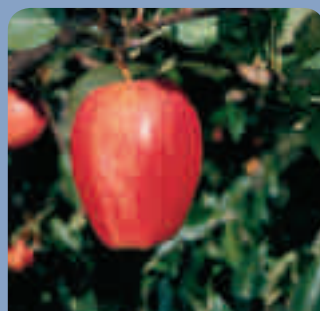


A Strategy for Sustainable Waste Management

Sweden's Waste Plan



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Preface

On 18 December 2003 the Swedish Government instructed the Environmental Protection Agency to draw up a national waste plan.

The Swedish EPA proposes that the plan be renewed by the end of 2010, since the new plan will then be able to incorporate new national waste statistics and revised environmental objectives.

While drafting this report the authors have engaged in a dialogue with representatives from public agencies, trade associations and operators. The Agency has referred an early draft of the plan to those concerned for consultative purposes. The current version of Part 2 has been referred to the Waste Council. Part 1 has been presented orally and discussed on two occasions at meetings of the Waste Council. It will be possible to take additional comments on the plan into account when it is revised in 1 – 2 years' time.

The plan has been prepared at the Swedish Environmental Protection Agency. Editorial changes have been made following decision and submission of the plan on 30 September.

Stockholm, September 2005
Swedish Environmental Protection Agency

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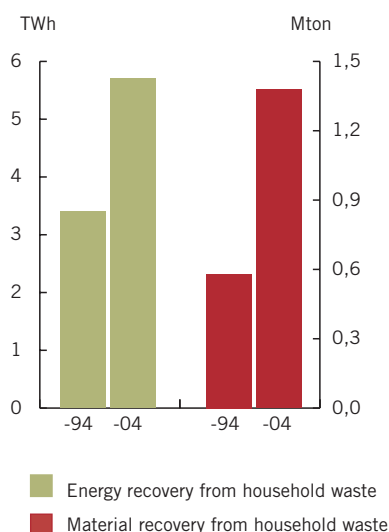
Summary

These days waste management is far more resource-efficient and has less effect on the environment than it did ten years ago. The measures taken since the 1990s to achieve more resource-efficient use of waste have yielded results. In this Strategy for Sustainable Waste Management we wish to place the action taken to achieve this change in context and set out the desired course to be followed over the next few years.

Landfilling has decreased and material recovery, biological treatment and incineration for energy recovery have increased as a result of more sorting of waste at source and changes in waste treatment. The quantity of energy and materials recovered has risen dramatically. These measures have also reduced the environmental impact of waste management. Greenhouse gas emissions have fallen and there has also been a general decrease in emissions of hazardous substances such as heavy metals and organic pollutants.

Successes include:

- Landfilling of household waste fell from 1,380,000 tonnes in 1994 to 380,000 tonnes in 2004.
- Around 1.3 million tonnes of materials and 5.7 TWh of energy in the form of heat and electricity were recovered from household waste in 2004. This is an increase of 140 per cent and 70 per cent, respectively, since 1994.
- Landfilling of other waste has also decreased. Approximately 2.1 million tonnes of waste other than household waste was landfilled outside of industrial sites in 2004, down 56 per cent since 1994, when 4.7 million tonnes was landfilled. This waste is now recovered in the form of materials or energy.
- Emissions from waste incineration have fallen despite a sharp increase in the quantity of waste incinerated. EU legislation requires that Swedish landfill sites be modified to achieve long-term safe landfilling by 2008.



Reduced landfilling 1994 - 2004 (Mtonnes). ^(31, 11, 42)

	1994	2004
Landfilling outside of manufacturing plants (whereof household waste)	6.08 (1.38)	2.48 (0.38)
Pulp and paper industry manufacturing waste	1.25	0.43

This is the effect of a number of powerful instruments:

- Producers have been made responsible for dealing with packaging, newspapers, tyres, cars and electrical and electronic waste.
- Prohibitions and taxes have been imposed on landfill.
- More demanding recovery and recycling targets have been adopted.
- EU membership has meant more stringent standards for hazardous waste, landfill and incineration.

The trend has been consistent – less waste must go to landfill and more must be recycled; all waste management must be environmentally safe.

The aims of Swedish waste management are formulated in the national environmental objectives, which are revised every four years. The Government's proposed overall interim target for waste is that:

"The total quantity of waste should not increase, and the maximum possible use should be made of the resource that waste represents, while at the same time minimising the impact on, and risk to, health and environment."

Although progress has been made over the last ten years, there is still plenty of scope for improvement. Action in the following areas should be given priority if the overall goals for waste management are to be achieved.

1. Implement the regulations and use the instruments decided on, and monitor progress to ensure they achieve the desired effect.

Our view is that provided the regulations decided on are implemented and the instruments that have been introduced are used, the environmental impact of waste management will be fairly limited. We consider it more important to implement and monitor the effect of regulations already in place than to introduce new ones.

2. Place greater emphasis on reducing the quantity of waste and the hazard it poses.

The quantity of waste and the hazard it poses can only be mitigated to a limited degree by action taken at the waste stage. Measures to reduce the quantity of waste and the hazard it poses should primarily be taken as part of the strategy on products and chemicals.

3. Improve knowledge about pollutants

Because of the large number of hazardous substances that have been, and still are, handled, waste management continues to constitute a major environmental risk. We still know little about some of the long-term risks and effects of diffuse emissions of hazardous substances from waste handling.

4. It must be easy for households to sort their waste

Reduced landfilling and increased recovery and recycling have largely been achieved by household sorting of waste at source. Public confidence is essential if the progress achieved is to be maintained. It must be easy to sort household waste in the right way. The division of responsibility between producers and municipalities should not be changed, but cooperation between them should be further developed. It is important to monitor this cooperation and service levels.



Household sorting and collection of waste for recycling should be simple.

5. Develop Swedish participation in EU work in the waste management field

EU membership has changed the way Swedish waste management is regulated. Key policy decisions and regulations are now decided by the Union. Sweden should have a clear strategy as to how waste issues should be pursued in the EU. Public agencies as well as other actors should improve their efforts to produce quality-assured, balanced Swedish standpoints.

A strategy for sustainable waste management

Waste management in Sweden has changed a great deal over the last ten years. Producers have been made responsible for dealing with several categories of waste. Landfill bans and taxes have been introduced. Targets have been set for increased recycling. EU membership has meant more detailed requirements governing hazardous waste, landfill and incineration. The trend has been consistent – less waste is to go to landfill and more is to be recycled; all waste is to be dealt with in an environmentally acceptable manner. But the number of measures taken has caused many people to perceive the situation as disorganised and objectives as unclear.

We wish to place the measures that have brought about this change in context and clarify the desired course to be pursued over the next few years.

The Strategy for **Sustainable Waste Management** is based on the Government's sustainable development goal. Sustainable development means that all political decisions are to be formulated taking account of their long-term economic, social and environmental implications.

An important feature of sustainable waste management is that low emissions and efficient use of the resource that waste represents can be combined with disposal methods that are simple for consumers and efficient for society.

Waste management is an environmental issue where waste is often a resource as well as a problem. The aim is to produce as little waste as possible. Where waste does arise, the resource it represents in the form of materials or energy should be used as efficiently as possible. At the same time, the environmental impact of waste treatment in the form of emissions should be minimised. The national environmental quality objectives form the basis for what may be considered to be environmentally sustainable waste management.

It is necessary to collect and treat waste for society to function. Waste management has long been a key feature of our infrastructure, in some respects comparable to energy supply, water and sewage treatment and the road and rail networks. Households, public bodies and private enterprise are all dependent on someone coming to collect and dispose of their waste. Waste management must also be performed in an efficient and user-friendly way. Prerequisites for sustainable waste management include a clear division of responsibility and a proper regulatory framework.

This Strategy for Sustainable Waste Management consists of two parts:

Part 1 – Targets and measures for sustainable waste management describes sustainable waste management on the basis of environmental objectives, environmental impact, the measures taken and the prevailing conditions. We summarise the results of the changes and analyse the need for further action. On this basis, Part 1 concludes with overall priorities for the next three to five years.

Part 2 – Swedish waste management presents background factual information. It is intended to serve as a reference work on Swedish waste management.

The Strategy for Sustainable Waste Management is also intended to meet the great demand for information about Swedish waste management from politicians, public officials, journalists, corporate environmental managers, students and other interested parties. The entire strategy has been translated into English to meet the considerable foreign interest in Swedish waste management.

The strategy covers all types of waste. However, the emphasis is on household waste and waste from manufacturing industry, since these types of waste have been most affected by the measures taken over the last decade. Less space has been devoted to mining waste and sewage sludge, for example, since these are covered by separate strategies and regulations.

This strategy concentrates on waste management as an environmental issue and infrastructure since these areas fall within the Swedish EPA's sphere of responsibility. The impact of the measures taken must also be described from several viewpoints. If measures are to be sustainable, the cost must equal the benefit. It must also be possible to implement measures to improve the environment and service levels while maintaining a good working environment for those collecting and handling the waste.



PART 1:

Targets and measures for sustainable waste management

Targets and measures to reduce environmental impact

Impact of waste management on the environmental objectives

The overall aim of environmental policy and protection is to ensure that we can hand on to the next generation a society in which the major environmental problems have been solved. On this basis, Parliament has enacted fifteen national environmental quality objectives.

The national environmental quality objectives form the basis for assessing sustainable waste management.

A Good Built Environment

Waste management comes under the Good Built Environment environmental objective. In addition to waste, the objective covers a number of aspects of the built environment, such as planning, cultural heritage, noise, natural gravel, energy use in buildings and the indoor environment. This reflects waste management as infrastructure and its relationship to the built environment. The Government has proposed the following interim targets for waste:

Interim targets for a Good Built Environment

The total quantity of waste must not increase, and maximum possible use must be made of the resource that waste represents, while at the same time minimising the impact on, and risk to, health and the environment. In particular:

- The quantity of waste going to landfill, not including mining waste, must be reduced by at least 50 per cent by 2005, as compared with 1994.
- By 2010 at least 50 per cent of household waste is to be recycled by recovery of materials, including biological treatment.
- By 2010 at least 35 per cent of food waste from households, restaurants, institutional catering and shops is to be recycled by biological treatment. The target covers food waste sorted at source for composting at home or treatment at a central facility.
- By 2010 food and similar waste from food manufacturing facilities etc are to be recycled by biological treatment. This target applies to waste arising without being mixed with other waste, whose quality renders it suitable for use as fertiliser after treatment.
- By 2015 at least 60 per cent of phosphorus compounds in sewage are to be recycled for use on productive land, of which at least half should be used on arable land.

The Resource Efficiency Commission has estimated that total energy consumption in Sweden may increase by 35 per cent, and that raw material consumption may increase by between 20 and 40 per cent by 2030. Increased consumption of energy and materials will generate more waste.

The main problem caused by increased energy and material fluxes is their growing impact on environment and health, i.e. emissions of hazardous substances from the manufacture and use of products. It is the environmental impacts that define the limits for use of most natural resources, rather than a shortage of the resource itself. Exceptions include natural gravel and phosphorus, where scarcity of the resource is also an important factor. The greatest benefit derived from better management of waste resources is in reducing greenhouse gas emissions. The greatest risk posed by waste management is the risk of dispersal of hazardous substances found in the waste or formed during its treatment.

Environmental impacts often outweigh the scarcity of natural resources

Impacts of waste management under other environmental objectives

Waste management impacts have a bearing on several of the other environmental objectives, either directly or indirectly. Environmental impacts of waste management are therefore reviewed below under each environmental objective. Reduced Climate Impact and a Non-Toxic Environment are the two objectives of most importance for achievement of ecologically sustainable waste management. Waste management also has environmental impacts on Clean Air, Natural Acidification Only, a Protective Ozone Layer and Zero Eutrophication, in particular

The main impact of waste is on the Reduced Climate Impact and Non-Toxic Environment objectives

Table 1. Impact of the waste system on environmental objectives in relation to total Swedish emissions in 2002. Waste from manufacturing and resource extraction industry is not included. See table 12. ⁽²⁸⁾

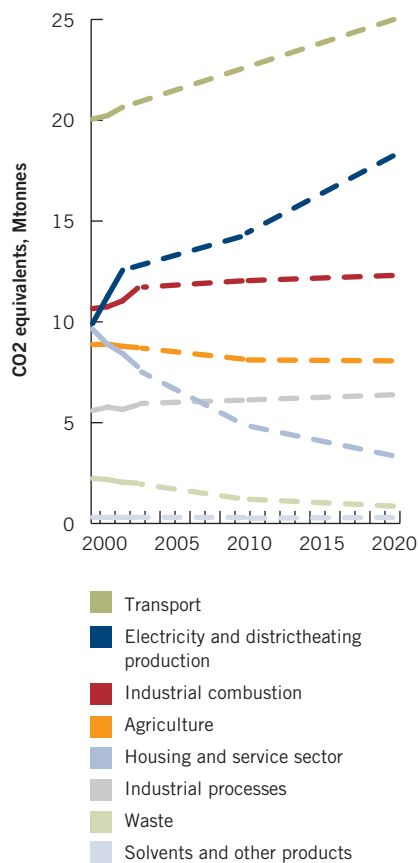
Environmental objectives	Gross impact of the waste system	Net impact of the waste system
Reduced Climate Impact	3 %	No data
Non-Toxic Environment (Pb, Cd, Hg, Dioxins to air)	2-3 %	No data
Good Built Environment Consumption of raw materials for energy,	0.6 %	- 2.0 %
Good Built Environment b. Consumption of finite raw materials for energy (coal, oil, gas, uranium)	0.8 %	- 0.1 %
Zero eutrophication (water and land)	1.7 %	0.7 %
Natural acidification only (inc. nitrogen oxides and ammonia)	2.4 %	0.8 %
Clean Air a. Nitrogen oxides	1.7 %	- 0.4 %
Clean Air b. VOCs	1.3 %	0.8 %

Reduced Climate Impact

The overall aim is that average Swedish greenhouse gas emissions between 2008 and 2012 are to be at least four per cent lower than they were in 1990.

Total emissions of greenhouse gases in 2002 were approximately 70 million tonnes CO₂ equivalents. Emissions from the waste sector were around 2 million tonnes CO₂ equivalents, i.e. about three per cent of total emissions.

Emissions of greenhouse gases from waste are low



Less waste and more recycling produce lower emissions

Emissions of hazardous substances are falling

Most emissions from the waste sector come from degradable waste, which is land-filled and emits methane – one of the worst greenhouse gases. Incineration of plastics, transport of waste, composting of food waste and other easily biodegradable waste also adds to greenhouse gas emissions, but to a lesser extent. Waste management's share is significant but small as compared with the emissions from energy consumption and traffic (approximately 75 per cent of total emissions) and agriculture (approximately 3 per cent of total emissions).

Greenhouse gas emissions can be reduced because recycling and recovery are a more efficient use of the resource that waste represents in the form of materials and energy. Waste recycling reduces emissions by avoiding landfill and hence methane emissions.

Indirectly, emissions can also be reduced as recycled materials replace virgin materials. For example, energy is saved by using recycled metals or plastics as compared with mining and refining new metals or producing new plastics. Use of waste to produce heat and electricity, thus replacing coal or oil, also helps indirectly to reduce emissions of fossil carbon dioxide. The amount by which optimum resource-efficient use of waste would reduce greenhouse gas emissions has not been calculated. But more than two million tonnes of carbon dioxide equivalents would probably be saved.

Naturally, resource-efficient manufacture and use of products generating less waste is even more efficient. This is not primarily because of a reduced impact from waste management; the benefit is in the energy saved by using fewer raw materials. There is great scope for reducing greenhouse gas emissions in this way. Measures of this kind should be implemented in manufacture and use, and cannot merely be seen as part of waste management. Waste then becomes a symptom of squandering resources in the manufacture and use of products.

A Non-Toxic Environment

The aim is that the environment should be free of substances and metals that have been created or abstracted by man and that can threaten human health or biological diversity. Six interim targets have been set for a Non-Toxic Environment with regard to knowledge, information, phasing out hazardous substances, reduced risk to health and the environment, guide values and site remediation.

Waste management involves a large number of substances hazardous to health and the environment. These substances are dealt with separately as hazardous waste but are also present as contaminants in other waste. Some substances, such as dioxins, are formed unintentionally when waste is incinerated.

Emissions occur in flue gases during incineration of waste and in leachate from landfill. Hazardous substances may also be dispersed via natural cycles when they are present in small quantities in waste recovered or recycled. Emissions may also occur because of accidents, dumping or other improper waste disposal.

Emissions of heavy metals and organic pollutants from waste management have fallen, particularly those from waste incineration. Emissions of dioxins to air from waste incineration were 0.7g in 2004. This is a decrease of almost 99 per cent since

A Non-Toxic Environment – key interim targets in the waste sector:

Interim target 1: By 2010, as far as possible, there should also be information on properties of chemicals handled in the market. Information on chemicals handled in large quantities or considered to be particularly hazardous should be available before 2010.

Interim target 2: By 2010 products should be labelled with health and environmental information about the hazardous substances they contain.

Interim target 3: The phase-out of particularly hazardous substances between 2003 and 2015 means that newly-produced products should, as far as possible, contain no hazardous substances. The date by which the interim target is to be met varies from substance to substance. Examples of substances to be phased out are mercury (2003), carcinogenic substances, genetically harmful substances and substances harmful to reproduction (2007), and lead and cadmium (2010).

Interim target 4: The risks to health and the environment from the manufacture and use of chemicals are to be reduced continuously up to 2010. The occurrence and use of chemicals that hinder recycling are to be reduced during the same period.

Important interim targets for waste under a Non-Toxic Environment

1985. Nowadays emissions from industrial processes are more important. Dioxin emissions from these sources totalled 44g in 2001. Concentrations of pollutants in treated landfill leachate are usually low.

Even though direct emissions are fairly limited, the large quantities of hazardous substances that are and have been involved in waste management constitute a major risk. To achieve non-toxic natural cycles it is essential that hazardous waste be identified and dealt with in the right way. If hazardous waste is treated carelessly or deliberately dumped, this may have a major environmental impact, at least locally. Significant quantities of hazardous waste are not dealt with properly and therefore end up in sewage or are mixed with other waste. Landfill sites also contain large quantities of pollutants because of past landfill practice. For example, fly-ash going to landfill contains substantial quantities of dioxins (approximately 160g each year). At present landfill sites are not considered to be major sources of emissions of hazardous substances, but more information about long-term risks is needed. Nor do we know enough about the risks involved in recovery of materials, including composting and digestion, from waste that may contain low concentrations of hazardous substances. Landfill, incineration

Waste quantities represent a risk

Hazardous waste is dealt with separately in an environmentally safe manner

Table 2. Collection of hazardous waste.

Generated/collected amounts of hazardous waste in 2002 (tonnes)

Industrial waste	676,000
Household waste	26,000

All waste treatment
must be safe

The degree of hazard posed
by waste must be reduced

and recovery must all meet standards for safe disposal so as to prevent and counteract dispersal of hazardous substances from waste management.

Pollutants will continue to be a feature of waste management as products containing these substances are manufactured and discarded, or when polluted sites are decontaminated. Large quantities of the most common heavy metals and pollutants are still present in products that have not yet become waste. If waste is to be made less hazardous in the long term, the use of hazardous substances must be phased out.

Table 3. Emissions to air from waste management in 2002. ^(28, 31, 7)

Non-Toxic Environment Emissions to air	Unit	Gross impact of the waste system in 2002 (household waste in brackets)	Total Swedish emissions
a. Pb	Tonnes/year	0.48	15
b. Cd	Tonnes/year	0.020	0.91
c. Hg	Tonnes/year	0.022	0.65
d. Dioxins	g/year	1.0	44

Measures taken in
different areas must
act in concert

Strategy for non-toxic and resource-efficient natural cycles

Parliament has adopted three action strategies to achieve the fifteen environmental objectives more effectively. Advantages of the strategies include being able to present coherent proposals for strategies to achieve more objectives, and avoiding sub-optimal approaches. One strategy is that for non-toxic and resource-efficient natural cycles. This should aim to reduce the use of natural resources, reduce emissions of pollutants and create energy and material-efficient natural cycles. Policy on waste, chemicals and products, in particular, needs to be coordinated so that measures are taken based on a holistic view of the environmental impact of materials and substances throughout their life cycle. The aim is to achieve measures having a combined effect in the product, chemicals and waste sectors.

The Government considers that the strategic basis for priorities to be set for further efforts in this field can be summarised as follows: ⁽¹⁹⁾

- Measures having near and long-term effects
- Holistic perspective and cost-effectiveness
- Development of effective instruments
- Involvement of all key stakeholders, particularly trade and industry and municipalities
- Particular focus on work in the European Union
- Evaluation of measures already implemented.

Measures to achieve the environmental objectives

On the basis of the interim target for waste under a Good Built Environment and the description of the environmental impact of waste management, we have used the fol-

Guidelines for sustainable waste management

1. Preventive action to reduce the quantity of waste and the hazards it poses
2. Detoxification of natural cycles
3. Using the resource that waste represents as efficiently as possible
4. Safe treatment.

lowing four guidelines to describe environmentally sustainable waste management. The aim is to demonstrate the interrelationships between various measures to be able to monitor their effects and decide whether further measures are needed.

Preventive efforts to reduce the quantity of waste and the hazards it poses

The amount of waste generated and how hazardous it is are determined as early as the product design phase. It is then that the quantity of materials used to manufacture the product and whether it will contain hazardous substances are decided. To achieve the objective of reducing the quantity of waste and the hazards it poses, waste must be seen as part of the manufacture and use of products.

