FINAL REPORT

Pilot Study on Statistics on Waste Management in Agriculture, Forestry and Fisheries in Iceland.

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Pilot Study for the implementation of Regulation 2150/2002/EC on waste statistics:
Agricultural waste

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Summary

This report presents the Icelandic findings made during a pilot study on statistics on waste arising in agriculture, forestry and fishery *(shortly AFF)*. The Icelandic study is mainly focussed on waste generation and – treatment in agriculture and fishery, as relatively little waste is generated in forestry in Iceland.

To improve waste data comparability between countries the Regulation 2150/2002/EC on Waste Statistics *(shortly WStatR)* entered into force. This Regulation sets the framework for the generation of harmonized statistics by the EU Member States on waste generation, recovery and disposal. The implementation process of the WStatR includes the conduction of pilot studies by Member States and new accession countries on specific areas of more difficult nature in the field of waste statistics that could not be determined during the preparation of the Regulation.
Areas covered by these pilot studies are: 1) waste generated in agriculture, forestry and fisheries, 2) the import and export of waste, 3) packaging waste and 4) preparatory waste treatment operations.

The objective of the study is to develop an effective methodology for data collecting concerning sector-specific waste generated by these economically important sectors. Included in the study were the treatment of AFF waste, an assessment of the cost-effectiveness of the system, its updatability and the quality of the data that were obtained using the methodology. Important aspects that were investigated during this pilot study were:

1. To *recognise* and *visualize* the relevant waste streams within these economically important sectors in Iceland,
2. To describe, compare and where needed to *clarify* national definitions of sector-specific AFF waste sorts and its treatment,
3. To assess the *compatibility* of the current data collection system with the WStatR, and the quality of the obtained,
4. To asses the *cost-effectiveness* of the methodology.

In those cases that data were insufficient some assumptions and estimations had to be made which were thoroughly evaluated before they were used.

The pilot study was carried out in two phases, starting with a *literature study* and followed by a *case-by-case approach*. The reason to use this approach was to separate the relatively easy work, such as collecting general information on the AFF sectors, from the more complex work as discussions on waste definitions, methodologies and calculations on waste generation and – treatment.

The methodology that was developed during this pilot study is based on a waste monitoring plan, on pilot studies on AFF waste carried out by other countries and available Icelandic data. The monitoring plan handles all the recognised waste streams in agriculture, forestry and fisheries in Iceland.

The strategy is to handle each waste sort, by-product or raw/secondary material individually and to address specific topics such as: waste classification according to LoW and WStatR, waste treatment methods used, discussion and national waste definitions, possible methods for waste estimation and data collection. The reason for including by-products and raw/secondary materials in the study is that such data might provide a basis for further discussions on waste definitions at a European level.

Iceland also proposes to introduce a threshold for relative small waste amounts in AFF, to reduce the burden of data collection of non-relevant waste streams or waste that is already accounted for in other reporting.

The methodology described here meets the set of objectives to recognise and visualize the relevant waste streams in AFF, clarifies waste definitions where possible and assesses the compatibility of obtained data as well as their cost-effectiveness. Further improvements of the methodology may be achieved in the future, as registration by municipalities and waste management facilities is expected further to improve with the implementation of regional waste management plans *(RWMP)* in 2005 and have to be revised every three years. To enhance maximum data quality and consistency through the coming years it is necessary to reconsider the here used assumptions and estimations in every round of updating the AFF waste statistics with the developed methodology.

This report comprises the first consistent set of data on waste generated in AFF in Iceland in 2002. It roughly recognises two main waste streams in AFF, i.e. *bio-organic* – and *other sector-specific AFF waste.* Bio-organic is subdivided in animal – and vegetal waste, and other sector-specific AFF waste is divided in packaging –, chemical – and other waste.

In total, circa 1.705.000 tons of AFF waste, by-products and raw/secondary materials were generated in Iceland in 2002. The greater part of this quantity is covered by livestock effluent *(78%)* and other animal tissue waste/residues generated during slaughtering *(livestock)* or guttering *(fishes)* of animals *(18%)*. From this total, 57.202 tons *(4%)* are seen as waste within the frame of Icelandic waste definitions of which 56.200 tons should be reported as waste under NACE A and B. Based on the total amounts of waste generated in Iceland in 2002 *(465.000 tons)*, almost 12% of this waste is generated by agriculture, forestry and fisheries, given the above mentioned definitions.

