints , varnishes, acids and alkalis, used syringes and biocides
- Group C: aerosols, photochemicals, CFC equipment, PCB transformers and electronic equipment.

Table B.15.2 Costs (x10^6 euros) of collection, disposal and set-up for HHW in the UK (DETR 1999)

Collection scheme	Group A		Group A+B		Group A+B+C	
	C/D	Set-up	C/D	Set-up	C/D	Set-up
Door-to-door	10.5-24.3	84.2-186.4	23.5-50.7	84.2-186.4	50.8-115.2	84.2-186.4
Bring	2.7-9.3	12-50.7	6.1-18.6	12-50.7	13.2-43.7	12-50.7
Take-back	1.4-4.6	45.3-93.4	3-9.3	45.3-93.4	6.6-21.8	45.3-93.4

Note: C/D cost for collection and disposal

Quantities of hazardous household waste

In England and Wales, around 28 million tonnes of MSW are produced each year, of which 81% are landfilled, 10% recycled and 8% incinerated. There seems to be an increased awareness in the public for disposing of HHW separately and the quantities of HHW brought to civic amenity centres are increasing (no figures available). However most HHW still enter the general domestic waste stream.

The national estimate for hazardous municipal waste and similar commercial and institutional waste under category 20 in the EWC arising in England and Wales is reported to amount to about 65,000 tpa (DEFRA 2000) equivalent to 1.2 kg/inh/y and representing about 0.2% of total MSW arising. This includes equipment containing CFC.

Other estimates for HHW quantities arising in MSW for England and Wales amount to 250,000 tpa (Table B.15.3 below) (DETR 1999), equivalent to 0.9% of MSW arising. The estimate is based on gross annual tonnage of waste arising in refuse collection vehicle, civic amenity sites, bulky waste and recycled waste and multiplying these figures by the estimated fraction of individual HHW components (Table B.15.4). This includes aerosols (26%), paints (17%), oils (15%), batteries (14%), bleaches (10%) and asbestos (7%), biocides (6%). In addition, it was estimated that 208,000 tonnes of electronic and electrical equipment waste and 164,000 tonnes of CFC containing waste are arising in MSW.

Table B.15.3 Estimates (tonnes) of HHW arising in England and Wales (DETR 1999)

Waste category	Kerbside collection	Civic amenity	Bulky collected	Separately collected	Total
Oils	8,200	29400	240	85	37925
Solvents	6,068	420	120	85	6693
Pesticides	820	2100	24	85	3029
Lead acid batteries	0	21000	600	0	21600
Other batteries	14,760	0	0	425	15185
Mercury containing waste	164	0	0	17	181
Bleaches	19,680	4620	24	850	25174
Asbestos	164	16800	1080	170	18214
Paints	14,760	4200	120	23800	42880
Acids/alkalis	0	42	24	0	66
Biocides	13,120	1680	24	340	15164
Used syringes	328	0	24	0	352
Photochemicals	164	84	24	0	272
Aerosols	37,720	84	24	27200	65028
Total	**115,948**	**80,472**	**2,352**	**53,057**	**251,829**

Table B.15.4 Percentage composition of HHW categories in the different MSW waste streams (DETR 1999)

Category	Kerbside collection (%)	Civic amenity (%)	Bulky collected (%)	Separately collected (%)
Oils	0.05	0.7	0.02	0.005
Solvents	0.037	0.01	0.01	0.005
Pesticides	0.005	0.05	0.002	0.005
Lead acid batteries	0	0.5	0.05	0
Other batteries	0.09	0	0	0.025
Mercury containing waste	0.001	0	0	0.001
Bleaches	0.12	0.11	0.002	0.05
Asbestos	0.001	0.4	0.09	0.01
Paints	0.09	0.1	0.01	1.4
Acids/alkalis	0	0.001	0.002	0
Biocides	0.08	0.04	0.002	0.02
Used syringes	0.002	0	0.002	0
Photochemicals	0.001	0.002	0.002	0
Aerosols	0.23	0.002	0.002	1.6
CFC containing equipment	0	3.85	0.195	0
WEEE	0.28	2.85	3.55	0
Total	**0.99**	**8.62**	**3.94**	**3.12**

The estimated quantities and treatment of specific HHW categories are described below:

Batteries

Approximately 10 million lead acid automotive batteries are sold in the UK each year and a similar number are scrapped. In 1997/98 140,000 tonnes of lead acid batteries were consigned for recycling in England and Wales, rising to 144, 000 tonnes in 1998/99. There is a 16 euro consignment fee applied on these wastes (DEFRA 2000).