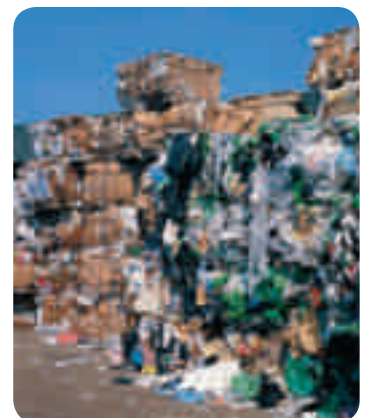
Reduced waste quantities require more resource-efficient manufacture and products that require fewer materials and last longer. The most dangerous substances will have to be phased out and use of other hazardous substances reduced to lower the degree of hazard posed by waste. However, measures taken at the waste stage can be formulated to provide feedback on the products that are difficult to deal with as waste.

Waste quantities have risen sharply in line with industrialisation and increased welfare. The increase has often been higher than the increase in production and consumption, although it has not been as pronounced in recent years. Since waste quantities are partly dependent on the economic climate, it is too early to draw any conclusions based on recent years' figures.

Producer responsibility for waste

A number of measures have been taken to reduce waste quantities and the environmental impact of products throughout their life cycle. Measures focusing on the waste phase include producer responsibility for packaging, newspapers, tyres, cars and electrical and electronic products, where producers are responsible for dealing with end-of-life products. Producer responsibility has increased recycling and recovery, although results in the form of reduced waste quantities are less evident. But producer responsibility has brought the spotlight to bear on the respective product categories, which, in the case of packaging, for example, has meant greater use of resource-efficient refillable packaging of various kinds, as well as packaging using fewer materials. Yet this trend has been counteracted by an increase in the amount of packaging and the fact that some packaging has become more complex and resource-intensive.

Waste quantities and properties are determined during manufacture and use



Producer responsibility has increased recycling

The landfill tax
has reduced landfilling

Landfill tax

Other action taken includes the landfill tax. The tax has dramatically reduced landfilling and helped in the implementation of landfill bans. It is not yet clear whether it has had an impact on waste quantities.

Statutory resource conservation standards

The Environmental Code, which is the new legislative framework in the environmental field, entered into force in 1999 and imposes resource conservation standards as part of its general "rules of consideration". All activities must take advantage of opportunities to save materials and energy. The effects of this resource conservation requirement have not yet been analysed.

Sustainable production and consumption

Use of "soft" instruments was developed in the early 2000s. The Integrated Product Policy (IPP) and efforts to achieve sustainable production and consumption are intended to ensure that non-legislative measures have a greater effect. IPP includes instruments such as eco-labelling, development of life-cycle analyses, environmental management systems, information and sustainable procurement. Another common feature of these instruments is that they involve measures reflecting a holistic approach to the entire life cycle of products.

Ever increasing waste

The instruments mentioned above (landfill tax, producer responsibility, the "rules of consideration" in the Environmental Code and IPP) have not yielded a pronounced reduction in waste quantities. It is also too early to say whether they have been a factor in the apparent levelling off of the increase in waste quantities. However, all instruments have highlighted waste issues, and it is likely that waste quantities would have risen more rapidly if these measures had not been taken.

Measures required in manufacture and use

To reduce waste quantities, preventive measures must yield results. The "rules of consideration" in the Environmental Code must have a greater impact, and systematic approaches such as environmental management, life-cycle thinking and sustainable procurement are needed to reduce waste quantities, or at least slow down the rate of increase. However, a sustainable and definite reduction of waste quantities in line with the interim target under a Good Built Environment will only be achieved if production and consumption become more resource-efficient.

Increasing and decreasing hazards

Several measures taken in the chemicals and product sectors have reduced the level of hazard posed by waste. For example, the use of heavy metals such as mercury, cadmium, lead and certain chromium compounds has been banned or strictly limited.

Use of chemicals is on the
increase, even though some
have been phased out



Organic pollutants such as chlorinated solvents, PCBs and certain brominated flame retardants, as well as ODSs such as chlorofluorocarbons (CFCs and HCFCs) have also been banned or strictly limited. But the use of similar substances having somewhat less hazardous environmental properties, or having environmental properties that are not fully known has increased, e.g. other types of brominated flame retardants. The use of chemicals overall has also continued to increase.

Using less hazardous chemicals

Further reduction in the degree of hazard posed by waste will require that use of the most hazardous chemicals be phased out or reduced in line with the Non-Toxic Environment objective. Efforts to achieve the objective are proceeding, but success is very much dependent on international cooperation to achieve this ambitious Swedish environmental objective. And there is still a long way to go. The forthcoming EU regulatory framework REACH is now being debated by the Council and Parliament. REACH will be an important means of improving information about properties of chemicals and banning the unrestricted use of the most hazardous chemicals in the European Union. But it will be at least 15 years before the system has been fully implemented, and even longer before it has become fully effective in reducing the degree of hazard posed by waste.

The new EU chemicals policy
– REACH

Integrate waste management with chemicals policy

Renewed efforts are being made in waste management to identify product flows whose content of hazardous substances makes them difficult to deal with. The aim is to obtain background data for further bans on the use of hazardous substances.

Holistic approach and life-cycle perspective

It is important that efforts to reduce the amount of waste and the degree of hazard it poses, as well as measures to increase recycling, incorporate a life-cycle perspective so that the overall result is beneficial to the environment. Strategies for products, chemicals and waste must therefore be integrated so that measures do not counteract one another. Efforts to develop the overall environmental strategy for non-toxic and resource-efficient natural cycles will therefore be a central feature of measures to reduce the overall environmental impact of products throughout their life cycle.

Environmental protection
and policy in the product,
chemicals and waste sectors
must be coordinated

Detoxification of natural cycles

Many of today's products contain hazardous substances. It is therefore important that waste containing hazardous substances be sorted and dealt with separately for recycling, destruction or long-term safe storage. Steps should also be taken to ensure that hazardous substances do not leak into the environment as a result of poorly supervised recycling or wrong disposal methods.

It is important that waste
containing hazardous substances
be sorted and dealt with separately



Regulations governing hazardous waste

There are regulations stipulating separate treatment of hazardous industrial waste and that only authorised companies may transport and dispose of hazardous waste. There must be a declaration of contents for waste. There are specific regulations governing the handling of certain flows of hazardous waste, such as waste containing PCBs, batteries, mercury, electrical and electronic waste, scrapped automobiles and waste oil.

Municipalities are responsible for arranging the collection and safe disposal of hazardous household waste. Regulations now also require that incoming waste for incineration or landfill be inspected, among other things to ensure that hazardous waste mixed in with other waste is not being received. The municipal environmental offices and county administrative boards are the regulatory authorities for hazardous waste management.

Large quantities collected and processed

Some 700,000 tonnes of hazardous waste is collected each year. Around 676,000 tonnes of this comes from manufacturing industry and just under 26,000 tonnes direct from households. Additional hazardous waste is produced during waste incineration in the form of about 138,000 tonnes of ash and sludge from flue gas treatment.

Ending up in the wrong place

Based on sample analyses and monitoring performed by the Swedish Association of Waste Management, as much as half of hazardous household waste ends up in the rubbish bin, instead of being collected for separate treatment.

Management of hazardous waste is a priority issue in regulatory control of hazardous activities such as industrial operations. There has been no national survey of hazardous industrial waste. Hence, it is not possible to say whether current regulatory control suffices to ensure proper management of this type of waste.

Consumer-friendly collection of hazardous waste

Quantities of hazardous waste collected by local authorities vary more from one municipality to another than can easily be explained. This would tend to suggest that a more uniform and higher level of service would be a fairly simple way of increasing the quantity collected. Action should be taken to ensure that all municipalities have a high-quality system for collecting hazardous household waste.

Survey hazardous waste management methods

It is of great interest to perform a systematic survey of the effectiveness of hazardous waste collection, the aim being to ascertain the need for improved self-regulation, regulatory control or tougher statutory requirements.

All municipalities must have
a good system for collecting
hazardous waste

Check pollutants in waste not classified as hazardous

Waste that is not hazardous may also contain small quantities of hazardous substances. It is therefore particularly important to assure the quality of waste from which materials are to be recovered. This applies, for example, to waste used for construction purposes (excavated earth and stone, concrete, bricks, asphalt etc), food waste for biological treatment and plastics for recovery of materials. There is a certification scheme for composting and digestion residues, which has been developed by the waste industry. The Swedish EPA will be producing guidelines for assessment of waste used for construction purposes. The recoverer and the user are otherwise responsible for quality assurance. Generally speaking, the standards applying to recycled raw materials should be the same as for virgin raw materials. More knowledge is needed to assess the risks associated with contaminants present in recycled waste

Better guidance for material recovery

What is hazardous in household waste?

The hazardous components of household waste are chemicals, medicines, batteries, refrigerators, freezers, certain kinds of electrical and electronic waste, glue, paints and lacquers. These contain pesticides, oils, solvents, freons, heavy metals and other substances. Hazardous waste may affect us and our surroundings because it is toxic, carcinogenic, corrosive, harmful to foetuses, environmentally harmful, infectious and flammable. ^(31, 43)



Hazardous industrial waste

Industry generated almost 700,000 tonnes of hazardous waste in 2002. The most hazardous waste is produced by the steel and metals industry, and by the engineering industry, followed by the chemicals, rubber and plastics industries. ⁽⁷⁾

Resource-efficient use of waste

Making use of the resource that waste constitutes by recycling materials and energy as efficiently as possible reduces emissions of greenhouse gases in particular. Less waste goes to landfill, emissions of methane, which is a greenhouse gas, are thereby reduced, and fossil fuels are saved or replaced in the production of materials or energy. Using waste as a resource often reduces other emissions having an influence on acidification, eutrophication and air quality etc.

Measures to reduce landfilling

From an environmental viewpoint, landfilling, or dumping waste on a rubbish tip, is the worst method of disposing of waste from which materials can be recovered or which can be incinerated for energy. However, for the foreseeable future landfill will

Landfill bans and the
landfill tax increase
conservation of resources

remain a necessary method for disposing of waste that, for various reasons, is unsuitable for any form of recycling. Various measures have been taken to use resources more efficiently in waste management, thereby reducing the amount of waste going to landfill. As a pointer to the desired changes, an interim target was set under the Good Built Environment objective, i.e. that waste going to landfill was to be reduced by 50 per cent between 1994 and 2005. A tax on landfilled waste was introduced in 2000. The tax is currently SEK 370 per tonne. The aim of the tax is to discourage landfill as a waste disposal method and increase the economic incentives for treating and recycling waste in a more environmentally friendly and resource-efficient way. 2002 saw the introduction of a ban on landfilling burnable waste, followed by a ban on landfilling all organic waste in 2005.

Much less waste
now goes to landfill

Sharp fall in waste going to landfill

The above measures have greatly reduced waste going to landfill. For example, annual landfill of household waste fell by 1 million tonnes between 1994 and 2004. Only 380,000 tonnes of waste was landfilled in 2004, representing nine per cent of household waste. Landfill of other waste (industrial, construction and demolition waste, ash and sludge etc.) outside of the manufacturing industries own waste sites fell from 4.7 million tonnes to 2.1 million tonnes. Landfill, particularly of burnable and organic waste, at industrial waste sites has also declined markedly. For instance, landfill of waste specifically from the pulp and paper industry fell from around 1.25 million tonnes in 1994 to some 0.43 million tonnes in 2004. ^(11, 37)

Table 4. Landfilling outside of manufacturing facilities. ⁽³¹⁾

Year	Total Quantity (ktonnes)	Quantity of household waste (ktonnes)
1994	6,080	1,380
1998	4,800	1,070
2002	3,770	830
2004	2,480	380

The EU waste hierarchy

EU waste hierarchy as a rule of thumb

Under the EU waste hierarchy, recovery of materials (including biological treatment) is preferable to incineration, provided it is environmentally justified. Analyses carried out in Sweden show that this assumption is correct. In practice, it is not always easy to weigh up the pros and cons of recovering materials or incineration. Some wastes have properties rendering them unsuitable for materials recovery from an environmental viewpoint, or because the environmental benefits would not justify the effort or costs entailed. Combined with recovery of materials, waste incineration for energy recovery is therefore of great importance as a resource-efficient way of recycling waste that should not go to landfill. Since recovery of materials is often more expensive, or yields lower

revenues than incineration, there has been reason to take action specifically designed to encourage recovery of materials, including biological treatment.

Producer responsibility increases recovery of materials

Producer responsibility for packaging and newspapers was introduced in 1994, one aim being to increase recovery of materials. Producer responsibility has since been extended to cover tyres, cars, and also electrical and electronic products. Producers in these sectors are responsible for end-of-life disposal of the products they sell. Producer responsibility expressly requires a certain percentage of waste to undergo materials recovery. The long-term aim of producer responsibility is to encourage sustainable product development.

Composting and digestion targets

To highlight the importance of recycling food waste by biological treatment, an interim target has been set whereby at least 35 per cent of food waste from households, restaurants, institutional catering and shops should be recycled by sorting of waste at source and biological treatment. There is also an interim target for food and similar waste from food manufacturing plants. Government grants are available for investment in biogas units.

The Government has also proposed that the interim target for waste be supplemented to include a target that at least 50 per cent of household waste materials should be recovered, including biological treatment, by 2010. ⁽¹⁸⁾



Results – producer responsibility ⁽¹⁴⁾

Waste subject to producer responsibility is end-of-life packaging, recycled paper, tyres, automobiles and electrical and electronic products.

- Ten years has passed since producer responsibility for packaging was introduced. Recycling has increased steadily since 1994. The rate of materials recovery was around 40 per cent that year. Recycling of packaging has now risen to around 67 per cent (calculated in accordance with the Packaging Directive).
- Recycling of paper remains unchanged at a high level of 80 per cent. The target is 70 per cent.
- It is difficult for producers to achieve the target of 30 per cent materials recovery from plastic packaging. The current figure is 19 per cent.
- The agricultural sector has met its commitment: 57 per cent of agricultural plastics are recovered into materials.
- No tyres are put into landfill.
- 85 per cent of scrapped cars are recycled.
- 12kg of electrical and electronic waste per person was collected in 2004.

Recycling of materials
and energy has
doubled since 1994

Target for recovery of phosphorus from sewage

The Government also proposed an interim target for recycling 60 per cent of phosphorus in sewage by 2015. This will necessitate far-reaching measures to improve sludge quality, development of new methods for recovering phosphorus from sludge, and the introduction of sewerage systems in which waste is sorted at source. These changes will in turn require funding for research, development and investment. ⁽¹⁸⁾

Increased resource-efficiency

The reduction in landfill has meant a sharp increase in materials recovery and incineration with energy production. For instance, approximately 43.4 per cent of household waste underwent materials recovery in 2004. Incineration of waste at traditional waste incineration plants produced about 8.5 TWh of heat and 0.74 TWh of electricity in 2004. This is double the amount of energy produced in 1994, when 4.3 TWh was generated. ⁽³¹⁾

Table 5. Comparison between quantity of materials recovered and energy obtained from household waste in 1994 and 2004. ^(5, 31)

	1994	2004
Energy produced	Approx. 3.2 TWh	Approx. 5.7 TWh
Recovered materials	Approx. 580,000 tonnes	Approx. 1,385,000 tonnes

Reduced environmental impact

The reduction in landfilling, increased materials recovery and incineration achieved by methods including sorting of household waste at source and by industry have yielded significant benefits in the form of emission reductions. Between 1998 and around 2010 reductions in landfill will cause waste management's share of Sweden's total greenhouse gas emissions to fall by 3 per cent, i.e. from 4 per cent to 1 per cent. Large indirect emission reductions have also been achieved by replacing virgin raw materials or fossil fuels with waste. ⁽¹⁵⁾

Our assessment is that materials recovery will continue to increase so that the target for biological treatment of food waste and materials recovery from household waste will be achieved. Between 1990 and 2010 it is expected that direct emissions of greenhouse gases from the waste sector will have fallen by 85 per cent. By 2020 they are expected to make up only half a per cent of Sweden's total emissions. Reductions in the waste and agricultural sectors are expected to be so great that the traffic, energy and industrial sectors merely need to stabilise their emissions of greenhouse gases to achieve the 4 per cent reduction target.

Encourage increased material recovery

It is important to monitor trends in the proportion of waste incinerated as compared with materials recovery. Additional instruments should be modified so account can be

Less landfilling means lower
greenhouse gas emissions

taken of waste properties, practical and local conditions such as economic factors, markets, technologies and, in particular, public acceptance. Appropriate instruments remain targets, taxes, grants and competence and planning standards. To encourage material recovery, the Government has proposed the introduction of a tax in 2006 on fossil waste going to incineration. The Swedish EPA supports the need for a flat-rate tax on waste incineration. However, the tax rate should be set fairly low in the first instance, so that its effects can be evaluated. Another instrument that should be brought more to the fore is "the rules of consideration" in the Environmental Code, which incorporate requirements for conservation of resources and recycling.

Proposed incineration tax

Low environmental impact from waste management

The environmental impact of waste management can be lessened by reducing waste quantities, detoxifying natural cycles by dealing with hazardous waste separately and by using the resource that waste represents with maximum efficiency. Environmental impact can also be reduced by ensuring that emissions from the disposal process itself (landfill, incineration, biological treatment and materials recovery) are as low as possible.

Low emissions from waste treatment

Sustainable landfilling

Emissions from landfill sites occur mainly in the form of methane emissions and leachate discharges. Leachate contains nutrients and oxygen-consuming substances in particular, but may also contain heavy metals and organic pollutants. The Landfill Ordinance was introduced in 2001 and requires all landfill sites to be watertight, airtight and covered to a certain degree, and also requires information on the waste accepted by the site. By the end of 2008 all sites accepting waste must meet the high standard stipulated by the ordinance. The Swedish EPA considers that emissions are generally limited. On the basis of current knowledge, the measures required by the ordinance may be regarded as sufficient to ensure sustainable safe landfill.

New regulations for sustainable landfill

Lower emissions from waste incineration

Waste incineration produces emissions in the form of air pollutants in flue gases and water pollutants from flue gas treatment processes. The environment may also be indirectly affected by landfilling of slag and ash from incineration. The Waste Incineration Ordinance entered into force in 2003 and contains general requirements governing acceptance of waste and permit issues. These requirements are to be met by all facilities after 28 December 2005. The Swedish EPA has also issued supplementary regulations setting out technical environmental protection standards, and has also proposed more rigorous standards for inspection of incoming waste. Emissions have fallen sharply (95 – 99 per cent since 1985 for most pollutants). Despite the rapid increase in incineration, overall emissions have continued to fall. Although emissions are low, further steps should be considered. Modified processes and thermal post-treatment of ash should be considered, so as to limit the formation of dioxins and hence the quantity of dioxins in fly ash.

Emissions are falling despite increased incineration.

Table 6. Emissions from incineration in 1996 and 2004. ⁽³¹⁾

	1996	2004
Particulates (tonnes/year)	33	24
Hydrogen chloride (tonnes/year)	412	101
Sulphur oxides (tonnes/year)	1,121	337
Nitrogen oxides (tonnes/year)	1,463	1,707
Mercury (kg/year)	77	37
Cadmium (kg/year)	8	5
Lead (kg/year)	214	54
Dioxins (g/year)	2	0.7

Guidelines for biological treatment

Controlled composting and digestion

The Swedish EPA has produced general guidelines and an accompanying handbook to provide better guidance and more uniform application of the Environmental Code for digestion and composting of waste. These guidelines are expected to reduce environmental impacts and help the permit-issuing and regulatory authorities to adopt a more uniform approach. The guidelines cover intermediate storage, digestion and composting of food waste and food-related waste in particular, but also deal to some extent with sewage sludge, manure and refuse from parks and gardens.

Quality-assured materials recovery

Of the various methods of dealing with waste, materials recovery often has the lowest impact on the environment. However, it is important that the entire process up to completion of the new raw material be carried out in a quality-assured way, reflecting concern for the environment. A permit is required to operate a materials recovery facility. This is to ensure that materials are recovered in a controlled way with minimum environmental impact. However, there is a need to study the environmental impact of materials recovery.

New guidelines are being developed

Guidance on recovery of materials for construction purposes

Recycling of materials for building roads, golf courses, noise barriers and landfill cover may result in eutrophication and dispersal of hazardous substances in soil and water. At present there is no national framework for sustainable recycling for construction purposes. The Swedish EPA will be developing guidelines to ensure that recycling of this kind has a low environmental impact.

Regulatory control and monitoring of existing regulations are important

Limited emissions from waste disposal

If existing regulations are complied with, the direct environmental impact of landfill, incineration and materials recovery will be fairly limited. If the regulations are not followed, or do not have the desired effect, there may be extensive local environmental impacts.

To ensure that regulations are followed and have the desired effect, regulatory control, monitoring and evaluation of existing regulations will be important over the next few years. Implemented measures need to be evaluated to provide a basis for determining the need for further action. Technological developments should be monitored so that continuous improvements can be made.

It is particularly important to examine and assess the long-term reliability of measures taken at waste sites. The reason for this is the future threat posed by landfill sites owing to the large quantities of hazardous substances that have historically gone to landfill.

Uncertain long-term risks?

There is one proviso attached to the view of low environmental impact. The precautionary principle dictates that particular attention be paid to assessing the long-term risks of emissions of organic pollutants. There are gaps in our knowledge of the content and impact of these pollutants. Available data should be improved by research and collation of existing information.

More knowledge is needed



Covering over landfill sites reduces their environmental impact.

Requirements and measures to achieve effective waste management

As mentioned by way of introduction, waste management is part of societal infrastructure, the aim being to simply and efficiently dispose of the waste that is generated. To this end, and to ensure that the environmental objectives are achieved, it is important that a number of basic requirements are met. In this section we analyse the overall prerequisites for effective waste management.

Effective planning, clear strategy and adequate knowledge

One key requirement for sustainable waste management is that there be an effective planning process with clear objectives and well-considered and supported strategies for achieving them. The planning process must include monitoring and evaluation of the action taken. The evaluations will then be used as a basis for adopting new objectives and strategies. Evaluation will require information produced by collating statistics and research findings.

Waste planning based on the national environmental quality objectives

Planning of waste management and measures is to be based on the national environmental quality objectives. These objectives are the overall determinants for the environmental aspects of waste management. The next detailed evaluation of the environmental objectives will be submitted to the Government in 2008 and will form the basis for a new Environmental Objectives Bill in 2009.

The purpose of the national waste plan is to show the implications of the objectives for waste management, the relationship between objectives and measures, to analyse the effect of measures and instruments, and to provide guidelines on future priorities. The proposed future priorities included in this plan should form a basis for the formulation of proposed new interim targets and measures.

Lack of targets for waste management as infrastructure

There are no national targets for the operation of waste management as infrastructure. The Swedish EPA will be considering targets for collection, service levels, disposal capacity etc. in preparation for a revision of this plan.

Monitor effects of the instruments introduced

For several years now, the Swedish EPA has been monitoring the effects of producer responsibility and the landfill bans. Only a few other areas have been monitored. There is a pressing need to survey the effects of the instruments introduced over the past few years. It is particularly important to evaluate the landfill bans and the new regulations governing landfill sites to see whether they have had the desired effect. This survey should be carried out as part of the detailed evaluation of the environmental objectives. Reliable statistics will be needed for general monitoring. The Swedish EPA is the responsible statistical agency and is currently developing a reporting system. A sufficient amount of reliable statistics for 2004 will be available in 2006, and thereafter every other year.

New infrastructure targets

Better statistics and monitoring of compliance with regulations

More information needed to determine progress

Research and development are important means of achieving the environmental objectives in the long term. Less emphasis has been placed on waste research in recent years, but projects are now under way at several agencies, such as the Swedish Research Council for Environmental, Agricultural Sciences and Spatial Planning (Formas), the Swedish Energy Agency (STEM), the Swedish Agency for Innovation Systems (Vinnova) and the Swedish EPA. In addition to scientific and technical research and development, there is a need to use knowledge from research in the field of social sciences and interdisciplinary research to understand social and economic aspects of waste management, for example. In the field of traditional waste research, we need to know more about incineration, biological treatment and landfill.

More knowledge and research is needed

The Swedish EPA has announced a national research programme in the waste field, focusing on improving our knowledge about instruments for sustainable waste management such as consumer-friendly and cost-effective waste sorting and collection systems and sustainable material and waste flows.

Renewed focus on waste research

Simple, efficient and clear*Stakeholders responsible for waste management*

If measures are to be implemented and have the desired effect, responsibilities must be defined and the rules must be clear. Municipalities are responsible for collecting and disposing of household and similar waste. Exceptions to this are household wastes for which producers are responsible (packaging, newspapers, tyres, cars and waste from electrical and electronic products). Responsibility for other waste rests with the operator of the facility where it is generated.

Clear division of responsibility

In recent years the actions of municipalities in the market have been the subject of debate, and it has been questioned whether the market for certain segments operates effectively. There is cause to continue to monitor the market situation and the actions of various players. There may also be a need to clarify the existing regulatory framework without altering prevailing responsibilities.

The Swedish EPA monitors market efficiency

Capacity to deal with all waste

The importance of waste management as infrastructure has come to the fore in recent years when there has been insufficient capacity to recycle the waste subject to the landfill ban. The increased technical requirements to be met by landfill sites have also rapidly reduced their numbers. There is a risk of regional shortfalls in capacity for landfilling or recycling waste. There is also a risk that waste incineration capacity is being increased so much that it will exceed the quantity of waste available and suitable for incineration. The Swedish EPA has been instructed to monitor developments and propose measures where necessary.

It must be easy for households to sort their waste

Sorting of waste must be simple

The dramatic increase in materials recovery achieved over the last ten years has meant that much more waste is now sorted at source. In the case of household waste in particular, there have been complaints that the producers' systems for collecting packaging and newspapers from households have been sub-standard and have generated litter etc. Complaints have also been made about the standards of municipal collection of bulk waste and hazardous waste.

It is important that all households are easily able to sort their waste and take it to a depot or have it collected, whether the waste falls under the municipality's public cleansing obligation or producer responsibility. The Government considers that it should be easier for households to sort their packaging and newspapers. The aim of further improvements made by producers and municipalities should be to ensure that collection is perceived as a system by consumers.

In 2004 the Waste Council set up at the Swedish EPA concentrated on cooperation between municipalities and producers. The Council arrived at criteria for a suitable collection system. The Swedish EPA considers there is reason to continue to monitor collection of household waste to ensure that households are receiving a good level of service. This discussion should also include the standard of service provided by municipalities for waste falling under its public cleansing obligation, e.g. bulk waste and hazardous waste. Measures to reduce litter should also be discussed. Moreover, it is important that consumers see the benefits of sorting of waste at source and increased recycling so that they are motivated to continue sorting.

Regulatory control is essential

Ensure that regulations are clear, effective and that they are followed

The regulatory framework for waste has been extended and amended a great deal in recent years. Regulatory control is essential if the measures decided on are to be implemented. Guidance on the application of regulations is needed to ensure they have the desired effect and are implemented fairly and uniformly throughout the country.

There is a need to review the framework and clarify it without actually changing its effects or emphasis. The Swedish EPA will be simplifying, and providing guidance on, priority areas of the regulatory framework to ensure fair application of the regulations. Regulatory control and use of the regulations should also be monitored.

EU and international

EU policies and strategies

EU waste prevention and recycling strategy

The basic strategic environmental document in the EU is the Sixth Environmental Action Programme. The programme decided that a number of thematic strategies were to be developed. A draft thematic strategy on prevention and recycling of waste is expected in the autumn of 2005. The strategy will have a major impact on the development of sustainable waste management in Sweden.

Waste regulations usually decided by the EU

Virtually all regulations governing waste are decided in the form of EC regulations or directives. Those decisions are usually preceded by lengthy deliberations by expert committees and at Council meetings. The Swedish EPA assists the Ministry of Sustainable Development, which represents Sweden. Swedish standpoints have been accepted in a number of cases. But in many cases discussions on the effect of regulations have not been initiated until Swedish implementation of EC directives, when there is little chance of influencing the wording of the regulations.

Sweden needs to act early and put forward firm views

There is a pressing need to bring the national debate forward to the time when directives or strategies are formulated. The Swedish EPA gathers together the views of Swedish agencies and industry representatives early in the decision-making process. These stakeholders are also very much responsible for keeping abreast of developments in their field and supplying the Swedish EPA with facts and impact assessments.

International agreements

International agreements are required to come to grips with many environmental problems. Examples include the efforts to combat global warming and to protect the ozone layer (the Kyoto and Montreal Protocols). Waste management is an important part of solving both these environmental problems (see earlier sections). Sweden should act to ensure that emissions from waste management are limited and monitored under these agreements. Import and export of waste to non-EU countries is governed by the Basle Convention. See page 66 for a detailed description of waste import and export.

Global waste management

The free movement of goods and labour in the EU and global trade make it more difficult to decide and implement effective national provisions. For example, a more rigorous waste management regime in Sweden may mean that waste is exported for less sustainable disposal in another country. China's economic growth has increased demand for recycled materials. This favours recycling, but may make life harder for Swedish companies that used recycled raw materials.

Increased globalisation

Export of Swedish experience

Supporting environmental protection measures is part of Swedish development assistance. Waste management is often one of the first issues addressed when a country begins to improve its environment. Here, Swedish know-how and experience are in great demand.

When it comes to waste, Sweden is very much at the forefront, and there is thus great potential for commercial export of technologies and know-how, even to rich countries.

Priority areas

The action taken since the 1990s to achieve more resource-efficient use of waste has yielded results. Increased sorting of waste at source and changes in waste treatment have reduced quantities going to landfill and increased materials recovery, biological treatment and incineration with energy recovery. The quantity of energy and materials recovered has risen sharply. The measures taken have also reduced the environmental impact of waste management. Emissions of greenhouse gases have fallen and emissions of hazardous substances such as heavy metals and organic pollutants have also generally decreased.

The overall interim target for waste as proposed by the Government is that:

”The total quantity of waste should not increase, and the maximum possible use should be made of the resource that waste represents, while at the same time minimising the impact on, and risk to, health.”

Although progress has been made over the last ten years, there is still plenty of scope for improvement. Action in the following areas must be given priority if the overall goals for waste management are to be achieved.

1. Implement the regulations and use the instruments decided on, and monitor progress to ensure they achieve the desired effect.

Provided the regulations decided on are implemented and the instruments that have been introduced are used, the environmental impact of waste management will be fairly limited in comparison with that of other sectors.

A large number of new regulations and instruments have been introduced since the 1990s. We are now in the process of implementing them and monitoring their effects. Guidelines, self-regulation, regulatory control and monitoring are therefore essential to ensure that the measures decided on are implemented. Monitoring and evaluation should take priority to find out whether measures decided on have had the desired effect, or whether further action should be taken. We consider this more important than introducing new regulations or instruments. It is particularly important to implement and monitor compliance with regulations governing landfill sites and hazardous waste, to ensure low emissions of hazardous substances. The introduction of a tax on waste incineration, greater emphasis on the ”rules of consideration” in the Environmental Code and an efficient household waste collection system are important means of encouraging increased materials recovery.

2. Place greater emphasis on reducing the quantity of waste and the hazard it poses.

Although waste management now makes better use of the resource that waste represents, and environmental impact in the form of emissions has decreased, there has been no marked reduction in waste quantities. And even though use of a large number of hazardous substances has been banned or has very much declined, large quantities of these substances must still be dealt with in waste management.

The quantity of waste and the hazard it poses can only be mitigated to a limited degree by action taken at the waste stage. Measures to reduce the quantity of waste and the hazard it poses should primarily be taken as part of the strategy on products and chemicals. The environmental objectives strategy for non-toxic and resource-efficient natural cycles should be used to implement measures reducing the environmental impact of products throughout their life cycle.

Under the strategy for non-toxic and resource-efficient natural cycles, we wish to draw particular attention to the following instruments and measures:

- The "rule of consideration" in the Environmental Code requiring knowledge and conservation awareness should be brought to the fore so that resources can be used more efficiently in the manufacture and use of products.
- Chemicals that cannot be dealt with safely at the waste stage should be phased out in line with the Non-Toxic Environment objective, or should be rejected on the basis of the product choice criteria in the "rules of consideration".
- Instruments such as sustainable procurement, environmental management and eco-labelling should be used to reduce the overall environmental impact of products. This will aid development of products requiring fewer resources and less use of hazardous chemicals.

This will enable us to reduce the quantity of waste and the hazard it poses.

3. Improve knowledge about pollutants

Because of the large number of hazardous substances that have been, and still are, handled, waste management continues to constitute a major environmental risk. We still know little about some of the long-term risks and effects of diffuse emissions of hazardous substances from landfill in particular, as well as from dispersal of hazardous substances via materials recovery and biological treatment of waste containing low concentrations of hazardous substances.

Waste treatment methods should therefore be evaluated in combination with research to provide a basis for assessing the need for further measures. When conducting regulatory control, self-regulation and considering permit applications, particular attention should be paid to the risks posed by environmental pollutants. Research programmes should give priority to research into risks and effects of pollutants in waste treatment.

4. It must be easy for households to sort their waste

Reduced landfilling and increased recovery and recycling have largely been achieved by household sorting of waste at source. Public confidence is essential if the progress achieved is to be maintained. It must be easy to sort household waste in the right way.

Waste collection by municipal authorities and producers alike works very well in many municipalities. But both systems need to be developed so that all households have access to a high standard of service. The effort and expense involved must be in propor-

tion to the environmental benefit. Information must be available about the purpose of sorting and how it should be carried out. The results of sorting should be fed back to consumers.

The division of responsibility between producers and municipalities should not change but cooperation between them should be further developed. It is important to monitor this cooperation and service levels.

5. Develop Swedish participation in EU work in the waste management field

EU membership has changed the way in which Swedish waste management is regulated. Key decisions on policy and regulations are now decided by the Union.

Sweden should have a clear strategy as to how waste issues should be pursued in the EU. Public agencies as well as other actors should improve their efforts to produce quality-assured, balanced Swedish standpoints.

When the process of drafting a new directive begins, there must be a basic Swedish standpoint on which there is broad agreement. Stakeholders should have been given the opportunity to comment on the standpoint. A group of representatives from industry and agencies etc. should be involved in every directive or committee. The Waste Council should be used to gain support for Swedish policy and strategies.



PART 2:

Swedish waste management

Swedish Waste Policy

Over the years waste has sometimes been regarded as a resource, sometimes as an environmental problem. Responsibility for waste treatment was allocated to a number of actors in the 1990s. In addition, a series of instruments have been introduced over the last ten years to move away from landfill and towards incineration. EU strategies and regulatory frameworks have increasingly influenced developments in Sweden. A detailed account of developments is given in APPENDIX B, Swedish Waste Policy.

Environment Protection Act

The Environment Protection Act 1969 imposed far-reaching environmental obligations on new waste treatment facilities. The importance of waste as a resource was emphasised in the 1970s, when sorting, composting and incineration facilities were built.

In the 1980s the focus shifted to reducing the quantity, hazard and environmental impact of waste. As a result, more stringent requirements were imposed on emissions from waste treatment, together with phase-out or substitution of hazardous substances. Municipal planning responsibility was also introduced in 1991.

Producer responsibility

1992 saw a bill introducing the concept of "ecocycles". This requires sustainable reuse, recycling or safe disposal of everything taken from nature, using a minimum of resources and without harming the environment. The most important feature of the Government's proposal was to impose upon producers physical and economic responsibility for collecting and disposing of certain end-of-life products.

Landfill tax and landfill bans

In 1997 a bill was presented entitled "Management of end-of-life products in an ecologically sustainable society – a common responsibility". The bill focused on measures to reduce landfilling of waste. A ban was imposed on landfilling burnable and organic waste. From 1999 onwards the right of municipalities to extend their public cleansing responsibility was restricted to hazardous industrial waste. A tax on waste going to landfill was decided the same year and entered into force in January 2000.

Environmental Code

The Environmental Code was enacted in 1998. It codified a number of existing laws and replaced the Environment Protection Act. The code also sets out principles applying to everyone impacting the environment.

EU harmonisation

Following the EEA agreement and Sweden's accession to the EU in 1995, Swedish waste management is subject to EU policy and regulatory frameworks. The core of the policy is known as the EU "waste hierarchy". This gives first priority to reducing the quantity of waste and the degree of hazard it poses. The waste nonetheless generated is to be reused or recycled and, in the last resort, landfilled.

EC directives and regulations have had a great impact on Swedish waste management. The Framework Directive on Waste, the Landfill Directive and the Waste Incineration Directive are of great importance.

Environmental objectives

The Government adopted national environmental quality objectives in 1999. Progress towards achieving the objectives is monitored regularly and they are amended as necessary by Parliament following Government proposals. The Government's latest proposal includes a separate statement setting out general principles and quantified interim targets for waste management. Since environmental objectives relating to waste are dealt with under the environmental objectives system, the purpose of the waste

plan is to set out a coherent waste policy and highlight priority strategies and measures to achieve the objectives.

The government bill presented in 2003 ("A Society with Non-Toxic and Resource-Efficient Natural Cycles") emphasises the importance of waste management as part of our infrastructure. Waste planning is to be given greater weight by a national waste plan and clearer regional planning. A national Waste Council is to assist the Swedish EPA, which was also given responsibility for ensuring efficient waste management. The Government also proposed increased local adaptation of producer responsibility by better standards of service and municipal responsibility for information.

The present task in waste policy is to carry out measures on the basis of the latest bill. In September 2005 the Government proposed that a tax on incineration of the fossil fraction of waste should take effect as from 2006. The forthcoming EU thematic strategy on prevention and recycling of waste and implementation of the EC Waste Statistics Regulation are important. The EU "REACH" regulatory framework for chemicals provides an essential means of discovering and reducing quantities of hazardous substances in products and hence in waste.

EU strategy to 2010

An EU strategy for sustainable development was established in 2001. A number of policy conclusions were adopted in Gothenburg on that basis. Those conclusions are referred to here as "the EU sustainability strategy". The environmental dimension of the strategy complements the economic and social conclusions reached in Lisbon. The environmental dimension of this strategy is clarified in "Environment 2010: Our future, our choice; 6th EU Environment Action Programme 2001 – 2010".

The Commission identified four priority areas in the programme. Sustainable use and management of natural resources, together with sustainable waste management, is one such area. To further progress in this area, the Commission intends to propose a thematic strategy in 2005, focusing on prevention and recycling of waste, as well as conservation of natural resources.

This thematic strategy is intended to strengthen and develop EU waste policy in the years to 2010. Important initiatives include improving compliance with existing regulations, simplifying the regulatory framework, introducing environmental impact targets, planning in member states to reduce waste quantities, clear delineation between recycling and disposal, and clarification of the point at which waste becomes a product.

Planning and infrastructure

Waste statistics

EU strategy

Waste quantities

Large amounts of
industrial waste



Some 90 million tonnes of waste was generated in Sweden in 2002. Resource extraction, mainly mining, generated just over 54 million tonnes of waste. Manufacturing industry produced about 19 million tonnes ⁽⁷⁾.

Some 4.2 million tonnes of household and similar waste was produced in 2004 ⁽³¹⁾. Sludge produced at municipal sewage treatment plants is fairly constant at approximately 1 million tonnes (equivalent to about 220,000 tonnes total solids) each year.

No survey has been made of the quantity of construction and demolition waste, but it may be around 5 - 10 million tonnes, including excavated material. The quantity of industrial waste produced outside manufacturing industry is also highly uncertain, but may total around 2 million tonnes.

Industrial waste

Resource extraction and manufacturing industry produced a total of just over 73 million tonnes of waste in 2002. Resource extraction produces most waste owing to extensive mining operations in Sweden. The pulp and paper industry and the wood and wood products industry account for the majority of manufacturing waste, following by steel and metal works and the engineering industry. ⁽⁷⁾

Compared with the latest figures (1998), mining waste has diminished by about 10 million tonnes. Waste quantities from manufacturing industry have fallen marginally. There was approximately 700,000 tonnes of hazardous waste in 2002, down approximately 100,000 tonnes on 1998. The quantity of industrial waste produced depends on the economic climate, industrial structure, development of cleaner technology and emission control requirements. ^(7, 27)

Table 7. Quantity of industrial waste produced by sector in 2002, 1,000 tonnes ⁽⁷⁾

Sector	Total 2002	Hazardous waste 2002
Resource extraction, mostly mining	54,432	2
Manufacturing	18,690	674
Including:		
Food, drink and tobacco industries	934	11
Textile, clothing and fur industry, tanneries	32	0
Wood and wood products, furniture ¹	5,752	5
Pulp, paper and paper products, graphics industry	6,464	16
Chemicals, rubber and plastic goods industry	399	135
Soil and stone goods industry	349	1
Steel and metal works	2,735	298
Engineering industry ¹	2,016	208
Other manufacturing industries, not including furniture	9	0
Total	73,122	676

¹ Some of the waste quantities given above are highly uncertain, particularly with regard to the engineering industry and wood products industry.

Household waste

Approximately 4.2 million tonnes of household waste was collected in 2004, which is slightly less than in 2004 and on a par with 2002 ⁽³¹⁾. The quantity of household waste has hitherto risen in line with consumption. It is not yet clear whether the levelling off represents a new trend. One reason that waste quantities are no longer rising as fast may be that the statistics do not reflect the increased storage of waste.

Under chapter 15, section 2 of the Environmental Code, household waste is "waste from households and similar waste from other activities". In practice, this represents waste from households, shops, offices, restaurants, institutions and businesses with mixed waste in bags or bins handled using the same system as that for household waste.

Household waste includes paper, cardboard, kitchen waste, packaging, glass, textiles, metal, wooden and plastic objects, electronic waste, garden waste, bulk waste, hazardous waste, latrine, sludge from septic tanks. Latrine and sewage sludge are not included in the statistics, however, since they are normally sent to sewage treatment plants.



Waste in bags and bins made up around half the quantity of household waste in 2000. The composition of this waste has altered substantially since the advent of sorting at source and recycling. Random sample analyses suggest that around 70 per cent of this waste is biodegradable. ⁽³²⁾

In 2004 40 per cent of household waste in bags and bins consisted of food waste. Packaging is another large fraction. Waste in bags and bins also contains newspapers, garden waste, nappies (diapers), other burnable waste, textiles and other types of waste.

⁽³²⁾

70 per cent biodegradables

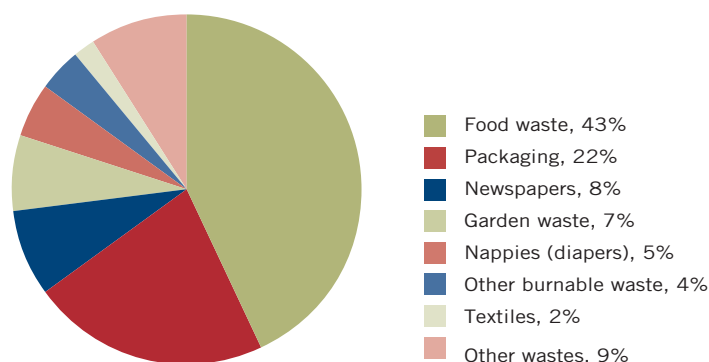


Figure 1. Breakdown of waste in bags and bins, 2004. ⁽³²⁾

Waste disposal



75% of industrial waste
is recycled

Collection

Operators are responsible for waste from industrial and other operations. This is often collected by private contractors. Some municipalities offer small and medium-sized businesses the opportunity to take their waste to recycling centres.