An estimated 600 million consumer batteries (zinc-carbon, alkaline manganese, nickel-cadmium and nickel-metal hydride), representing between 20 and 40,000 tonnes are thrown away each year in the UK (EA 2000).

At present only nickel-cadmium consumer batteries are collected in any numbers, (primarily from industrial and commercial business) and shipped to France for processing through an industry led programme, REBAT. The industry is currently focusing on collection schemes from large users, for example the police, ambulance and coast guards. Some trial schemes for consumer Ni/Cd collections have been undertaken, however only the London Borough of Sutton has a permanent scheme with collection points in public buildings.

Fluorescent tubes:

Sale of the traditional fluorescent lamps for domestic have fallen over the last couple of years, however there has been a significant increase in the sale of halogen and compact fluorescent lamps (CFL) also contain mercury. The estimated sales in the UK for 1999 of fluorescent tubes (including straight lamps and low energy lights) for the domestic market (Table B.15.5) amounted to 11 million units (Lighting Association 2000), compared with a total of 96.5 million units reported in 1994 for the whole of the UK (SWAP 1995).

Table B.15.5 UK sales (in million units) of lamps for the domestic market (1999)

Lamp	Sale (million units)
Standard Fluorescent	2
Halogen	4
CFL	5
Total	11

Ref: Lighting Association, Domestic lighting, Market Intelligence December 1999/January 2000

The mass of mercury used in domestic lighting lamps has decreased considerably with technological advances over the last two decades. The average mass of mercury in fluorescent lamps sold is estimated to be 20 mg/bulb.

It is estimated that, in the UK, the disposal of fluorescent tubes releases 2 tonnes of mercury into the environment, of which between 54 kg and 135 kg come from household sources. At present the packaging of fluorescent tubes and low energy light bulbs does not include any warning of the presence of mercury or advice on handling spent tubes and disposal.

There is only one plant dedicated to mercury recycling from fluorescent tubes in the UK. This plant uses a system, which recovers metallic mercury to a high degree of purity. The glass and metal components of each lamp have a low enough mercury contamination to allow them to be recycled if markets exist.

Paints and varnishes

Approximately 150 million litres of decorative coatings are sold in the UK for domestic use each year with, an estimated 25 % (37.5 million litres) remaining unused, see Table B.15.6. Surveys in the UK have revealed that on average, 17 paint containers were present in households. In addition to the 40 million litres being added to the stockpile each year, it is estimated that over 100 million litres are stored in shed and garages. Decorative coatings can be stored for lengthy periods of time, but ultimately the majority of the surplus is discarded, usually during periodic clear-outs, when moving property or during house clearances.

Table B.15.6 Volumes of coatings sold and unused in the UK

Sector	Coating Sales	Unused material	
	million litres	% of sales	million litres
DIY	150	25	37.5
Trade	160	1.5	2.5

In the UK, the total amount of VOCs emitted from man-made sources is reported to be 3 million tonnes of which 70,000 tonnes comes from the manufacture and use of paints. Solvent-based paints constituting only 25% of the UK market account for 80% of the total VOC emissions coming from decorative paints (Table B.15.7).

A legislative framework for the progressive reduction of VOC emissions is being promoted, however the industry has adopted an environmental policy aimed at achieving further reductions in the VOC content of products voluntarily. Part of the policy introduces a labelling system to inform users of the VOC content of each product, using a 5 band classification scheme; minimal, low, medium, high, and very high.