At present, household waste that is not subject to producer responsibility is collected by municipalities themselves or by their contractors. Bulk household waste, electrical and electronic waste, and hazardous waste is often taken to municipal recycling stations or left in a bulk waste room. Other types of waste, such as packaging, newspapers, glass, metal, plastics and batteries, are collected from recycling stations or collection centres in residential areas on the instructions of producers. Municipalities increasingly arrange for household food waste to be collected from homes.

Nowadays spent batteries can be placed in one of numerous collection boxes or in shops, whereas household hazardous waste must be taken to special collection stations. Hazardous waste collection methods vary from one municipality to another; this waste is usually collected from boxes left at the gate, hazardous waste collection stations at selected petrol stations or from recycling centres. Producers and municipalities assume joint responsibility for end-of-life electrical and electronic products, which are taken to municipal recycling centres.

Disposal of manufacturing waste

Material recovery and incineration with energy recovery account for almost 75 per cent of waste handled from manufacturing industry, not including resource extraction. Significant quantities of waste from the pulp and paper industry, as well as from steel and metal works, were landfilled in 2002.

The pulp and paper industry accounts for one third of manufacturing waste. Resource extraction (mainly mining) is the next largest producer of this type of waste, almost all of which is landfilled. As yet, there are no comparable statistics on changes in the quantity of recycled and landfilled manufacturing waste. ⁽⁷⁾

Table 8. Disposal of non-hazardous industrial waste in 2002 (ktonnes). ⁽⁷⁾

	Total quantity	Landfill	Incineration		Biological treatment	Other recycling	Other*
			With energy recovery	Without energy recovery			
Resources extraction – mining	54,431	51 786	1	0	0	1,521	1,122
Pulp, paper and graphics industry	6,448	583	4,732	4	192	905	31
Wood and wood products, furniture	5,747	45	2,215	3	3	3,471	10
Steel and metal works	2,437	608	9	0	0	1,674	146
Engineering	1,808	194	81	6	26	1,211	290
Food, drink and tobacco	923	146	52	2	183	482	59
Soil and stone goods	348	109	6	0	0	210	24
Chemicals, rubber and plastics	264	92	69	1	17	78	6
Textile, clothing and furs industry, tanneries	32	4	11	0	5	11	1
Other manufacturing	8	0	5	1	0	1	0
Total	72,446	53,567	7,181	17	426	9,546	1,689

*) Temporary storage, removal transport and export

Disposal of household waste

Some 90 per cent of household waste was recycled in some way in 2004. This is a considerable rise on previous years. About the same amount of waste is recycled by material recovery and biological treatment as by incineration with energy recovery. Less than ten per cent of waste now goes to landfill. ⁽³¹⁾

90% of household waste
is recycled

Table 9. Quantities of household waste treated in 2004. ⁽³¹⁾

Treated quantity of household waste in 2004	Tonnes	Kg/person	%
Material recovery	1,384,760	153,7	33,2
Biological treatment	433,830	48,1	10,4
Incineration with energy recovery	1,944,290	215,8	46,7
Landfilling	380,000	42,2	9,1
Hazardous waste	25,700	2,9	0,6
Total	4,168,580	462,7	100

Incineration and material recovery in particular, as well as biological treatment, have increased sharply in recent years. Landfill has fallen from approximately 1.4 to around 0.4 billion tonnes of waste. Biological treatment still accounts for a small proportion, but is expected to increase. Material recovery has remained steady at high levels in recent years.

The amount of hazardous waste collected has increased since 1998 and totalled 25,700 tonnes in 2004. Random sample analyses have revealed a further 4,600 tonnes of hazardous waste mixed in with other household waste. Management of household waste between 1994 and 2004 is shown in the table below.

The proportion of biodegradable municipal waste going to landfill in 2003 was approximately 17 per cent of the quantity of such waste generated in 1995. This meets the requirement set in the EC Landfill Directive (1999/31/EEC) that by 2016 no more than 35 per cent of the total quantity of biodegradable municipal waste generated in 1995 should go to landfill.

Sweden has met the EU target for reduced landfilling

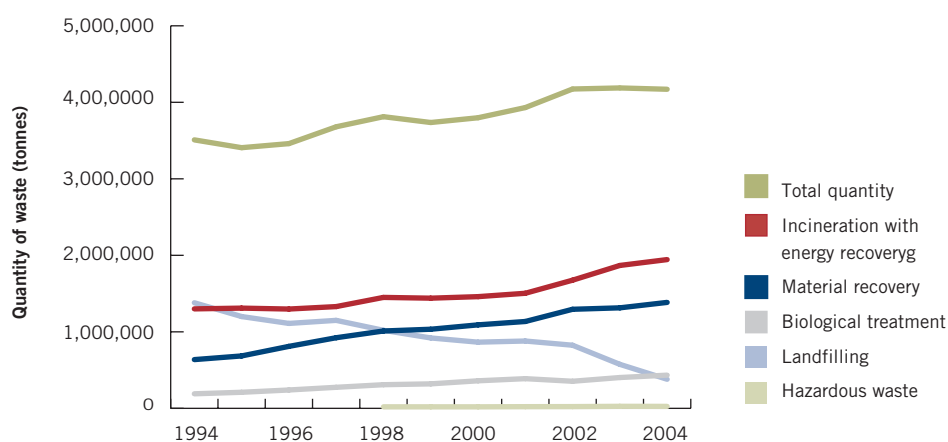


Figure 2. Quantity of household waste treated between 1994 and 2004. ⁽³¹⁾

Table 10. Total and landfilled quantity of biodegradable waste. ⁽¹³⁾

Year	Total quantity of biodegradable municipal waste	Quantity of biodegradable municipal waste put into landfill	Proportion of biodegradable municipal waste put into landfill (base year 1995)
1995	2,540,000		
1998		800,000	32 %
2003		428,000	17 %

Material recovery

Material recovery comprises recycling whereby other manufacturing or construction materials are substituted. For instance, scrap, recycled paper and recycled plastics can replace a certain amount of new raw materials in manufacture. Some kinds of waste, such as ash and excavated materials, may be suitable for use as ballast in road building, where it can replace gravel and crushed rock.

Just over 8 million tonnes of manufacturing industry waste was recycled. The greatest quantities are recycled in the wood and wood products industry, steel and metal works and the engineering industry. 60 per cent of waste was recycled in the wood and wood products industry, and no less than 68 per cent in the steel industry. Scrap steel is not included as waste in the figures for 2002. ⁽⁷⁾

The amount of construction and demolition waste, and industrial waste other than that from manufacturing, that is used for recycling at factories and in construction has not been surveyed. The reduction in quantities of this waste going to landfill suggests that increasing quantities are recovered into materials.

It is likely that large quantities of sludge from municipal sewage treatment are also used in soil cultivation or construction works. Landfill has decreased sharply in recent years, from around 50 per cent in 1999 to about 15 per cent in 2003 ⁽³¹⁾.

Approximately 1.38 million tonnes of household waste (154 kg/person) was recovered into materials in 2004. Material recovery therefore accounts for about 33 per cent of the treatment of household waste, which is a small rise since 2003.

The quantity of household waste undergoing materials recovery is increasing for all types of material except refrigerators and freezers for freon recovery. In terms of quantity, recycled paper and corrugated paper predominate, although the percentage collection figures are higher for refrigerators, freezers, glass and metal. ⁽³¹⁾

Material recovery of packaging has increased steadily since 1994. The increase has levelled off in recent years, however ⁽¹⁴⁾. Some 580,000 tonnes of household waste was recovered into materials in 1994 ⁽⁵⁾. This represents an increase in materials recovery of household waste of around 140 per cent between 1994 and 2004.

40% of industrial waste is recovered into materials

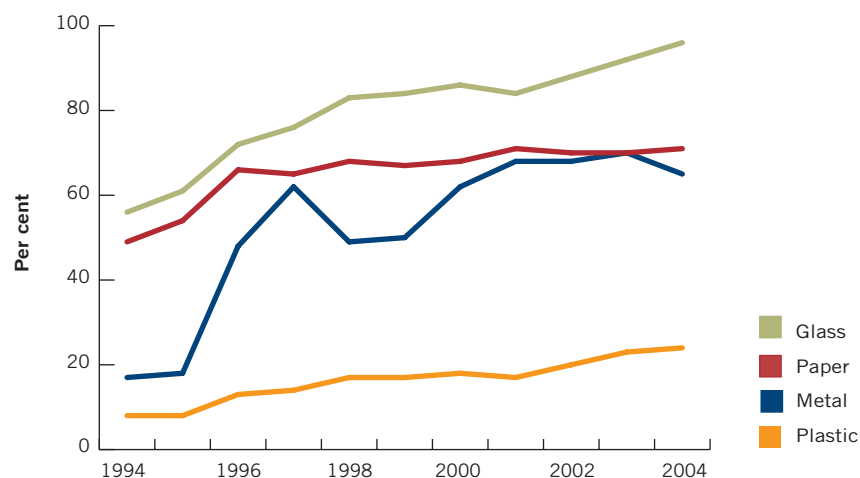


Figure 3. Total material recovery of packaging and recycled paper from households and industry between 1994 and 2004. ⁽¹⁴⁾

Biological treatment

Biological treatment entails digestion and composting of degradable waste. Digestion involves biological decomposition of organic matter into biogas under anaerobic conditions. Composting involves biological decomposition of organic matter into carbon dioxide and water with a plentiful supply of oxygen. The energy in the waste that breaks down is released in the form of heat. The compost or digestion residues produced are normally used as fertiliser or for soil cultivation.

Approximately 430,000 tonnes of manufacturing waste was recycled by biological treatment in 2002. Half of this came from the pulp and paper industry. Around 518,000 tonnes of waste other than manufacturing waste underwent biological treatment in 2004. 244,000 tonnes of this went to digestion and 274,000 tonnes was composted. ⁽⁷⁾

Just over 10 per cent of household waste underwent biological treatment in 2004, i.e. about 430,000 tonnes of waste. Half of the waste treated in 2004 was waste from parks and gardens, and one third was food waste. ⁽³¹⁾

In addition, more than two thirds of the one million tonnes or so of the sludge produced at Swedish municipal sewage treatment works is digested. Some of the sewage sludge is composted before being used.

Incineration

Almost all energy produced by waste incineration in Sweden is recovered. This is due to the need for heating throughout much of the year and the fact that virtually all urban areas have extensive district heating networks.

In total, some 10 million tonnes of waste underwent incineration with energy recovery in 2002. Approximately 5.2 million tonnes of manufacturing waste was incinerated by the industry itself. A further 2 million tonnes or so of industrial waste was

10% of household waste is treated biologically

All towns and cities have district heating networks

incinerated at external facilities. Approximately 3.2 million tonnes was incinerated at traditional waste incineration plants.

Approximately 40 per cent of industrial waste is incinerated. Most waste was incinerated in the pulp and paper industry, where some 73 per cent is dealt with in this way. Another sector in which incineration is prevalent is the wood and wood products industry, where some 39 per cent of waste is incinerated. ⁽⁷⁾

There were 29 dedicated waste incineration plants in 2004, at which around 3.2 million tonnes of waste was incinerated in 2004, including approximately 1.9 million tonnes of household waste and 1.2 million tonnes of industrial waste. Hence, just less than half of household waste was incinerated. There are also just over one hundred thermal energy plants, of which a small proportion incinerate waste. ⁽³¹⁾

The landfill bans and tax doubled the quantity of waste going to waste incineration proper and the energy recovered from it between 1994 and 2004. Existing plants, in particular, have increased their capacity. Ten or so new plants have come into operation and more are planned.

Energy recovered from household waste increased substantially between 1994 and 2004. Total energy recovered rose from 4.3 till 9.3 TWh between 1994 and 2004. Energy recovery from household waste increased from approximately 3.4 TWh in 1994 (approximately 79% of 4.3 TWh) to around 5.7 TWh in 2004 (61% of 9.3 TWh). This is based on the simplified assumption that the proportion of incinerated household waste equals the proportion of energy recovered. A total of some 1.7 million tonnes of waste was incinerated in 1994, including 1.34 million tonnes (i.e. 79%) household waste ⁽⁵⁾. Household waste accounted for 61 per cent of waste incinerated in 2004. ⁽³¹⁾

Around 10 million tonnes of waste is incinerated

40% of industrial waste is incinerated

Half of household waste is incinerated

Energy recovery doubled between 1994 and 2004

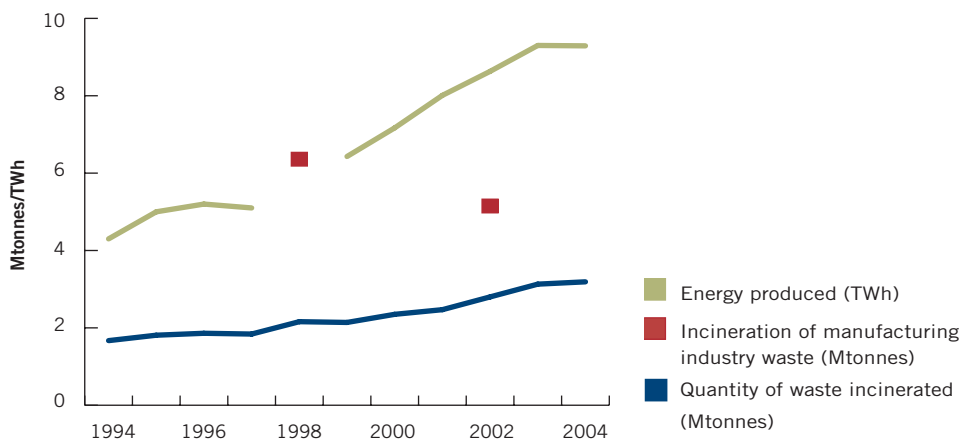


Figure 4. Quantities of waste incinerated and energy produced at waste incineration plants and in manufacturing industry between 1994 and 2004. Quantities of waste and energy produced refer to non-industrial incineration at waste incineration plants. ⁽³¹⁾

Landfill

A landfill site is a place for storage of waste. Storage of waste for less than three years before recycling or treatment, or for less than one year before final disposal (usually by landfill) does not constitute a landfill site under the Waste Ordinance (SFS 2001:1063). Landfill takes place at waste treatment facilities proper and also in sectors in which waste management is a secondary activity.

Approximately 1.8 million tonnes of manufacturing waste was landfilled in 2002, including just under 1 million tonnes landfilled at industrial sites ⁽⁷⁾. There are around 140 landfill sites belonging to companies in the manufacturing sector. It is likely that landfill of manufacturing waste has decreased significantly. For instance, pulp and paper industry waste going to landfill fell from around 1.25 million tonnes in 1994 to approximately 0.43 million tonnes in 2004 ^(11, 37).

In 2004 some 2.5 million tonnes of waste was landfilled at sites where waste management is the main operation. Approximately 6.1 million tonnes of waste was landfilled at such sites in 1994. This means that landfill more than halved between 1994 and 2004. Industrial waste is now the predominant kind of waste landfilled at these sites. In addition, several million tonnes of waste undergoes transfer, sorting, intermediate storage and recycling at sites of this kind.

There were some 175 non-industrial landfill sites in 2004. This number has fallen by half since 1998 and is expected to decrease further. This is due to a sharp fall in the quantity of waste going to landfill and the introduction of substantially more stringent environmental standards following new EU regulations as from 2008. ⁽³¹⁾

Less than 10% of household waste goes to landfill

Landfilling outside of manufacturing industry was more than halved between 1994 and 2004



Leachate treatment at a landfill site.



Compacting waste at a landfill site.

Table 11. Landfill quantities (ktonnes/year) at facilities primarily engaged in waste treatment. ^(29, 31)

Type of waste	1994	1998	2002	2003
Household and similar waste	1,380	1,065	825	575
Park and garden waste	80	45	38	33
Construction and demolition waste	900	740	530	370
Waste from energy recovery	660	710	520	470
Waste from treatment of municipal sewage	610	490	215	155
Waste from treatment of industrial sewage	190	210	95	49
Sector-specific industrial waste	490	425	390	275
Non-sector-specific industrial waste	1,060	1,010	970	820
Special waste	90	203	185	187
Other	620			
Total	6,080	4,900	3,770	2,935

* Quantities landfilled in 1994 do not include plan reactors and bio cells

Treatment capacity

More recycling is needed to comply with the landfill bans

Need for recycling capacity

Since the late 1990s the amount of waste going to incineration and biological treatment has risen considerably while landfill has decreased. This is largely due to the landfill bans on burnable waste (2002) and organic waste (2005) and the tax on landfill introduced in January 2000.

To comply with the landfill bans, it will be necessary to increase recycling capacity. County administrative boards grant exemptions from the bans. Exemptions allowing 700,000 tonnes of burnable and organic waste to go to landfill were granted in 2005. In practice, it is likely that organic waste exceeding this figure goes to landfill. ⁽¹⁶⁾

Figure 5 below shows capacity utilisation at plants for biological treatment, incineration and landfill of waste during the period 1999 - 2004. A list of all facilities may be found in APPENDICES D - F.

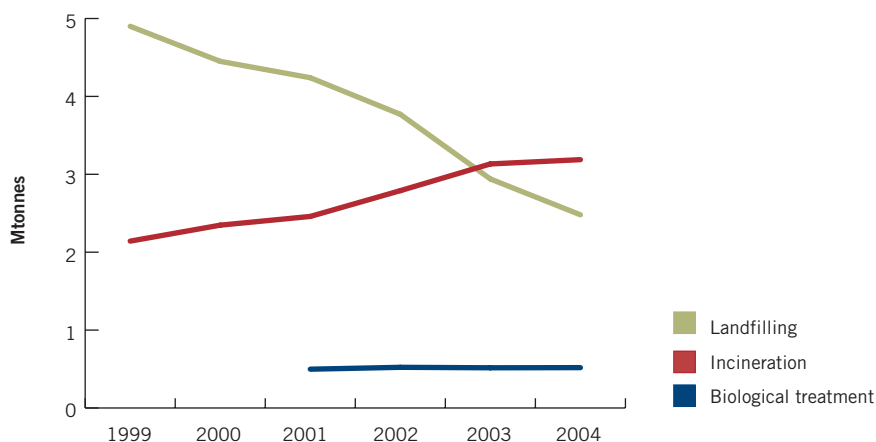


Figure 5. Waste going to biological treatment, incineration and landfilling 1999 - 2004. ⁽³¹⁾

Biological treatment

Capacity used for biological treatment of manufacturing waste totalled some 430,000 tonnes in 2002. Biological treatment of non-manufacturing waste totalled around 518,000 tonnes in 2004. An unknown amount of sewage sludge was also composted. In total, around one million tonnes of waste was treated biologically in 2004, not including sewage sludge digestion.

Capacity to increase by 2006

Biological treatment of non-manufacturing waste is expected to increase to 620,000 tonnes of waste per year in 2005, as compared with 518,000 tonnes in 2004 ⁽¹⁶⁾. It is mainly capacity at biogas facilities that is increasing; it is estimated that this capacity represents half of total capacity at present (2005). The reason for this is that digestion with energy recovery, mainly for vehicle operation, is usually better for the environment. Moreover, a government grant of approximately 30 per cent of the investment cost is

available for biogas plants. See also the section on government investment grants. The environmental objectives for recycling of food waste and for phosphorus from sewage, the ban on landfilling organic waste and the demand for materials for final cover of landfill sites are drivers of increased biological treatment. ⁽¹⁶⁾

Waste incineration

The amount of household waste going to incineration has risen sharply since the late 1990s. In 2004 there were 29 facilities for incineration of household waste in Sweden. Incineration at those facilities totalled 3.2 million tonnes, of which 1.9 million tonnes was household waste. ⁽³¹⁾

Information supplied by county administrative boards shows that there are plans to increase waste incineration at industrial and non-industrial facilities by 1.3 million tonnes by 2007 ⁽¹⁶⁾. This increase will take place mainly by increasing capacity at existing facilities. APPENDIX D, Incineration facilities with energy recovery, shows existing and planned facilities for waste incineration, not including industrial facilities.

Capacity to increase by 1.3
Mtonnes by 2007

Landfilling

Between 1994 and 2004 the number of non-manufacturing industry landfill sites, outside of the manufacturing industry, receiving more than 50 tonnes of waste a year fell from about 300 to 175 ⁽³¹⁾. This is largely due a decreasing need for landfill and higher costs owing to the landfill tax introduced in 2000, as well as the landfill bans introduced in 2002 and 2005. A similar trend is expected for manufacturing industry landfill sites.

In addition, as from 2009 landfill sites receiving waste will have to meet all the new requirements based on the EC Landfill Directive. The result of this is expected to be that many landfill sites will stop accepting waste after 2008. All in all, there is thus reason to monitor required capacity and planned capacity remaining post-2008.

The enactment of new regulations on acceptance and landfill of waste may also mean that it will not be possible to landfill certain kinds of waste in Sweden, since they exceed the limit values that will apply. If landfill is not possible, the waste will have to be pre-treated before landfill or exported for recycling or final disposal.

Sharp drop in number of landfill
sites by 2009

Hazardous waste

Hazardous waste is waste possessing properties or containing substances that are undesirable or can cause a greater impact on health or the environment than other waste. The Swedish market for hazardous waste is fairly small in volume terms, and so there are a limited number of treatment facilities. Capacity for dealing with certain types of hazardous waste is therefore only available at a few places in Sweden.

Many facilities specialise in processing a specific kind of hazardous waste or in using a specific method. Hazardous waste can be processed by incineration, wet chemical treatment, biological treatment and landfill.

Waste is also commonly pre-treated. Examples of pre-treatment include evaporation or removal of hazardous components in electronic waste. ⁽¹²⁾

Few treatment facilities for hazardous waste in Sweden

- Waste oil can be refined and then burnt. There are three main specialists in Sweden. There are no operators engaged in regeneration of waste oil in Sweden.
- Batteries have been covered by the Batteries Ordinance since 1 January 1998. Once they have been collected and sorted, batteries are taken to various recycling facilities or repositories. These are located at Landskrona, Kumla and Oskarshamn.
- Electrical and electronic waste is pre-treated, i.e. it is sorted or dismantled before being sent for further treatment. Most of this waste is dismantled by hand by certified pre-treatment enterprises. There are around 30 private and municipal operators engaged in dismantling electronic equipment in Sweden.
- Oily waste, such as sludge from petrol stations and oil separators can be processed at a number of facilities throughout Sweden.
- Waste containing more than 0.1 per cent mercury by weight must be sent for storage in a deep rock repository as from 2015. In the meantime the Government has appointed a coordinator to establish the repository.
- Quantities of hazardous waste in the form of contaminated soil are increasing. There were 38 treatment facilities in 2004. The waste is usually treated using biological methods.
- There were around 60 reception stations for contaminated soil in 2004 ⁽¹⁰⁾.



Processing hazardous waste.

Environmental impact of waste

Effects on the environmental objectives

Waste management entails sorting, collection, transport, intermediate storage, recycling and landfill. The results shown in Tables 1 and 12 suggest that the relative importance of waste management is a few per cent for many environmental objectives, particularly taking into account emissions from alternative systems. The results indicate that waste may be somewhat more important vis-à-vis the Reduced Climate Impact and Non-Toxic Environment objectives, and these objectives are therefore dealt with separately below.

The table below shows the impact of waste management on various environmental objectives. Most of the figures are based on results from a general system analysis study performed by the Swedish Environmental Research Institute (IVL). However, the data on the climate impact of waste have been taken from Swedish EPA Report 5392 ⁽¹⁵⁾. The figures on total emissions are from national statistics ⁽³³⁻³⁶⁾ and estimates made by IVL. In the study, net impact includes the environmental impact of the alternative systems needed to produce the same utilities as waste does. Negative figures indicate that the environmental impact is greater in the alternative system. Here, the waste system can reduce environmental impact.

Climate impact and hazardous substances are most important

Table 12. Impact of the waste system on environmental objectives in relation to total Swedish emissions in 2002 ^{(28), *}

Environmental objectives	Unit	Gross impact of the waste system in 2002 (including household waste)	Net impact of the waste system in 2002 (including household waste)	Total emissions/consumption in Sweden
Reduced Climate Impact	Tonnes CO2 equiv./year	2,000,000	-	70,000,000
Non-Toxic Environment				
Emissions to air				
a. Pb	Tonnes/year	0.48 (0.42)	-	15
b. Cd	Tonnes/year	0.020 (0.014)		0.91
c. Hg	Tonnes/year	0.022 (0.014)		0.65
d. Dioxins	g/year	1.0 (1.0)		44
A Good Built Environment	Terajoules/year			
a. Consumption of raw materials for energy, total		13,300 (11,300)	-43,800 (-30,200)	2,214,000
b. Consumption of finite raw materials for energy (coal, oil, gas, uranium)		12,500 (10,400)	-2,250 (-2,710)	1,610,000
Zero eutrophication (water and land)	tonnes oxygen equiv./year	83,100 (53,200)	36,600 (16,800)	5,009,000
Natural acidification only (inc. nitrogen oxides and ammonia)	Tonnes sulphur dioxide equiv./year	9,800 (6,430)	3,410 (1,300)	407,000
Clean Air				
a. Nitrogen oxides	Tonnes nitrogen oxides/year	5,190 (3,260)	-1,050 (-1,480)	297,000
b. VOCs	Tonnes ethene equiv./year	2,530 (1,220)	1,540 (277)	199,500

* The study covers household waste and a large proportion of non-manufacturing industrial waste. It does not include recycling and manufacturing waste, or construction and demolition waste. The figures for a Non-Toxic Environment do not include emissions from crematoriums or fires at landfill and intermediate storage sites. The current value of future emissions from waste have been estimated, and so the results do not represent actual environmental impact in 2002.

The environmental impact of household waste is decreasing 1994 – 2010

According to the above study and Table 13, the environmental impact of household waste is decreasing in relation to most environmental objectives between 1994 and 2010. Emissions of all substances are falling, as is consumption of raw materials for energy. The exception is eutrophying substances, which remain largely unchanged. ⁽²⁸⁾

The main reason for reduced environmental impact and energy consumption is that waste is being recycled instead of landfilled. Negative net effects reduce environmental impact because alternative treatment involves greater environmental impact.

Table 13. Environmental net impact of household waste in different scenarios, 2010A and 2010B correspond to 2 and 0 per cent increase of waste amounts per year. ⁽²⁸⁾.

		1994	2002	2010A	2010B
Greenhouse gases	<i>Tonnes CO2 equiv./.</i>	3,449,674	2,322,376	495,489	317,324
Eutrophication	<i>Tonnes oxygen equiv.</i>	22,925	16,824	31,800	22,747
Acidification	<i>Tonnes sulphur dioxide equiv</i>	3,234	1,302	2,685	1,653
Volatile organic compounds (VOC)	<i>Tonnes ethene equiv</i>	1,240	277	-496	-455
Nitrogen oxides	<i>Tonnes</i>	753	-1,478	-1,572	-2,175
Consumption of energy, total	<i>Terajoules</i>	-20,513	-30,181	-39,921	-35,904
Consumption of energy, non-renewable	<i>Terajoules</i>	672	-2,714	-2,835	-4,053
Particulates to air	<i>Tonnes</i>	-611	-949	-1,229	-1,069

Climate impact from waste is falling sharply 1990 – 2010

Impact of waste on climate

The impact of waste on climate derives mainly from emissions of methane from landfill sites. Less landfill and more recycling will reduce the relative contribution made by waste to Swedish climate impact from around 4 per cent in 1990 to about 1 per cent between 2008 – 2012. Figure 6 below shows forecast of the relative impact on climate of various sectors to 2020. ⁽¹⁵⁾

In the long term, the impact of waste on climate will be even further reduced if waste replaces fossil fuels, not only for electricity, but also for heat production. This is because biofuels may ultimately become a limited resource in Europe.

A system analysis study has indicated that the net contribution made by household waste will be approximately 495,000 tonnes CO2 equivalents by 2010, assuming a two per cent annual increase in waste quantities. However, household waste would reduce the total climate impact by 1,870,000 tonnes CO2 equivalents if heat generated from waste replaced oil instead of replacing biofuels. This demonstrates how important it is that waste should primarily replace fossil fuels. ⁽²⁸⁾

An even greater reduction will be achieved if waste replaces fossil fuels

Despite the greater distances that waste is transported, increased recycling greatly reduces emissions of greenhouse gases as compared with landfill. This is because methane emissions from landfilled organic waste have a major impact on climate.

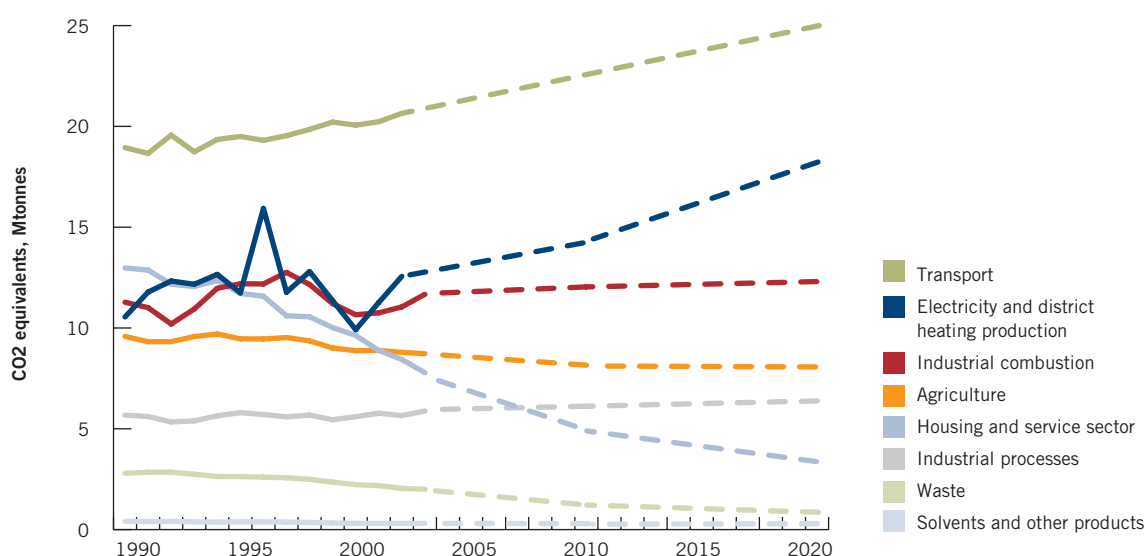


Figure 6. Emissions of greenhouse gases, historically and projected per sub-sector. ⁽¹⁵⁾

Impact of waste on a Non-Toxic Environment

Systemic studies and national statistics suggest that waste only contributes marginally to total emissions to air of dioxins and metals such as lead, cadmium and mercury.

Yet certain types of waste contain large quantities of hazardous substances. For instance, increasing quantities of metals and dioxins are present in waste incineration residues. If the waste is not dealt with properly, this may have a serious impact on health and the environment.

Dispersal of hazardous substances is normally less important, provided that waste is dealt with in an environmentally compatible way. But we need to know more about the presence and dispersal of hazardous substances. This need will become more pressing as recycling for construction purposes, for example, becomes more common.

Notwithstanding increased waste quantities, the transition from landfill to recycling of household waste during the period 1994 – 2010 is likely to reduce emissions of hazardous substances to air in many cases. The results of the study presented in the table on the next page support this view. Fires at intermediate storage and landfill sites are not included, however.

Waste management produces few emissions of hazardous substances

We need to know more about hazardous substances

Emissions of hazardous substances from household waste are falling 1994 – 2010

Table 14. Emissions to air from household waste disposal. 2010 A represents a 2% annual increase and 2010 B a 0% annual increase in waste quantities. ⁽²⁸⁾

	Unit	1994	2002	2010 A	2010 B
Lead	kg	409	422	584	487
Cadmium	kg	20	14	22	18
Mercury	kg	100	14	21	18
Dioxins	g	4	1	0	0

Environmental impact of sorting and treatment

Sorting and intermediate storage

Leachate and fire affect
the environment

Sorting and intermediate storage of waste has increased dramatically as recycling has become more widespread and landfill has decreased. This may give rise to emissions of various substances when leaching occurs due to rain or snow melt, or as organic matter decomposes. Fires also occur in combustible waste stored at landfill sites. Fires of this kind may result in major emissions of dioxins and particulates, for example.

Landfilling

Landfilling impacts climate

Landfilling principally involves emissions to air, which add to climate impact, and emissions to water, which cause eutrophication and dispersal of hazardous substances. However, some methane can be collected for energy recovery and can replace alternative fuels. But we do not know enough about the nature, quantity or long-term effects of these emissions.

We need to know more
about long-term effects

A tax on waste put into landfill was introduced in January 2000. General environmental protection regulations governing landfill followed in 2001. These regulations set exacting standards for the types of waste that may be landfilled and for the design and operations of waste facilities. A ban on landfilling sorted burnable waste was imposed in 2002, followed in 2005 by a ban on landfilling organic waste.

Far-reaching environmental
standards for landfill

Hence, only limited quantities of degradable waste will go to landfill in future. This means that future greenhouse gas emissions will fall sharply. Relatively speaking, emissions via leachate will then become increasingly important.

A large number of landfill sites in Sweden will be finally covered over within 10 - 20 years as a result of increasingly rigorous environmental standards and smaller quantities. Large quantities of material are needed to cover a landfill site. It will therefore be important to monitor developments to ensure that final cover does not cause unwanted environmental impact.

Landfill is often the most suitable alternative for waste that cannot reasonably be recycled. This may be waste that is produced in small quantities, that does not constitute a usable resource, or that contains hazardous substances.

Fires at landfill sites may produce significant emissions to air of substances like dioxins. It is therefore necessary to investigate and prevent these fires. However, fires

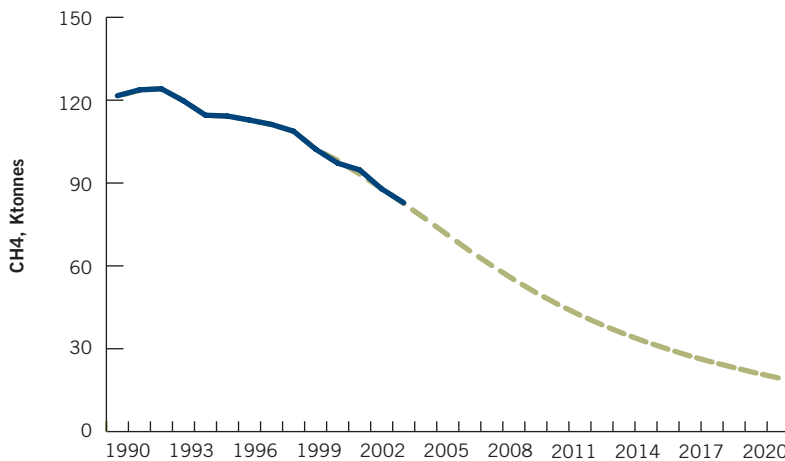


Figure 7. Emissions of methane from landfill sites 1990 - 2020. ⁽¹⁵⁾

at landfill sites are no longer thought to be as common as those at intermediate storage depots.

Older landfill sites lacking appreciable environmental protection measures may have a significant environmental impact. These sites should therefore be identified and remediated to ensure that emissions are acceptable.

Waste incineration

Incineration produces emissions of pollutants to air via flue gases and to water via discharges of water from wet flue gas treatment. Incineration destroys most organic pollutants and infectious substances at the same time, although dioxins, nitrogen oxides and other substances may be formed during the process.

Incineration with energy recovery reduces emissions from alternative energy recovery from fossil fuels or biofuels. In some respects environmental impact can be reduced indirectly by waste incineration. The greatest environmental gain is achieved where waste replaces fossil fuels.

Emissions to air have fallen substantially in recent years owing to increased waste control, better incineration processes and more efficient treatment technology. At the same time, the quantity of waste going to incineration doubled between 1985 and 2004; see Table 15 ⁽³¹⁾.

Landfilling suitable for certain types of waste

Incineration produces limited emissions of pollutants

Table 15. Emissions to air from waste incineration. Waste going to incineration doubled during the period 1984 - 2004 ⁽³¹⁾

	1985	1991	1996	2001	2004
Particulates (tonnes/year)	420	45	33	22	24
Hydrogen chloride (tonnes/year)	8,400	410	412	130	101
Sulphur (tonnes/year)	3,400	700	1121	595	337
Nitrogen oxides (tonnes/year)	3,400	3,200	1,463	1,649	1,707
Mercury (kg/year)	3,300	170	77	46	37
Cadmium (kg/year)	400	35	8	20	5
Lead (kg/year)	25,000	720	214	139	54
Dioxins (g/year)	90	8	2	1.7	0.7

Emissions have fallen sharply over the past 20 years

Far-reaching environmental standards for waste incineration

Ash contains large quantities of hazardous substances

Biological treatment may cause environmental impact and odour

Guidelines on biological treatment

Alternative energy use is causing decreasing environmental impact

More rigorous general incineration standards were introduced in 2003. These standards, which are based on common minimum regulations in the EU, also apply to existing facilities as from the end of December 2005. The standards cover emissions both to air and to water, as well as numerous process conditions. Facilities burning waste with other fuels are only partly covered by the requirements.

The increased quantity of waste burned gives rise to more ash and sludge. Fly ash and sludge from flue gas treatment contains large amounts of metals, salts and dioxins. This is because flue gas treatment equipment filters out these pollutants in the waste that is incinerated. The ash is therefore treated as hazardous waste and must be land-filled in accordance with specific regulations. Bottom ash may contain less hazardous metals as well as organic pollutants.

We need to know more about incinerated waste, and quality assurance should be further developed. The Government has therefore proposed binding rules on control of waste going to incineration.

Biological treatment

The environmental impact of digestion or composting may consist in emissions of ammonia, nitrous oxide and methane to air, and of eutrophying substances to water. If processes are not controlled and monitored actively, or if they occur in the open, there may be emissions of methane and nitrous oxide, two powerful greenhouse gases. Odour may also be a nuisance to local residents. ⁽³⁰⁾

Since 2003 guidelines have been available on sustainable storage, digestion and composting of various types of waste based on the precautionary principle embodied in the Environmental Code. For example, storage should be limited in time and food waste should be composted in closed systems with treatment of air and leachate. Digestion should also take place in closed systems, so that emissions of methane and odorous substances are minimised. Compliance with guidelines in permit procedures, regulatory

control and self-regulation should be monitored. Where necessary, general regulations may be considered.

Biogas from digestion can often replace fossil motor fuels, which reduces the environmental impact of manufacturing and using these fuels. The environmental gain normally diminishes if biogas replaces renewable fuels. Compost and digestion residues reduce the environmental impact of making and using alternative fertilisers.

Recycling by way of digestion and composting will increase over the next few years as a consequence of the environmental objective on recycling food waste. Since more controlled biological treatment is a fairly new recycling method, there is a great need to monitor its environmental impact and develop process technologies. ⁽³⁰⁾

Environmental impact must
be monitored

Material recovery

It is important that waste recovered into materials, including waste covered by producer responsibility, undergoes high quality recycling with low environmental impact. In some instances we lack knowledge of the environmental impact of recycling processes and quality assurance of the recycled product. This also applies to recycling in other EU countries or elsewhere.

Waste that is recovered into materials such as paper, metals and plastics may also contain small quantities of hazardous substances, which may be dispersed in the environment. This must be taken into account when assessing environmental impact and conservation of resources.

Alternative production derived from recycled resources such as plastics, metals and paper yields great environmental benefits. Replacing fossil fuels and materials with materials recovery yields greater environmental benefit than replacing renewable materials.

Alternative materials affect
environmental benefit

Use of waste on land

Use of various recycled waste types on land or in soil may result in eutrophication/nitrogen saturation, as well as dispersal of hazardous substances to soil and water. We need to improve our knowledge of the quality and environmental characteristics of waste in various applications.

The ban on landfilling organic waste, the landfill tax and the need for final cover of landfill sites provide an impetus for increased recycling of waste on land. Examples of applications are use as fertiliser and for soil cultivation, as well as construction of roads, golf courses, noise screens and material for covering landfill sites.

Sustainable recycling of waste for construction purposes has not been defined and practices vary throughout the country. It is therefore necessary to produce guidelines or propose regulations governing this type of recycling.

There are well-established environmental standards governing the use of sewage sludge as a fertiliser on arable land. Voluntary quality assurance schemes for using sludge, compost and digestion residues have also existed for a number of years. The efficacy of these voluntary schemes should be examined.

A definition of sustainable
use on land is needed

Division of responsibility

A clear division of responsibility for waste management makes long-term planning and investment easier. This in turn helps to make waste management more ecologically sustainable. The Waste Ordinance imposes physical, economic and legal responsibility for various kinds of waste on waste owners, municipalities and producers. Various agencies also play a key role in ensuring that waste management is environmentally acceptable and becomes more sustainable.

Waste owners

The waste owner is responsible

Anyone producing waste is responsible for ensuring that it is dealt with in accordance with current regulations. This applies both to private individuals and to commercial operators. Hence, individuals must sort their waste and take it to the right place. The owner also decides who will be given the task of disposing of waste. Exceptions are household waste, for which municipalities are responsible, in some municipalities all hazardous waste, and waste covered by producer responsibility.

The "rules of consideration" in the Environmental Code apply to everyone

Chapter 2 of the Environmental Code contains "rules of consideration" to be observed by anyone running an operation or performing an activity. These rules require waste owners to possess sufficient competence and use the potential for recycling and reuse.

Producers

Producers of certain goods are responsible for them when they become waste

Sweden has producer responsibility for end-of-life packaging, cars, tyres, recycled paper and electrical and electronic products. Voluntary commitments have also been made by the office paper, construction waste and agricultural plastics sectors.

This responsibility imposes on anyone manufacturing or importing a product a duty to ensure that it is collected, processed and recycled. The aim is to persuade producers to reduce waste quantities and ensure that waste is less hazardous and easier to recycle.

Producers establish joint ventures

Producers have established "material companies", which contract service providers to arrange the actual waste management and ensure that targets are met. Collection and recycling are financed by the charge allocated by each material company to the products covered by producer responsibility.

Municipalities

Municipalities are responsible for household waste and waste planning

Sweden's 290 municipalities are responsible for collecting and disposing of household waste, except for the product categories covered by producer responsibility. Municipalities are also responsible for collecting dry-cell batteries. Some municipalities have also exercised their right to assume responsibility for collecting all hazardous waste. This occurs in just over 100 of the 290 municipalities ⁽¹²⁾.

Swedish municipalities have an additional responsibility to draw up municipal public cleansing procedures and a waste plan. Municipal waste management is financed by charges paid by individual property owners, not via municipal tax.

As public authorities, municipalities also consider the permissibility of small-scale activities. They also exercise regulatory control in most cases, except for certain large-scale facilities, which are regulated by the county administrative boards.

Regulatory authorities intervene in the event of non-compliance with the provisions of the Environmental Code. The authorities must make a report to the police or prosecutor and/or impose a fine if an operator breaches environmental regulations.

County administrative boards

The 21 county administrative boards are the permit-issuing authorities for the majority of operations, a limited number of major facilities being granted permits by the environmental courts. Alongside a certain amount of regulatory activities, the boards also guide municipalities on regulatory issues. Moreover, county administrative boards are responsible for regional waste planning, which includes monitoring available capacity.