Table B.15.7 VOC content and proportion of the decorative sector

Product Category	Market split %	Typical VOC range %	Contribution to decorative coating VOCs %
Water-borne emulsions (walls/ceilings)[1]	70	0-5	16
Water-borne Trim (doors/windows)[2]	5	5-10	4
Organic Solvent Borne Trim (Doors/windows)[3]	25	30-40	80

Notes [1] emulsion paints, matts, vinyl silks, latex paints
[2] acrylate varnishes/primers, water-borne primers, water-borne top coats
[3] primers, undercoats, gloss topcoats, varnishes

Garden Chemicals

The quantities of active ingredients sold for domestic used in the UK for 1999 and 2000 are presented in Table B.15.8. Waste garden chemicals are not usually suitable for recycling and therefore, in general, schemes have focused on a reduction in use and correct disposal. Advice to householders on the management of garden chemicals not suitable for use is that small quantities (i.e. less than 125 ml) can be diluted and sprayed onto bare soil or gravel paths and drives. Anyone having large volumes of garden chemicals to dispose off is advised to contact their local authority, which may have a special collection service or storage facility at a civic amenity site.

Table B.15.8 UK sales of active ingredients for domestic pest control

	1999 (t)	**2000 (t)**
Herbicides	783.5	865.9
Fungicides	15.8	12.2
Insecticides	121.8	2730.7
Ferrous sulphate based products	1359.1	512.6

Motor oil and related products

It has been estimated that 7 million car owners (18%) service their own vehicle in the UK. There were about 49,700 tonnes per year (1996 basis) of motor oils sold via retailers to DIY motorists in the UK. It was calculated that 44% was lost from leakage and burnt in ill-maintained vehicles (NHHWF 2002). It is estimated that in the UK, 1,100 tonnes of oil is lost in spent oil filters which are either landfilled or incinerated along with other household waste. Only a third (about 16,500 tonnes) of oils is reported to be recovered.

WEEE

It is estimated that around 1 million tonne of WEEE are discarded in the UK annually (DEFRA 2002) increasing to 1.2 million tonnes by 2005. Collection, recovery and recycling is being developed such as a take-back system for mobile phone. In 1998, the electronics industry estimated that separate collection and reprocessing of WEEEs would cost up to 3.2 billion euros. The retailers estimated that this would cost them an additional 800 millions euros to set up take back schemes. The DTI estimated in 2000 that treatment and recovery costs would amount to 864 millions euros per annum. These figures were revised in March 2002 to range between 305 and 625 millions euros per annum. About 70% of these costs relate to treatment and disposal will have to be covered by producers and the remainder will be incurred by retailers (ENDS 2002). It is estimated that between 133,000 and 339,000 tonnes of WEEE could be diverted from landfill in 2005.

Contacts

National HHW Forum web site (www.nhhwf.org.uk)

Rushmoor web site: www.rushmoor.gov.uk

Mr Patrick Coulter – Head of Waste Management Unit - Oxford County Council

Jonathan Harris – Technical operator – Grundon – waste operator

Dr Elaine Kerrell – Save Waste and Prosper Ltd – SWAP

Mark Gregory – Re>Paint Project co-ordinator - Save Waste and Prosper Ltd – SWAP

Rob James – General Manager of Cleanaway Ltd – Waste operator

Neil Barnet – Shanks Chemical Services

John Wright – Section head on Safety, Health and Environment Activities - ICI paints

B.16 HUNGARY

Legislative and regulatory framework

Hungary has made significant progress in the area of environmental legislation. The publication of the Hungarian Act XLIII (1. 2000.) on Waste Management entered into force on the 1 January 2001. The Act implements EC Directives regarding waste such as 75/442/EC Waste Framework Directive modified by the 91/156/EC Directive. A Ministerial Decree on the list of wastes was issued which has entered into force in January 2002.

The 102/1996 (VII. 12.) Government Order regulates hazardous wastes. This regulation, however, does not apply to household hazardous waste. There is no individual legislation for the collection and treatment of hazardous wastes produced by households. The responsibility for treatment of municipal wastes lies with the municipality.

There is a product charge on products such as packaging, refrigerators, car tyres and batteries, lubricating oils which was introduced by the LIII/1995 Law. The charge is to reduce the pollution due to these products and to establish funds for the reduction and prevention of their impact (Commission 2001).

Collection and treatment

Nearly 4.3 million t of municipal solid waste is generated in Hungary every year. Around 57% (2.5 million t) is produced from households, 20% is produced by institutes (e.g. hospitals) and 23 % is waste of other origins.