County administrative boards act as regulators and issue permits

Swedish EPA

The Swedish Environmental Protection Agency is the central environmental authority, acting as a driving force and coordinator in environmental policy and protection. The agency produces regulations, general guidelines and other guidance, including regulatory guidance. It is also a stakeholder with an environmental agenda in conjunction with permit applications under the Environmental Code. Additionally, the agency supports the Government in EU environmental policy and protection.

The EPA takes the initiative and implements waste policy

The EPA's responsibility in the waste sector has been extended to include ensuring that waste management is environmentally acceptable, socio-economically efficient and simple for consumers. A national Waste Council was therefore set up at the agency in 2004 to provide support and consultation in the implementation of waste policy.

The EPA monitors progress to ensure that waste management is socio-economically efficient

The EPA also monitors achievement of various environmental objectives and coordinates the overall strategy governing the objective: "non-toxic and resource-efficient natural cycles".

The environmental courts and the Environmental Court of Appeal

The environmental courts issue permits for a number of major industrial facilities and hear appeals of decisions made by other authorities. Examples include permits for hazardous operations and other environmental protection issues concerning public cleansing, hazardous waste, damages and compensation matters having an environmental dimension. There are five environmental courts at various locations in Sweden. Their judgments can be appealed to the Environmental Court of Appeal at Svea Court of Appeal and thence to the Supreme Court. Judgments of the Court of Appeal and Supreme Court constitute legal precedents.

Environmental courts issue permits for large facilities

The Environmental Court of Appeal decides appeals

The waste market

To develop infrastructure and maintain effective competition, there is a need for clear regulations in the waste market. The Swedish EPA oversees the market to ensure there is capacity for waste management, that it is socio-economically efficient and simple for consumers.

The waste management market comprises those responsible for, or dealing with, waste. Municipalities, producers and waste owners are therefore market participants. Private enterprise, municipal departments and municipal companies are participants performing actual waste management.

Industrial waste

Industrial waste collection and materials recovery are managed primarily by private enterprise. Municipal entities are responsible for a significant proportion of recycling by incineration and biological treatment, as well as disposal by way of landfill. ⁽¹²⁾

Household waste

Household waste falling under municipal responsibility is collected in roughly equal proportions by municipalities themselves or by their contractors. The trend is increasingly to expose waste management to market forces and to engage private contractors to perform the work.

Almost all household waste falling under municipal responsibility is treated by municipal administrations themselves or by municipal companies. In recent years private energy companies have acquired a number of municipal facilities for incineration of household and other waste. ⁽¹²⁾

Hazardous waste

Most hazardous waste is collected by private service providers, even where municipalities have a wider responsibility. Hazardous waste is treated both by private companies and by municipalities or their companies. At present there are only a few treatment options. Hence, one trend is for private and municipal participants increasingly to choose foreign waste treatment operators. ⁽¹²⁾

Waste covered by producer responsibility

At the request of the "material companies", private stakeholders collect the majority of waste covered by producer responsibility (packaging and recycled paper). This waste is usually also recycled by private operators. A limited proportion of packaging and recycled paper that is not recovered into materials ends up in household waste and is recycled by municipalities by incineration with energy recovery. ^(12, 31)

The "El-kretsen" material company has concluded agreements with municipalities under which they are to accept historical electrical and electronic waste from households at recycling stations. The waste is then processed mainly by private operators.

Most industrial waste collection and material recovery is performed by private enterprises

Municipalities receive historical electrical and electronic waste

Experience of instruments used

Powerful instruments have been introduced over the last few years to improve the ecological sustainability of waste management. The measures taken have primarily increased recycling and reduced the amount of waste going to landfill, although a collateral aim has been to reduce quantities of waste and the hazards it poses. Some of the main instruments are described below, together with experience of their use.

The "rules of consideration" in the Environmental Code

The "rules of consideration" set out in chapter 2, sections 1 – 7 of the Environmental Code, apply to all activities. The Conservation and ecocycle principle imposes a duty to conserve raw materials and energy, and to use the potential for reuse and recycling. Other important rules of consideration are the competence requirement, the precautionary principle and the product choice principle. The rules of consideration are applied in permit application procedures, regulatory control and self-regulation. The environmental objectives of conservation of resources and low environmental impact provide support when applying the rules of consideration.

The rules of consideration have not yet had sufficient impact ^(21, 22). There is therefore a need for more guidelines and regulatory control. This will give greater impetus to reducing waste quantities and the hazard they represent, increasing recycling and reducing environmental impact.

The conditions applying to certain kinds of waste management that are set out in permits and notifications vary considerably around the country. This may distort competition and have adverse environmental effects.

Need for guidelines and regulatory control

Need for uniform assessments and clearer practice

The general "rules of consideration"

- Burden of proof
- Competence requirements
- Precautionary principle
- Location principle
- Conservation and ecocycle principles
- Product choice principle
- Reasonableness rule
- Liability to remedy damage
- Maximum permissible disturbance rule

In several cases there is therefore a need for a more uniform assessment of permit applications and clearer guidance as to what is considered to be "low environmental impact".

Producer responsibility and voluntary commitments

- electrical and electronic products (SFS 2005:209 and 2000:208)
- cars (SFS 1997:788)
- packaging (SFS 1997:185)
- recycled paper (SFS 1994:1205)
- tyres (SFS 1994:1236)
- office paper (voluntary commitment)
- construction and demolition waste (voluntary commitment)
- agricultural plastics (voluntary commitment)

Producer responsibility
should reduce waste
quantities and increase
recycling

Producer responsibility

Certain producers are obliged to collect and recycle their products when they reach the end of their life. The purpose of producer responsibility is to reduce the amount of waste, increase recycling and achieve more sustainable product development. This requires products to be more resource-efficient, easier to recycle and free of hazardous substances.

Common EU regulations define producer responsibility standards in a number of cases. The following product categories are covered by producer responsibility in Sweden:

Material recovery has increased sharply over the past ten years. Recycling targets are met in all cases except for metal packaging and materials recovery of plastic packaging. Commitments made by the construction industry have not yet been translated into action.

Producer responsibility has reduced the relative volume of packaging. In some cases producer responsibility also entails a ban on use of hazardous substances in products. This also makes the waste generated by the products less hazardous. ⁽¹⁴⁾

Simpler for consumers

Collection of packaging and recycled paper needs to be easier for consumers. Producers and municipalities have therefore agreed to work more closely together. Municipalities have also been given an overall responsibility to supply information. In addition, producers have agreed to work to establish collection close to homes. Increased regulatory guidance and control will help to ensure that collection standards are high and that all producers accept their responsibility.

Increased recycling of electrical
and electronic waste

A high percentage of electronic waste is collected compared with other EU member states. As from 2005 producers must regularly report their level of compliance to the Swedish EPA, which also assumes the role of regulatory authority. Producer responsibility has been extended to include refrigeration and freezer products. All in all, this should increase the collection ratio and further reduce environmental impacts. This will require development of existing collection systems, however.

Municipal waste planning

All municipalities have
a waste plan

Since 1991 all municipalities have had to have a waste plan covering all types of waste, specifying the measures needed to deal with it in a sustainable, resource-efficient way.

Waste plans often include targets and strategies for various waste flows, although they usually focus on household waste.

Waste planning means that municipalities have assumed wide-ranging responsibility for improving management of household and hazardous waste. For example, many municipalities have developed comprehensive systems for sorting at source and recycling various types of waste. Continued municipal waste planning is important to support efforts to achieve the national environmental objectives and to complement national and regional waste planning.

Ban on landfilling burnable and organic waste

In Sweden it has been illegal to landfill sorted burnable waste since 2002, and landfilling organic waste has been banned since 2005. (SFS 2001:512). The aim of these bans is to improve resource conservation and reduce environmental impact. To make recycling easier, a requirement for sorting burnable waste at source was also introduced in 2002.

For various reasons certain types of waste should be landfilled. This may be because substances in the waste should not be dispersed, or because recycling is not feasible. Waste containing very little organic matter causes no appreciable environmental impact when it is landfilled. Waste of this kind is therefore exempt from the bans. Where capacity for recycling waste is lacking, county administrative boards can also grant exemption for one year at a time. The landfill site owner applies for exemption, except for household waste, for which the municipality must apply.

Quantities of waste going to landfill have fallen sharply since the bans were introduced. Full compliance with the bans will not be possible in 2005, however. This is mainly because it takes time to establish increased recycling capacity. The EPA, which monitors compliance with the bans each year, considers that almost total compliance with the bans will be possible within a few years. ⁽¹⁶⁾

By 2016 no more than 35 per cent of biodegradable municipal waste may be landfilled in the EU, based on quantities generated in 1995. Each country must also have a strategy for reducing landfill of biodegradable waste (Directive 1999/31/EEC). The Swedish bans have helped Sweden to meet these requirements already. In 2003 the amount of biodegradable municipal waste going to landfill was only around 17 per cent of the amount of waste generated in 1995. ⁽¹³⁾

The requirement that burnable waste be sorted at source affects a large number of operations. Exemptions are granted where, for example, it is difficult to find space during a construction or demolition process. Application of these regulations has not yet been surveyed. Smaller companies probably need to improve their knowledge in this area.

Landfill tax

The Landfill Tax Act (1999:673) was introduced in January 2000. The purpose of the tax is to increase the financial incentive for reducing waste quantities and treating and recycling waste in a more sustainable and resource-efficient way. The tax has risen from SEK 250/tonne of waste in 2000 to SEK 370/tonne as from 2003. The Government has proposed that the tax be raised to SEK 435/tonne of waste in January 2006.

Municipalities have developed infrastructure

We do not yet have the capacity to recycle all organic waste

The landfill bans have greatly reduced the amount of waste going to landfill

The landfill tax is SEK 370 per tonne and year

The tax has helped to reduce the amount of waste going to landfill

The tax is designed so that all materials entering a waste facility are taxed. Waste leaving the facility or used in construction is deductible, as is waste for which landfill is the best environmental solution. Waste undergoing incineration or biological treatment, for example, is exempt. The Landfill Tax Act will be reviewed in 2005 - 2006.

So far, the tax has helped to substantially increase recycling and reduce landfill. It is not certain whether it has had an impact on waste quantities. According to the Swedish Tax Agency, the quantity of waste taxed halved between 2000 and 2004. ⁽²⁴⁾

Table 16. Quantities of taxed waste (Mtonnes). ⁽²⁴⁾

	2000	2001	2002	2003	2004
Incoming/produced	9.2	9.1	8.3	8.1	8.3
Treatment residues	0.2	0.3	0.5	0.5	0.4
Outgoing	1.0	1.2	1.4	1.8	2.1
Other tax exemption	4.1	4.4	4.3	4.4	4.5
Net taxed waste	4.3	3.8	3.1	2.4	2.1

Government grants are available for biological treatment and material recovery

Government investment grants

Local Investment Programmes (LIP) qualified for government grants averaging approximately 30 per cent of the investment. These grants were awarded between 1998 and 2001. It is estimated that the amount of waste put into landfill was reduced by 370,000 tonnes as a result of investment grants to improve waste management. Action taken under LIP is estimated to have reduced emissions by around 2 per cent of total emissions impacting climate. Evaluations have shown that in many cases these grants were decisive in bringing about change.

A new government Climate Investment Programme (Klimp) has received SEK 1,040 million for allocation of grants of approximately 30 per cent of investments in climate-related measures between 2003 and 2006. To date, a quarter of grants have been for measures to increase production and use of biogas from waste. The Government has proposed that "Klimp" measures should also qualify for grants in 2007 and 2008.

Owners of apartment buildings will be entitled to a government grant during 2005 - 2006 for measures to make it easier for people living in their buildings to sort their waste. The grant will equal 30 per cent of the investment in collection facilities for various kinds of waste close to the building. Property owners must collect electrical and electronic waste to qualify for the grant.

New EU standards reduce environmental impact

More rigorous landfill and incineration standards

Environmental standards for waste incineration and landfill have been made more stringent in recent years. The new regulations are based on EU common minimum standards, Directive 1999/31/EC on landfill and Directive 2000/76/EC on incineration. The aim is to lessen the impact on soil, water and air. Existing landfill and incineration



Collecting household waste.

facilities must meet these requirements after 2008 and December 2005, respectively.

The Landfill Ordinance (2001:512) and Regulations (2004:10, 2005:9) require landfill sites to be designed, operated and finally covered in the light of the contaminant level of the waste. As from 2005 waste to be landfilled must also be inspected and analysed. The aim is to steer the right kinds of waste to the right landfill sites. These regulations, which must be complied with by all landfill sites after 2008, are expected to reduce the quantity of hazardous waste and undesirable substances dispersed from landfill. A handbook containing general landfill guidelines (2004:2) provides details about sustainable landfill on the basis of the new regulations.

The incineration regulations are set out in an ordinance (SFS 2002:1060) and regulations (NFS 2002:28). After 2005 all facilities must meet the standards for an efficient incineration process and low emissions to air and water. The quality of incoming waste is also regulated to a certain extent.

Effective regulatory control and regulatory guidance are needed to ensure that landfill and incineration standards are actually met. In addition, the environmental effects of new measures should be monitored, as should knowledge about the quality of waste that is incinerated and landfilled.

The Waste Council

The Swedish EPA was given broader responsibility for waste in 2004. Waste management is to be seen as a part of our infrastructure, and the EPA is to be a driving force in the transition towards ecologically sustainable waste disposal. The EPA must also ensure that waste management is conducted in a way that is simple for consumers and efficient for society.

To make this task easier, a Waste Council has been set up at the Swedish EPA. The Council comprises some 15 stakeholder representatives. The Council is described in Ordinance (2001:1096) with instructions for the Swedish Environmental Protection Agency, sections 25 – 26.

By way of example, in 2004 the Waste Council considered collection of certain kinds of household waste covered by producer responsibility, such as packaging and newspapers. As a result, several key stakeholders agreed on suitable solutions for effective collection. .

Landfill regulations must be complied with after 2008

More rigorous standards for emissions from incineration after 2005

National Waste Council supports the Swedish EPA

Export and import of certain types of waste

Import and export have increased dramatically

Waste is mainly imported for energy recovery

Import to Sweden of notifiable waste rose steadily between 1996 and 2002. There was a slight fall in 2003, however. Briefly, "notifiable waste" is hazardous waste, mixtures of waste and waste categories that are not on any list in the EC Waste Transport Regulation (259/93). Most imports are of sorted construction and demolition waste, wood waste, industrial waste, sorted household waste and sleepers used for energy recovery. Just over 80,000 tonnes of waste was imported for recovery of metals. Just under half of that waste consisted of lead accumulator batteries.

Export of notifiable waste also increased during the years 1996 to 2003. Just under half of the total quantity exported in 2003 was shipped to other EU countries for recovery of metals such as fragmentation waste, scrap, slag and particulates containing metals. Slightly less than 20,000 tonnes of the total quantity of waste exported was exported to non-EU countries. This is waste on the "green list", i.e. waste not regarded as hazardous, which was exported to countries requiring a notification procedure for the waste. Most of this category comprised end-of-life vehicles that had been emptied of hazardous substances before being shipped to Latvia for metals recovery.

Table 17. Quantities of exported and imported notifiable waste. The quantity imported for energy recovery is given in brackets. ⁽⁸⁾

Year	Import (tonnes)	Export (tonnes)
1996	115,000 (53,000)	24,000
1997	128,230 (58,178)	37,834
1998	181,790 (109,518)	71,129
1999	263,436 (196,359)	42,268
2000	364,184 (85,565)	73,518
2001	390,421 (60,608)	122,194
2002	513,651 (433,214)	111,215
2003	500,651 (406,524)	153,088

Under EC Regulation 259/93, competent sender and recipient authorities may object to notified shipments to ensure that shipments are in accordance with national waste plans. Comments are given below on a number of specific categories of waste.

Waste oil

Sweden regenerates too little waste oil

Under the Waste Oil Ordinance (SFS 1993:1268), waste oil must in the first place be regenerated if this is possible in view of the technical, economic and organisational circumstances. There are no facilities in Sweden for regeneration of waste oil and Sweden currently generates too little waste oil. The requirement that waste oil be regenerated will probably be altered in the near future. Some 43,000 tonnes of waste oil was exported in 2003, of which approximately 7,000 tonnes was regenerated. The remaining 36,000 tonnes was used for energy recovery. However, the Swedish EPA estimates that

regeneration of waste oil will increase from 7 per cent in 2003 to roughly 25 per cent by 2006; by 2010 it may be possible to regenerate 50 per cent. The agency considers it important that export of waste oil only be permitted for regeneration, so that the desired levels may be achieved. Other treatment should only be allowed in exceptional cases.

Export of waste oil solely for regeneration

Discarded refrigerators and freezers

Approximately 1,346 tonnes of discarded refrigeration and freezer units were shipped from Sweden to Germany for recovery in 2003. There are four facilities for processing end-of-life refrigerators and freezers in Sweden. These end-of-life products must be disposed of in a sustainable manner. The Swedish EPA intends to examine the possibility of setting recycling standards in regulations to ensure sustainable disposal of refrigerators and freezers. When these regulations take effect, facilities within or outside Sweden should not be permitted to receive end-of-life Swedish refrigerators and freezers unless they meet these standards. It should also be possible to refer to regulations governing treatment of end-of-life refrigerators and freezers when assessing notifications of export of waste of this kind.

Formulation of criteria for recycling refrigerators and freezers

Waste containing mercury

Waste containing mercury may be shipped from Sweden, since the National Chemicals Inspectorate has issued a general exemption from the ban on exporting waste containing mercury from Sweden. The permissibility of export must be considered by the EPA under the EU Waste Transport Regulation. Waste containing more than 0.1 per cent mercury may not be exported if it will be stored in a manner rendering placement of the waste in an underground repository impossible. Export of waste containing mercury totalled 256 tonnes in 2003. That waste comprised 226 tonnes of discarded fluorescent tubes, 10 tonnes of pulverised fluorescent tubes and 7 tonnes of amalgam waste. The treatment of fluorescent tubes enables the powder obtained from pulverisation to be used to make new tubes. Amalgam waste is placed in a depository.

A Chemicals Inspectorate report to the Government on a national mercury ban proposes that recovered mercury be shipped back to Sweden. This applies only to waste in which the mercury is not reused, such as amalgam waste.

Organic and burnable waste

The Landfill Ordinance (2001:512), prohibits landfill of sorted burnable waste as from 1 January 2001. Only small amounts of this waste have been exported, mostly for geographical reasons. The Swedish EPA considers that export of Swedish organic waste for landfill should not be permitted, since this circumvents the landfill ban.

Export of organic waste for landfill should not be permitted

Contaminated soil

Quantities of contaminated soil shipped out of Sweden have varied widely from year to year. 172 tonnes of contaminated soil was exported in 2003, mainly to Germany for thermal treatment. 2,631 tonnes was exported to Holland and Germany in 2002 for

Minor export of contaminated soil

other recovery. Around 5,000 tonnes of contaminated soil was exported for landfill to Norway in 2004.

Fly ash from waste incineration

The new acceptance criteria for landfill sites prohibit landfill of fly ash in Sweden. This is because the chloride concentration exceeds current limit values. Operators are thus seeking alternative solutions in other countries.

The options available abroad are mainly salt mines in Germany and limestone quarries in Norway. In 2004 three companies filed notifications of export of around 42,000 tonnes of fly ash to Norway for recovery (as compared with a total of some 150,000 tonnes shipped out of Sweden in 2003).

Restrictions on the import/export of fly ash will have major implications for operators. Capacity for pre-treatment or alternative disposal must be established. The cost of exporting fly ash is around SEK 550 – 900 per tonne. The environmental arguments against export are increased transport and resulting emissions, as well as the loss of the incentive for "refining" or pre-treating the waste if a simpler and less expensive method is available.

Electrical and electronic waste

Approximately 5,000 tonnes of electrical and electronic waste was imported in 2003, of which just over 3,600 tonnes went to Boliden Mineral for recovery. The same year about 750 tonnes of electrical and electronic waste (not including end-of-life refrigerators, freezers and fluorescent tubes) was shipped to Germany for recovery. The waste sent to Germany was sorted fractions of cathode ray tube glass, whereas the waste sent to Boliden Mineral was mixed electronic waste that had not undergone pre-treatment. The Swedish EPA considers that since Sweden requires pre-treatment of electrical and electronic waste, it is reasonable to require the same of waste of this kind entering Sweden from another country in which there is no such requirement.

Requirements
on pre-treatment
also on imported
electronic waste

Appendices

APPENDIX A

Environmental quality objectives

Up-to-date information about the national environmental quality objectives is available at the Environmental Objectives portal: <http://miljomal.nu>

Environmental objectives

The overall aim of environmental policy and protection is to ensure that we can hand on to the next generation a society in which the major environmental problems have been solved. On this basis, Parliament has enacted fifteen national environmental quality objectives, which form the basis for all environmental policy and protection. Parliament has also laid down some 70 interim targets under the various environmental objectives. Progress towards the objectives and interim targets is monitored and evaluated in detail every four years to identify new interim targets and measures needed to achieve the objectives. Waste management has a bearing on many of the

environmental objectives, although **A Good Built Environment**, **Reduced Climate Impact** and **A Non-Toxic Environment** are of most importance. Waste management also causes environmental impact under these objectives: Clean Air, Natural Acidification Only, A Protective Ozone Layer and Zero Eutrophication.

There are a number of interim targets under the **Good Built Environment objective**. These mainly address waste as a resource conservation issue, and require resources to be returned to natural cycles. Government Bill 2004/05:150 proposes an overall structure for a single waste-related interim target as set out below.

A Good Built Environment

– an overall interim target for waste:

The total quantity of waste should not increase, and the maximum possible use should be made of the resource that waste represents, while at the same time minimising the impact on, and risk to, health. In particular:

The quantity of waste going to landfill, not including mining waste, must be reduced by at least 50 per cent by 2005, as compared with 1994.

By 2010 at least 50 per cent of household waste is to be recycled by recovery of materials, including biological treatment.

By 2010 at least 35 per cent of food waste from households, restaurants, institutional catering and shops is to be recycled by biological treatment. The target covers food waste sorted at source for composting at home or treatment at a central facility.

By 2010 food and similar waste from food manufacturing facilities etc is to be recycled by biological treatment. This target applies to waste arising without being mixed with other waste, whose quality renders it suitable for use as a plant fertiliser after treatment.

By 2015 at least 60 per cent of phosphorus compounds in sewage are to be recycled for use on productive land, of which at least half is to be used on arable land.

Under the **Reduced Climate Impact** there is an interim target for lower emissions of greenhouse gases. Waste management is one of many sectors influencing greenhouse gas emissions. Sustainable waste management helps to achieve this target. Among other things, it is a matter of minimising emissions of greenhouse gases such as methane and carbon dioxide from landfill sites and from incineration of plastics.

Under the **Non-Toxic Environment** objective there is an interim target requiring information about the properties of chemicals and handling of chemicals that should not leak into the environment, such as cadmium, lead and mercury. Another interim target is to reduce the use of chemicals hindering materials recovery.

Action strategies

Efforts to achieve the environmental objectives are usually summarised in three overall action strategies – more efficient energy use and transport, non-toxic and resource-efficient natural cycles and conservation of land, water and the built environment. The action strategies supplement the environmental objectives by addressing "horizontal" issues and coordinating measures concerning various environmental objectives. The action strategy most relevant to waste is the strategy for non-toxic and resource-efficient natural cycles. The action strategies are being continuously developed, as are the environmental objectives.

Reduced Climate Impact – important interim target for waste:

Interim target: Average Swedish greenhouse gas emissions during the period 2008 - 2012 must be at least four per cent lower than they were in 1990.

A Non-Toxic Environment – important interim targets for waste:

Interim target 1: By 2010, as far as possible, there should also be information on properties of chemicals handled in the market. Information on chemicals handled in large quantities or considered to be particularly hazardous should be available before 2010.

Interim target 2: By 2010 products should be labelled with health and environmental information about the hazardous substances they contain.

Interim target 3: The phase-out of particularly hazardous substances between 2003 and 2015 means that new manufactured products should, as far as possible, contain no hazardous substances. The date by which the interim target is to be met varies from substance to substance. Examples of substances to be phased out are mercury (2003), carcinogenic substances, genetically harmful substances and substances harmful to reproduction (2007), and lead and cadmium (2010).

Interim target 4: The risks to health and the environment from the manufacture and use of chemicals are to be reduced continuously up to 2010. The occurrence and use of chemicals that hinder recycling are to be reduced during the same period.

APPENDIX B

Swedish waste policy

Sweden's environment and waste policy has developed a great deal over the past few decades. The Environment Protection Act and later the Environmental Code, alongside a series of EU regulations, have created an impetus for more sustainable waste management. Some of the important waste policy measures taken since the 1960s are described below.

Environment Protection Act 1969

The Environment Protection Act, which came into force in 1969, was a milestone in that it introduced a permit application procedure for all new industrial facilities. The act was amalgamated with other legislation, including the Natural Resources Act, to form the Environmental Code. The Environment Protection Act, and subsequently the Environmental Code, represent framework legislation, providing the scope for more stringent requirements based on local conditions when permit applications are considered.

Conservation of resources in the 1970s

A government bill in 1975 (1975:32) established the principle that responsibility for resource-efficient and sustainable waste management rested with the waste producer. This principle was not followed by any specific measures. The Government also emphasised that waste was to be seen as a resource to be conserved by efficient recycling and reuse.

Government grants were therefore given for mechanical separation and sorting facilities for recovery of materials from waste. Some twenty facilities of this kind were built in the early 1980s. Due to operating problems and difficulties in finding a market for the materials, among other things, several of these facilities had to close down. The experience provided knowledge about pre-treatment, incineration, composting and the importance of an established market for recycled materials.

Reduced environmental impact in the 1980s

Strategies and measures to reduce the environmental impact of waste management were developed in the 1980s following a report on energy from waste in 1986 and the Waste Bill (1989/90:100), among other things. For example, 1985 saw the introduction of a temporary moratorium on new waste incineration until the environmental impact caused by these facilities was reduced.

The Waste Bill 1990, echoing the sentiments expressed in the Swedish EPA report "Waste and the Environment", pointed out that the importance of waste as a growing environmental problem was greater than its importance as a resource. Hence, emphasis was given to the importance of preventing waste production and reducing its content of hazardous substances by preventive control of chemicals.

This also resulted in proposals for phasing out and substituting hazardous substances, a duty of information, material balances and environmental product declarations. A waste charge was also proposed for the first time. Another effect was that municipalities were given greater responsibility by being required to produce municipal waste plans.

Ecocycles policy and EU membership in the 1990s

To increase recycling, the Government proposed in 1990 that sorting of waste at source should be developed. Government Bill 1992/93:180 emphasised the "ecocycle" principle as a central means of achieving more cyclic materials recovery and hence more sustainable development. It was therefore proposed that producers be given legal, physical and economic responsibility for collecting and disposing of certain end-of-life products.

Initially, this responsibility was introduced for packaging and recycled paper, later extended to include tyres, cars and, most recently, electrical and electronic equipment. As a complement, voluntary recycling commitments were also se-

cured from the construction industry and for office paper. The 1992 bill also took important steps towards reducing the quantity of waste and the degree of hazard it poses by highlighting economic instruments, greater control of chemicals, increased consumer information, sustainable procurement, environmental management systems, material balances and environmental product declarations.

Following the EEA agreement and EU membership, Sweden's waste policy had to be harmonised with the principles and objectives laid down by EU Environmental Action Programmes. EC directives and regulations also set more rigorous standards in areas including environmental permits, waste planning, hazardous waste and import/export of waste.

Less landfill and increased environmental protection

The 1997 Bill on management of end-of-life products in a sustainable society (1996/97:172) proposed measures to increase recycling and reduce environmental impact. The proposals, which were partly based on a Swedish EPA report entitled "Action Plan Waste", include requirements for a certain amount of sorting of waste at source and a ban on landfill of organic waste from January 2005. The right of municipalities to assume responsibility for non-hazardous commercial and industrial waste was ended as from 2000. In addition, a law on landfill tax was enacted in 1999 (Bill 1998/99:84) and entered into force on 1 January 2000.

Wide-ranging EU regulations governing landfill were adopted in 1999 and are to have been fully implemented by 2009. An EC Waste Incineration Directive was adopted in 2000 and its provisions are to have been implemented at all facilities concerned by the end of December 2005. These directives are central to reducing the environmental impact of waste management in Sweden.

National environmental quality objectives

In 1999 Parliament decided a new approach, encapsulated in 15 national environmental quality objectives. Under each objective there are a number of interim targets. The environmental impact of waste management has a bearing on a number of these objectives. Progress towards the objectives is monitored annually, and an in-depth evaluation is carried out every four years. This also takes place at regional and local level. The in-depth evaluation forms the basis for a bill to be enacted by Parliament.

In May 2005 (2004/05:150) the Government presented a new Environmental Objectives Bill. Among other things, the bill proposes an overall interim objective that maximum possible use should be made of the resource that waste represents, while at the same time minimising the impact on, and risk to, health. New interim targets are also proposed: at least half of household waste should be recycled by materials recovery by 2010, and at least 60 per cent of phosphorus in sewage should be returned to productive land by 2015.

Since the aim is to gather together all environmental targets under the environmental objectives, no targets are proposed in this National Waste Plan. The purpose of the plan is to set out a coherent waste policy and identify priority measures to achieve sustainable waste management so that the environmental objectives are translated into action.

As a complement to measures to help achieve several of the environmental objectives, the work on implementing those objectives includes three action strategies, of which the strategy for "non-toxic and resource-efficient natural cycles" concerns waste management.

The Environmental Code 1999

The Environmental Code, which came into force on 1 January 1999, represents broader, integrated environmental legislation for sustainable develop-

ment. It integrates the provisions of fifteen existing environmental laws. The purpose of the code is to promote sustainable development so that present and future generations will be assured of a sound, healthy environment. The Environmental Code forms umbrella legislation governing all environmental impact.

Waste management as infrastructure with better planning

The bill entitled "A Society with Non-Toxic and Resource-Efficient Natural Cycles" (2002/03:117) confirmed the Government's previous focus on waste policy. It was emphasised that waste management is also a matter of infrastructure. The bill proposed better central planning (a national waste plan), monitoring, evaluation and regional planning. A Waste Council was established at the Swedish EPA to provide broader consultation and assist in the implementation of waste policy.

Producer responsibility was elaborated to aid consumer participation and so that greater account could be taken of local conditions by increasing municipal responsibility for information and planning. The responsibility borne by waste producers was also clarified. The Swedish EPA's sphere of responsibility was extended to include monitoring capacity and waste management methods and ensuring that waste is sustainably managed in a way that is efficient for society and simple for consumers. The bill also resulted in an interim target for recycling food waste by biological treatment.

The bill was based on a number of official reports. A comprehensive analysis of producer responsibility and its future was made in a white paper (SOU 2001:102). The EPA analysed the distribution between various recycling methods,

environmental impact, division of responsibility, planning and import/export in "Ecologically Sustainable Waste Management" (Swedish EPA Report 5177, 2002). Another white paper (SOU 2002:9) evaluated reasons for, and the form of, a tax on waste incineration. Further development of an integrated product policy was set out in "Towards Sustainable Products" (Swedish EPA Report 5225).

Current issues

The waste management environment is very much determined by common EU legislation. Within the framework of the EU Sixth Environmental Action Programme, the Commission intends to propose a "Thematic Strategy on Prevention and Recycling of Waste" in 2005. This strategy is intended to reinforce and develop EU waste policy over the next few decades. Key components may include giving priority to implementing existing regulations, simplifying and modernising the regulatory framework, clearer targets for environmental impact, plans to reduce waste volumes and development of criteria for recycling and disposal, as well as defining when waste changes into a product.

An earlier report on waste was followed by a similar report by the "BRAS Commission" in 2004 – 2005. The latter report (SOU 2005:23) proposes an energy tax on incineration of the fossil fraction of waste so as to harmonise energy taxes on various types of fuel. The BRAS Commission has also produced a white paper (SOU 2005:64) reviewing the landfill tax. The white paper proposes a number of clarifications and a differential tax on organic waste put into landfill on the strength of exemption from the ban (higher tax) and on contaminated soil (lower tax).

APPENDIX C

Selected EU and Swedish waste regulations

Area /sub-area	EU statutes/international conventions	Swedish laws and ordinances	Regulations	Guidelines/handbook
1. General	Council Waste Directive 75/442/EEC of 15 July 1975 Amended by Directive 91/156/EEC and 91/692/EEC (the Reporting Directive)	Environmental Code (1998:808) (MB) chs. 2, 9, 15 Waste Ordinance (2001:1063) SFS 1998: 899 on hazardous activities and health protection	Swedish EPA Regulations and General Guidelines (NFS 2000:14) on the timing of notification of notifiable activities NFS 1991:3 Regulations on municipal waste plans. NFS 2002:32, amending 1991:3	Handbook 2003:5 Permit procedures and notification of hazardous activities Swedish EPA statement to the Environmental Court of Appeal on classification of waste under Appendices 2 and 3 of the Waste Ordinance.
Waste statistics	Council Hazardous Waste Directive 91/689/EEC of 12 December 1991. Amended by Directive 94/31/EEC Council Waste Statistics Regulation No 2150/2002 of 25 November	Ordinance 2004:989 on review of certain hazardous activities		
2. Transport				
Waste		Waste Ordinance (2001:1063)	Swedish EPA Regulations (NFS 2005:3) on transport of waste	
Hazardous waste		–”– Transport of Hazardous Goods Act (1982:821) ; Transport of Hazardous Goods Ordinance (1982:923)	Swedish Rescue Services Agency Regulations on transport of hazardous goods (ADR)	Handbook NFS 2003:8 Hazardous waste
Import and export	Council Regulation (EEC) No 259/93 of 1 February 1993 on the supervision and control of shipments of waste within, into and out of the European Community. Amended by Regulations 120/97 (corrected by 120R/97) and 225/ 2001 and Commission Decision of 24 November 1999.	Ordinance 1995:701 on transboundary transport of waste		

Area /sub-area	EU statutes/international conventions	Swedish laws and ordinances	Regulations	Guidelines/handbook
	Council Regulation (EC) No 1420/1999 of 29 April 1999 and Commission Regulation (EC) No 1547/1999 of 12 July 1999 determining the control procedures to apply to shipments of certain types of waste to certain non-OECD countries.			
3. Treatment and management of waste				
Sorting of waste		Waste Ordinance (2001:1063)	NFS 2004:4 and General Guidelines on management of burnable and organic waste	NFS 2004:4 Swedish EPA Regulations with General Guidelines on management of burnable and organic waste
Intermediate storage		Ordinance 1998:899 on hazardous activities and health protection Waste Ordinance, (2001:1063)		NFS 2004:4 Swedish EPA General Guidelines on hazardous waste
Incineration	European Parliament and Council directive 2000/76/EC of 4 December 2000 on waste incineration	Ordinance 1998:899 on hazardous activities and health protection Ordinance 2002:1060 on waste incineration	Swedish EPA Regulations (NFS 2002:28) on waste incineration Swedish EPA Regulations and General Guidelines (NFS 2004:4) on management of burnable and organic waste Swedish EPA Regulations (NFS 2002:26) on emissions to air from incineration facilities having an output of MW or more	Swedish EPA Regulations and General Guidelines (NFS 2004:4) on management of burnable and organic waste
Landfill	Council Landfill Directive 1999/31/EC of 26 April 1999 Council Decision of 19 December 2002 establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 and Appendix II to Directive 1999/31/EC	Ordinance 1998:899 on hazardous activities and health protection Landfill Ordinance (2001:512) Environmental Code, ch. 15, s. 34 Environmental Code, ch. 22 Waste Tax Act (1999:673)	Swedish EPA Regulations (NFS 2004:10) on landfill, criteria and procedures for the acceptance of waste at landfill facilities. NFS 2004:4 and General Guidelines on management of burnable and organic waste	Handbook 2004:2 with General Guidelines on Landfill NFS 2004:4 Swedish EPA Regulations med General Guidelines on management of burnable and organic waste

Area /sub-area	EU statutes/ international conventions	Swedish laws and ordinances	Regulations	Guidelines/handbook
Biological treatment		Ordinance 1998:899 on hazardous activities and health protection General "rules of consideration" in chapter 2 of the Environmental Code		Handbook 2003:4 Methods of commercial storage, digestion and composting of waste. Handbook with General Guidelines on ch. 2, s. 3, Environmental Code
4. Producer responsibility				
Electrical and electronic waste	European Parliament and Council Directive 2002/96/EC of 27 January 2003 on waste electrical and electronic equipment	Ordinance 2005:209 on producer responsibility for electrical and electronic products Ordinance 2000:208 on producer responsibility for light bulbs and certain light fittings.	NFS 2001:8 Regulations and General Guidelines on commercial pre- treatment of electrical and electronic waste	Handbook 2001:7 Waste from electrical and electronic products. Handbook with General Guidelines on Swedish EPA Regulations on commercial pre- treatment of electrical and electronic waste
Cars	European Parliament and Council Directive 2002/53/EC of 18 September 2000 on end-of-life vehicles Commission Decisions (2002/525/EC) and (2005/293/EC)	Scrap Motor Vehicles Act 1975:343 1975:348 Scrap Motor Vehicles Ordinance; Producer Responsibility for Motor Vehicles Ordinance 1997:788	NFS 2002:2 Regulations on scrap motor vehicle operations	NFS 2002:2 General Guidelines Regulations on scrap motor vehicle operations Handbook 2001:8 Scrap motor vehicles with General Guidelines on Regulations on scrap motor vehicle operations
Tyres		Producer Responsibility for Tyres Ordinance 1994:1236		
Recycled paper		Producer Responsibility for Recycled Paper Ordinance 1994:1205 Last revised 1 January 2005	SNFS 1996:15 Regulations on monitoring of collection ratio etc for recycled paper	Waste Council conclusions and criteria for a suitable collection system and methods of consultation. www.naturvardsverket.se under Avfallsrådet (in Swedish). General Guidelines with handbook on regulatory control of producer responsibility for recycled paper.

Area /sub-area	EU statutes/ international conventions	Swedish laws and ordinances	Regulations	Guidelines/handbook
Packaging	European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste Last revised 2004	Producer Responsibility for Packaging Ordinance 1997: 185 Last revised January 2005 Ordinance on a recycling system for plastic bottles and metal cans 2005:220		Waste Council conclusions and criteria for a suitable collection system and methods of consultation. www.naturvardsverket.se under Avfallsrådet (in Swedish). General Guidelines with handbook on regulatory control of producer responsibility for packaging.

5. Other

Batteries	Council Directive 91/157/EEC of 18 March 1991 on batteries and accumulators containing certain hazardous substances. Adapted to technical developments by Council Directive 98/101/EC and Commission Directive 93/86/EEC	Charges for Hazardous Batteries Act (1990:1332) Batteries Ordinance 1997:645		
Mercury		Ordinance on prohibition in certain cases in connection with the handling, import and export of chemical products (1998:944)		
PCBs Priority Pollutants (POPs)	Council Directive 96/59/EC of 16 September 1996 on the disposal of polychlorinated biphenyls and polychlorinated terphenyls (PCBs/PCTs) European Parliament and Council Regulation (EC) No 850/2004 on persistent organic pollutants. Stockholm Convention Protocol on persistent organic pollutants to LRTAP Helcom Parcom	Ordinance on disposal of PCBs etc (1998:122) SFS 1985:837 and 1998:122	National Chemicals Inspectorate Regulations (ch. 7, s. 17 of KIFS 1998:8) on notification to the product register of PCBs and PCTs by importers and manufacturers.	

Area /sub-area	EU statutes/ international conventions	Swedish laws and ordinances	Regulations	Guidelines/handbook
Waste oils	Council Directive 75/439/EEC of 16 June 1975 on the disposal of waste oils	Waste Oil Ordinance 1993:1268	Protection against soil and water pollution in connection with storage of flammable liquids (SNFS 2003:24)	SPI has published a folder on regeneration/ sorting of waste oil
Ship waste	European Parliament and Council Directive 2000/59/EC of 27 November 2000 on port reception facilities for ship-generated waste and cargo residues. London Convention Marpol Helsinki Convention	Pollution from Ships Act 1980:424 . Ordinance on measures to combat pollution from ships (1980:789)	National Maritime Administration Regulations on measures to combat water pollution from ships (SJÖFS 1985:19), amended by (SJÖFS 2001:15) National Maritime Administration Regulations and General Guidelines on reception of waste from ships (SJÖFS 2001:12). National Maritime Administration Regulations and General Guidelines on reception of waste from leisure craft (SJÖFS 2001:13),	National Maritime Administration handbook: "Reception of ship-generated waste in ports" and Swedish EPA handbook: "Ports "
Dumping	London Convention	Environmental Code, ch. 15; Waste Ordinance 2001:1063		
Animal by-products	European Parliament and Council Regulation No 1774/2002 of 3 October 2002 laying down health rules concerning by-products not intended for human consumption	Epizootic Act 1999:657 Zoonotic Act 1999:658 Epizootic Ordinance 1999:659 Infectious Diseases Act 2004:168.	National Board of Health and Welfare Regulations and General Guidelines on handling infectious waste from the health and medical care sector, SOSFS 1999:27(M), amended by SOSFS 2000:4 (M) Regulations (SJVFS 1998:34) on handling animal cadavers and animal by-products. Last revised by SJVFS 2003:58/61.	Handbook 2003:4 Methods of commercial storage, digestion and composting of waste. Handbook with General Guidelines on ch. 2, s. 3, Environmental Code
Agricultural waste		Environmental Code, ch. 12 Ordinance on environmental concern in agriculture 1998:915	Regulations (SJVFS 2004:62) on environmental concern in agriculture in relation to plant fertilisers.	