Seventy five percent of the municipal waste, that is about 3.2 million tonnes of waste is landfilled while the remaining part, about 1.1 million tonne is incinerated or disposed of by other ways. Only 30% of the about 2,700 municipal waste dumping sites fulfil more or less the requirements of the legislation; the number of illegal and legal waste dumping sites is very high. There is limited separate waste collection for recyclable and biodegradable fraction.

There is currently a large investment programme for improving waste management systems in Hungary partly funded by ISPA which will allow for better disposal conditions and separate collection and treatment of the recycling fractions mainly paper, glass and metals. Four modern regional landfills serving 51 municipalities were established in 2000. There are plans to establish additional waste amenity sites, which would give a possibility to create permanent collecting sites for all types of waste. There currently 98 waste yards in operation and 69 have authorisation to collect hazardous waste.

The HHW fraction is estimated to amount to 17,000 tonnes per year, representing 0.7% of household waste (Table B.16.1). There is no national scheme for separate collection of HHW but there are some local initiatives in place. In Budapest and some other major cities, HHW such as fluorescent tubes, pesticides, solvents are collected from the population occasionally through mobile truck; the time and frequency of it depending on the agreement between the municipality and the authorised waste collecting company. There is a well-established national network for waste oil and car batteries collection since the introduction of the product charge (see below). There are hazardous waste landfills and incinerators as well as small adequately built mono landfills which can receive hazardous waste.

Batteries

The quantities of lead accumulators discarded per annum in Hungary are estimated to have increased from 11,086 tonnes to 16,240 tonnes between 1992 and 1997. It is estimated that about 3,000 to 4,000 dry batteries are discarded annually. The legal dry batteries do not contain mercury since 1994. However, there are 20 to 40% of total dry batteries which are imported illegally from NIS countries and China.

A product charge was introduced on car batteries/accumulators in 1996. The charge was 38 HUF/kg in 1996 and 1997 and 41 HUF/kg in 1998. Two rates were then introduced to distinguish between electrolytes and others. The rates applied in 2000 were 50 HUF/kg and 70 HUF/kg respectively (Commission 2001).

There is no product charge on dry batteries. Until 1998, the Ministry of Environment provided financial support for collection of dry batteries in schools, municipalities, and institutions. About 21% of discarded batteries were collected through that scheme. The Ministry support ended in 1999. There are no companies which can recycled these batteries in Hungary. They have to be disposed in hazardous landfill sites or sent abroad for treatment.

There are plans to organised similar system for expired drugs.

Table B.16.1 Household wastes category in Hungary (1998-basis)

Component	**Quantity**	
	(t/year)	**(%)**
Paper	411,768	16,8
Plastic	127,452	5,2
Textile	95,589	3,9
Glass	90,687	3,7
Metal	85,785	3,5
Organic	919,125	37,5
Inorganic	703,437	28,7
Hazardous (also xenobiotics)	17,157	0,7
Total	**2,451,000**	**100,00**

Contacts

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B.17 ROMANIA

Legal and regulatory framework

Romania is also in the progress of accessing the Union. On waste management, limited progress has been achieved in 2000 in the legislative field (Progress Report November 2001).

An number of regulations have been issued dealing with waste management such as:

- Government of Romania: 78/2000 Government Order of Urgency on Waste Management;
- 155/1999 Decree of Government on introduction of waste management registration, and on the European Catalogue of Wastes;
- Government of Romania: 16/2001 Government Order of Urgency on the Management of Reusable Wastes, etc.

There are also regulations in preparation on waste incineration and landfilling. There is however no specific regulation on hazardous household waste.

Collection and treatment management

There are no official data on quantities of HHW. Generally there is no separate waste collection, the hazardous and non-hazardous wastes are collected and treated together.

The composition of paints and colouring materials is not indicated in their packaging.

The mercury content of metals (neon-tubes), the Cd/Pb content of batteries is not known.

The PCB, PCT content of oil-wastes (motor-oil, lubrication oil, grease) is not known.

The situation is the same for pesticides (chemicals used in the garden and in the household), as well as for solvents – chlorinated solvents, degreasers, sealing-compounds, stain-removers, and leather tanning compounds.

Contacts

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