Area /sub-area	EU statutes/ international conventions	Swedish laws and ordinances	Regulations	Guidelines/handbook
Radioactive waste	<p>Council Directive 96/29/EURATOM of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation</p> <p>Council Directive 92/3/EURATOM on the supervision and control of shipments of radioactive waste between Member States and into and out of the Community.</p>	<p>Radiation Protection Act, SFS 1988:220</p> <p>Radiation Protection Ordinance, SFS 1988:293</p> <p>Nuclear Operations Act (1984:3),</p> <p>Nuclear Operations Ordinance (1984:14),</p> <p>Funding of Future Costs for Spent Nuclear Fuels Act (1992:1537),</p> <p>Funding of Future Costs for Spent Nuclear Fuels Ordinance (1981:671),</p> <p>Funding for Disposal of Certain Radioactive Waste Act (1988:1597)</p> <p>Funding for Disposal of Certain Radioactive Waste Ordinance (1988:1598).</p>	<p>SSI FS 2005:1</p> <p>Regulations and General Guidelines on disposal of ashes contaminated with caesium-137, (SSI FS 1992:4)</p> <p>Regulations on fire alarms containing a radiation source with a radioactive substance,</p> <p>SSI FS 2001:1,</p> <p>Regulations on disposal of radioactive waste and nuclear waste at nuclear facilities,</p> <p>SSI FS 1998:1</p> <p>Regulations on final disposal of spent nuclear fuels and nuclear waste,</p> <p>SSI FS 1995:4</p> <p>Regulations on the control of import and export of radioactive waste.</p> <p>SSI FS 1983:7</p> <p>Regulations etc on non-nuclear power-related radioactive waste,</p> <p>SKIFS 2002:1</p> <p>Regulations on safety at final repositories for nuclear substances and nuclear waste.</p>	

7. Use of waste

	<p>Council Directive 86/278/EEC of 12 July 1986 on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture.</p>	<p>Ordinance 1998:899 on hazardous activities and health protection</p> <p>Environmental Code, ch. 15</p> <p>Ordinance on prohibitions in certain cases in connection with the handling, import and export of chemical products (1994:944).</p>	<p>NFS 2001:5 Regulations amending (SNFS 1994:2) Regulations on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture.</p>	
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APPENDIX D

Facilities for incineration with energy recovery

(outside of manufacturing industry)

Municipality	Facility	Technical capacity	Permitted capacity	Planned expansion	(tonnes)
Avesta	Fortum	50,000	65,000	0	
Boden		~80,000	48,000**	80,000****	
Bollnäs		40,000	40,000	0	
Borlänge	Bäckelundsverket	40,000	40,000	0	
Borås		89,000	100,000	0	
Eksjö	Återvinningsterminalen	65,000	65,000	0	
Finspång	Finspångs Tekniska verk	25,000	35,000	0	
Gotland*	Cementa	~83,000□□	Permit review	0	
Gävle		0	100,000	100,000	
Gothenburg		430,000	460,000	0	
Halmstad	Kristinehed	200,000	200,000	0	
Haninge		10,600		-10,600	
Hässleholm	Beleverket	30,000	50,000	0	
Jönköping	Torsviks kvv	120,000	200,000	80,000	
Kalmar				70,000***	
Karlskoga	Karlskoga kvv	135,000	100,000	30,000	
Karlskrona	Bubbetorp	0	Permit not yet granted	70,000	
Karlstad		50,000	50,000	0	
Katrineholm		0	40,000	40,000	
Kil*	Kils avfallsförbränning	10,000	15,000	0	
Kiruna		70,000	70,000	0	
Kumla	SAKAB	200,000	200,000	0	
Köping	Norsa avf	22,000	23,500	0	
Landskrona		29,000		-29,000	
Lidköping		100,000	100,000	0	
Linköping	Gärstadverket	350,000	350,000	0	
Ljungby	Ljungby Energi	45,000	60,000	10,000	
Lomma*	Återbruket i Lomma	35,000	35,000	0	
Malmö	Spillepeng	400,000	550,000	150,000	
Mora	Sydkrafts avf	17,000	25,000	0	
Norrköping	Händelöverket	200,000	200,000	0	
Skövde		50,000	50,000	0	
Stockholm	Högdalen	400,000	600,000	200,000	
Sundsvall	Korstaverket	35,000	200,000****	165,000	
Södertälje*	Igelstaverket	250,000□	Restricted output	0	
Uddevalla		0	98,000	80,000	
Umeå	Dåva KVV	150,000	175,000	0	
Uppsala	Vattenfall sopincineration	475,000	375,000	0	

Västervik	Västerviks vv	50,000	85,000	35,000
Åmotfors	Åmotfors bruk	0	80,000	45,000
Ängelholm*	Ängelholms energi	0	100,000	100,000
Örebro*	Fortum	~30,000	Not restricted	0

Figures in italics are somewhat doubtful

* Does not accept household waste

** Has applied for a permit for 80,000 tonnes, provided a new plant is built.

*** Permit not yet applied for.

**** The current permit is for 45,000 tonnes/year; the permit will be extended if capacity is increased to 200,000 tonnes/year.

***** Depends on the incineration tax

□ Technically higher capacity but has no plans to use it.

∞ Quantity treated in 2004

APPENDIX E

Facilities for biological treatment

(outside of manufacturing industry)

Anaerobic digestion facilities

The table below shows the number of digestion facilities in Sweden and the quantities of waste they receive. Incoming quantities include a certain amount of farmyard manure. Digestion facilities at sewage treatment plants are not included.

Anaerobic digestion facilities	Incoming waste (tonnes)
Borås	13,350
Falköping	2,848
Helsingborg	26,000
Huddinge	225
Kalmar	22,070
Kil	1,072
Kristianstad	65,770
Laholm	46,840
Linköping	49,226
Uppsala	4,542
Vänersborg	12,431
Total	244,374
Including biological household waste sorted at source	24,816

Composting facilities

The table below shows the number of composting facilities in Sweden and the quantities of waste they receive. Incoming quantities include a certain amount of park and garden waste. Composting of sewage sludge is not included.

Composting facilities	Incoming waste (tonnes)
Alingsås	3,643
Borlänge	12,502
Borås	7,259
Eslöv	4,764
Fagersta	8,000
Gothenburg	21,001
Helsingborg	44,798
Huddinge	14,037
Karlskrona	4,090
Klippan	3,536
Ludvika	14,767
Luleå	8,735
Malmö	36,721
Mörrum	15,048
Sala	8,000
Södertälje	13,978
Täby	22,897
Uppsala	11,650
Västerås	8,600
Älvsbyn	1,345
Örebro	6,700
Östersund	6,381
Total	273,952
Including food waste sorted at source	80,482
Including sorted food waste	19,468

APPENDIX F

Landfill sites 2004

(outside of manufacturing industry)

Name of facility	Municipality	Waste quantity received	Quantity landfilled
Sörmossen	Ale	14,519	3,212
	Alingsås		4,782*
Hullaryd Avfallsupplag	Aneby	1,328	1,328
Mossebergs avfallsanläggning	Arvika	30,000	1,728
Karlslund	Avesta	16,683	9,913
Nolängens avfallsanläggning	Bengtstors municipality	28,797	7,986
Galhammar	Berg	1,348	931
Brändkläppen	Boden	12,251	3,101
Sävstaås avfallsanläggning	Bollnäs	41,998	10,032
Fågelmyra Återvinningsanläggning	Borlänge	45,371	14,072
Sobacken	Borås	134,735	49,545
Åsbodalens avfallsanläggning	Boxholm	2,361	199
Åsens avfallsanläggning	Bromölla municipality	18,080	7,424
	Bräcke		661*
Onsöns avfallsupplag	Dals-Ed	2,651	346
Bergvattnet 2:1	Dorotea	16,065	59
	Eda		6,446*
Gyesjöns avfallsdeponi	Eksjö	11,613	7,972
Lidahult Glasavfallsdeponi	Emmaboda	213	213
Annelund	Enköping	18,155	7,280
Lilla Nyby avfallsverk	Eskilstuna	88,711	9,670
Rönneholms avfallsanläggning	Eslöv	26,833	4,778
Krusegrydsdeponin	Essunga	1,042	452
Sänkmossen	Fagersta	20,210	5,090
Hebergs Återvinningscentral	Falkenberg	397	205
Ullareds Återvinningscentral	Falkenberg	1,251	469
Ätrans Återvinningscentral	Falkenberg	642	394
Falköpings avfallsanläggning	Falköping	45,385	2,590
Falu avfallsanläggning	Falun	118,139	30,285
Långskogen	Filipstad	17,528	2,158
Sjömansäng ÅVC and deponi.	Finspång	28,378	2,180
Frutorp	Flen	9,734	1,438
Mossarp avfallsupplag	Gislaved	31,371	9,430
Gynnås avfallsanläggning	Gnosjö	8,200	3,993
Slite deponi	Gotland	21,021	7,899
Karlbergs avfallsstation	Grums	2,462	244

*Landfill facilities in 2003

Name of facility	Municipality	Waste quantity received	Quantity landfilled
Odenslund	Gullspång	2,430	930
Kavahedens avfallsanläggning	Gällivare	23,977	4,692
Forsbacka Avfallsanläggning	Gävle	154,000	22,129
Tagene avfallsanläggning	Göteborg	155,598	32,578
Sibbabo	Habo	5,945	186
Holkesmossen	Hagfors	16,462	1,190
Trönninge avfallsanläggning	Halmstad	29,123	28,338
Slottsmöllans avfallsanläggning	Halmstad	12,782	8,190
Brandshults deponi	Halmstad	900	273
Skedala deponi	Halmstad	55,699	33,969
	Hammarö		1,427*
Filborna återvinningsanläggning	Helsingborg		86,103
Sofielunds återvinningsanläggning	Huddinge	239,168	80,707
Ulvbergets avfallsanläggning	Hudiksvall	61,620	17,035
Kejsarkullens avfallsanläggning	Hultsfred	4,926	1,339
Borabo	Hylte	52,381	38,504
Risöns avfallsanläggning	Härjedalen	3,940	3,148
Hede avfallsanläggning	Härjedalen	4,073	3,222
Ålandsbro Åland 1:32	Härnösand	28,776	7,769
Fläskebo avfallsanläggning	Härryda municipality	19,615	16,744
Vankiva avfallsanläggning	Hässleholm	69,462	29,006
Kolsrums deponi	Högsby municipality	3,018	464
Slamdeponi	Jokkmokk	186	186
Hults avfallsanläggning	Jönköping	139,479	77,354
Kalix avfallsdeponi	Kalix	13,806	4,852
Moskogens avfallsupplag	Kalmar	63,314	29,537
Avfallsverket i Mörrum	Karlshamn	43,865	9,348
Mosseruds Avfallsanläggning	Karlskoga	45,740	26,313
Bubbetorps avfallsanläggning	Karlskrona	63,754	20,798
Djupdalen	Karlstad	56,044	22,296
Vika deponi and återvinningscentral	Katrineholm	38,266	13,471
Lersätter	Kil	4,340	2,845
Adlerskog	Kinda	6,325	954
Kiruna återvinningscentral och deponi	Kiruna	53,754	1,911
Hyllstofta	Klippan	45,180	9,589
Högbergets avfallsanläggning	Kramfors	27,267	17,598

*Landfill facilities in 2003

Name of facility	Municipality	Waste quantity received	Quantity landfilled
Strandmossens avfallsupplag	Kristinehamn	61,248	7,180
Åse	Krokom	1,300	900
Kumla Deponeringsanläggning Östersätter	Kumla	8,052	2,624
Barnamossen	Kungsbacka	33,484	6,445
Munkegärdetippen	Kungälv	5,597	1,905
Norsa avfallsanläggning	Köping	62,673	6,095
Ahla deponi	Laholm	3,714	2,789
Lundåkrabuktens avfallsanläggning	Landskrona	51,000	9,620
Deponeringsanläggning Mosjön	Laxå	4,939	2,379
	Lerum		5,528*
Lessebo avfallsupplag	Lessebo	5,173	2,380
Karttåsens avfallsanläggning	Lidköping	57,204	18,036
Höjstorpstippen	Lilla Edet	17,223	16,407
Södra Måle avfallsanläggning	Lindesberg	12,052	5,520
Gärstad avfallsanläggning	Linköping	139,400	41,120
Bredemad	Ljungby	32,768	6,951
Lappmyran	Ljusdal	4,898	1,309
	Ljusnarsberg		3,973*
Björnhyttans avfallsanläggning	Ludvika	35,318	3,312
Sunderby avfallsanläggning	Luleå	68,200	8,630
	Lycksele		2,597*
Siviks avfallsanläggning	Lysekil	19,067	308
Spillepengs avfallsupplag	Malmö	403,799	59,587
Östra Industriområdet	Malung	3,397	831
Bångahagen	Mariestad	55,700	20,470
Alansköp	Markaryd	36,759	11,173
Kråkbergs avfallsanläggning, Mora	Mora	16,307	9,302
Tuddarps avfallsanläggning	Motala	56,659	7,972
Hästeskedes avfallsanläggning	Munkedal	12,016	499
	Mölnadal		18,037*
Mörkeskog	Mönsterås	8,712	2,828
Dvästa 1:9, Homotippen	Nordanstig	5,983	2,202
Häradsudden	Norrköping	58,592	13,763
Salmunge Avfallsanläggning	Norrtilje	34,896	6,934
Björshults avfallsanläggning	Nyköping	46,000	25,910
Boda avfallsanläggning	Nässjö	41,191	7,389

*Landfill facilities in 2003

Name of facility	Municipality	Waste quantity received	Quantity landfilled
Månsemyrs deponi- och återvinningsanläggning	Orust	9,295	4,951
Storskogens avfallsanläggning	Oskarshamn	20,154	5,688
Bredviksbergets Avfallsanläggning	Piteå	69,758	37,815
Hammarstrands avfallsanläggning	Ragunda	1,875	305
Fagerliden	Robertsfors	694	0
Angelskogs avfallsanläggning	Ronneby	23,074	6,954
Isätra	Sala	29,340	5,160
Brista	Sigtuna	23,929	20,968
Måsalycke avfallsanläggning	Simrishamn	40,400	19,200
Rödjorna	Skara	87,016	65,527
Degermyrans avfallsdeponi	Skellefteå	102,482	16,530
Vätterskoga	Skinnskatteberg	5,610	1,420
Risängens avfallsanläggning	Skövde	97,134	15,848
Rödsta avfallsanläggning	Sollefteå	35,541	2,630
Luspnäsets avfallsanläggning	Storuman	2,194	273
Kvittens avfallsanläggning	Strängnäs	16,497	3,626
Grandalens deponi	Strömstad	2,278	1,140
Lidens deponi & återvinningsanläggning	Strömsund	9,934	2,542
	Strömsund		460*
	Söderköping		626*
Blåberget	Sundsvall	86,435	31,879
Holmby Återvinningscentral och avfallsupplag	Sunne Municipality	13,962	3,770
Moga	Svenljunga	6,391	5,381
Änglarp	Svenljunga	13,743	5,098
Långtå avfallsanläggning och återvinningscentral	Söderhamn	23,145	3,778
Tveta Återvinningsanläggning	Södertälje	222,224	10,181
Tyfts avfallsanläggning	Tanum	14,688	511
Ekelands deponi	Tidholm	203	203
Gatmot	Tierp	3,382	63
Elsemåla deponi	Tingsryd	13,931	5,588
Heås	Tjörn	3,071	435
Prästtjärnsberg	Torsby	2,761	2,211
Gudarp	Tranemo	6,998	1,518
Norraby Deponi	Tranås	11,500	2,881
Trelleborgs avfallsstation	Trelleborg	63,430	3,167

*Landfill facilities in 2003

Name of facility	Municipality	Waste quantity received	Quantity landfilled
Borreboda	Töreboda	7,159	693
Havskurens avfallsanläggning	Uddevalla	58,300	10,970
Övreskog	Ulricehamn	41,104	2,643
Dåva deponi och avfallsanläggning	Umeå	68,044	14,742
Högbytorp	Upplands-Bro	414,178	285,516
Hovgärdens avfallsanläggning	Uppsala	101,000	52,744
Linneberga avfallsupplag	Uppvidinge	4,617	2,981
Toverums deponeringsanläggning	Valdemarsviks municipality	9,505	267
Löt Avfallsanläggning	Vallentuna	201,565	139,016
Bösarps avfallsanläggning	Varberg	8,354	6,046
Flishult	Vetlanda	34,989	10,959
Granberget	Vilhelmina	4,309	802
Vimmerby Avfallsanläggning	Vimmerby	29,953	1,991
Vik	Vingåker	17,360	1,198
Tumberg	Värgårda	12,465	1,615
TRAAB	Vänersborg	130,500	45,300
Starberget	Vännäs	2,380	615
Koviks Återvinningsanläggning	Värmdö	355,792	128,438
Stomsjö deponi	Värnamo	15,028	3,023
Målserums avfallsanläggning	Västervik	76,766	12,652
Gryta	Västerås	119,690	63,890
Häringetorp	Växjö	57,718	16,032
Berghagstippen	Ydre	175	175
Hedekoga avfallsanläggning	Ystad	46,300	5,200
	Åmål		8,573*
Brattåsens hushållsavfallstipp	Åre	7,616	7,295
Furskog	Årjäng	8,700	5,271
Korshults avfallsanläggning	Åtvidaberg	3,094	865
Äskya	Älmhult	36,557	20,929
Atleverket	Örebro	94,375	19,145
Må avfallsanläggning	Örnsköldsvik	47,872	1,797
Gräfsåsens avfallsanläggning	Östersund	48,860	21,721
Väddika avfallsanläggning	Östhammar	15,824	5,467
Kattarp	Östra Göinge	23,000	5,310

*Landfill facilities in 2003

References

1. Swedish Energy Agency 2000, Energiläget i siffror 2000.
2. European Commission 2001, A Sustainable Europe for a Better World: A European Union Strategy for Sustainable Development COM(2001)264 final.
3. European Parliament and Council 2002, Community Sixth Environmental Action Programme 160a0/2002/EC.
4. Environmental Objectives Council 2004, Miljömålen – allas vårt ansvar.
5. Swedish Environmental Protection Agency 1996, Aktionsplan avfall, rapport 4601.
6. Swedish Environmental Protection Agency 2002, Ett ekologiskt omhändertagande av avfall, rapport 5177.
7. Swedish Environmental Protection Agency 2004, Industrins avfall 2002, rapport 5371.
8. Swedish Environmental Protection Agency, 1996-2003, Rapportering av in- and utförsel av avfall till Baselkonventionen and Europeiska kommissionen.
9. Swedish Environmental Protection Agency 2005, Kartläggning av källor till oavsiktligt bildade ämnen m.m, Rapport 5462.
10. Swedish Environmental Protection Agency 2005, Lägesrapport för efterbehandlingsverksamheten 2004, DNo 642-5585-04.
11. Swedish Environmental Protection Agency 1996, Mål för särskilda avfallsslag, rapport 4602.
12. Swedish Environmental Protection Agency 2004, Marknaden för avfall, rapport 5408.
13. Swedish Environmental Protection Agency 2005, Response regarding Reports on implementation of waste legislation – period 2001 – 2003 e-mail to the Commission, 31 August 2005.
14. Swedish Environmental Protection Agency 2005, Samla in- Återvinn 2004, Rapport 5494.
15. Swedish Environmental Protection Agency, 2004, Sveriges klimatstrategi, Ett underlag till utvärderingen av det svenska klimatarbetet. Kontrollstation 2004, Rapport 5392.
16. Swedish Environmental Protection Agency 2004, Uppföljning av deponeringsförbudet 2004, Rapport 5393.
17. Government Offices of Sweden 2000, Svenska miljömål – delmål och åtgärdsstrategier, Regeringens proposition 2000/ 01:130.
18. Government Offices of Sweden 2004, Svenska miljömål – ett gemensamt uppdrag, Regeringens proposition 2004/ 05:150.
19. Government Offices of Sweden 2002, Ett samhälle med giftfria och resurssnåla kretslopp, Regeringens proposition 2002/ 03:117.
20. SOU (Swedish Government Official Report) 2001:2 Effektiv användning av naturresurser.
21. SOU (Swedish Government Official Report) 2002:50 Miljöbalken under utveckling – ett principbetänkande.
22. SOU (Swedish Government Official Report) 2004:37 Miljöbalkens sanktionssystem och hänsynsregler, Delbetänkande av Miljömålskommittén.
23. SOU (Swedish Government Official Report) 2005:23 En BRASKatt? – beskattning av avfall som förbränns.
24. SOU (Swedish Government Official Report) 2005:64 En BRASKatt! – beskattning av avfall som deponeras.
25. SOU (Swedish Government Official Report) 2002:9 Skatt på avfall idag och i framtiden.
26. Statistics Sweden 1998, Återvinning och bortskaffande av avfall 1998, MI 28 SM 0002.
27. Statistics Sweden 1998, Avfall från tillverkningsindustrin and utvinning av mineraler 1998, MI 28 SM 0001.
28. Sundqvist Jan-Olof, 2005, Svenska miljöinstitutet IVL 2005, Utvärdering av miljökonsekvenser av svensk avfallspolitik (not published).
29. Swedish Association of Waste Management 2000, Avfallsanläggningar med deponering – statistik 2000, RVF rapport 2001:11.
30. Swedish Association of Waste Management RVF, RVF rapport 2005:5.
31. Swedish Association of Waste Management RVF 1998-2005, Svensk avfallshantering 1998-2005.
32. Swedish Association of Waste Management RVF 2005, Trender och variationer i hushållsavfallets sammansättning – Plockanalys av hushållens säck- och kärlavfall i sju svenska kommuner, RVF rapport 2005:05.
33. Sweden's annual report under the UN LRTAP Convention.
34. Naturmiljön i siffror 2000. Swedish Environmental Protection Agency/Statistics Sweden 2000.
35. Utsläpp till luft av ammoniak in Sweden 1999. Statistiska meddelanden MI 37 SM 0001. SCB 2000.
36. Utsläpp till luft in Sweden, Statistiska Meddelanden MI 18 SM 0001. SCB 2000.
37. Swedish Forest Industries Federation, www.skogsindustrierna.se.

Strategy for Sustainable Waste Management

Sweden's Waste Plan

Swedish waste management has changed over the past ten years. New instruments in the form of producer responsibility, landfill bans and taxes have been introduced. EU membership has brought more detailed regulations in several areas. The trend has been consistent – less waste is to be put into landfill, more materials and energy in waste are to be recovered, and all waste must be managed in a way that is environmentally safe.

In A Strategy for Sustainable Waste Management, the Swedish Environmental Protection Agency describes Swedish waste policy and places the objectives, targets and instruments in the waste sector in context. We also explain the effects of the measures that have been implemented and identify areas that should be given priority in the waste sector over the next few years. The strategy also serves as Sweden's National Waste Plan.

A Strategy for Sustainable Waste Management is intended to meet the need for information about Swedish waste management among politicians, public officials, journalists, corporate environmental managers, students and interested members. It is also intended as an aid to local and regional waste planning throughout the country.

The strategy is also available in Swedish.

www.internat.naturvardsverket.se