1. Introduction

EU Member States have to report relevant waste streams arising in agriculture, forestry and fisheries to the EU Commission. Until now, this has been done by using the joint EUROSTAT/OECD Questionnaire, but it has become clear that comparison between Member States is problematic as different data registration systems, reporting methods and waste (treatment) definitions are being used.

Agriculture, forestry and fisheries *(AFF)* are relative important economical sectors in Iceland. Except normal household waste, these activities generate substantial amounts of sector-specific waste. However, data collection on the generation and treatment of waste from these sectors is not with the requirements of current EU regulation.

1.1 Waste Statistics Regulation

WStatR

In December 2002 the Regulation of the European Parliament and Council *(EC)* 2150/2002 on Waste Statistics *(shortly WStatR)* entered into force. This Regulation sets the framework for the generation of harmonized statistics by the EU Member States on waste generation, recovery and disposal. The first statistics in compliance with the Regulation have to be produced on the data for the year 2004 by the end of June 2006. It was decided that the implementation process of the WStatR should include the possibility for carrying out pilot studies in those areas that have proved to be problematic in the field of waste statistics and could not be determined during the preparation of the Regulation. Four types of pilot studies were determined in the program drawn up by the Commission:

1. **Statistics on waste generated in Agriculture, Forestry and Fisheries,**
2. Statistics on the import and export of waste,
3. Statistics on packaging waste,
4. Statistics on preparatory waste treatment operations.

Pilot studies

The general objective of these pilot studies is to lower the threshold for Member States *(including Candidate Countries and EFTA)* to develop compatible, reliable and cost-effective data collection systems in the above mentioned fields, which fulfil the needs of the Community. In the field of waste statistics these studies are specifically targeted at facilitating the implementation of the WStatR.

AFF pilot study

According to Article 4(3) in the WStatR, Member States shall conduct pilot studies on how to implement statistics on agriculture *(including hunting)*, forestry and fisheries. In late 2003 and beginning of 2004, 14 projects started to investigate the waste management practices and the respective data collection possibilities. The majority of the participating countries belong to the “old” Member States, 5 studies have been carried out by “new” Member States, and 1 study was conducted by a country belonging to the European Economic Area *(EEA) (Norway)*. By the beginning of 2005, 8 studies were finalised and the remaining 6 studies were finished in the first half of 2005.

Combining methods

As regards data collection, due to the large variety of waste types generated within AFF a combination of different methods is thought to be useful. The use of different registers or administrative systems for waste registrations appears to be the most favourable option. Statistics available through regular farm surveys may be used as a data source for the development of future estimation models.

Terms of Reference

According to the *Terms of Reference* this study should be based on the progress reached during earlier studies and should carry out the following tasks:

- Investigation, discussion, and finally suggestions for the waste categories to be included under these economic activities. A proposal for classifying of these categories according to the EWC-Stat Rev. 3[1] and underlying LoW[2], and, if necessary, a more detailed breakdown of waste categories in EWC-Stat should be made,
- Investigation on and description of waste treatment operations carried out in the agricultural sector and suggestions for harmonised reporting on waste treatment in agriculture and forestry,
- With regard to bio-organic residuals (e.g. manure, animal carcasses, harvest residues, logging residues) the national opinion on the borderline between waste/non-waste should be documented and proposals should be elaborated for waste amounts to be covered by waste statistics,
- Further development of estimation- and modelling methodologies for the sectors, to be able to make use of already collected data (e.g. production figures, livestock figures, waste factors).

In the conclusions of the study specific attention should be given to the questions:

- What is a realistic and manageable way of collecting the data in the Member States?
- What is the *(expected)* degree of precision or data quality for each of the selected waste streams?

The Commission shall, based on the results of these pilot studies, adopt the necessary implementing measures and make a proposal for amending the Regulation 2150/2002/EC on waste statistics in accordance with the committee procedure.

[1]) *EWC-Stat refers to Regulation (EC) no. 2150/2002 of the European Parliament and the Council of 25 November 2002 on waste statistics (WStatR).*
[2]) *LoW (List of Waste) refers to the Commission Decision of 3 May 2000 (2000/532/EC).*

1.2 Objectives

The main objective for this pilot study is to develop an effective data collecting system for estimating and dividing between general and sector-specific waste in AFF in Iceland. Important aspects that were investigated during this pilot study were:

Visualization
1. To *recognise* and *visualize* the relevant waste streams within these economically important sectors in Iceland,

Definition
2. To describe, compare and where needed to *clarify* national definitions of sector-specific AFF waste sorts and its treatment,

Compatibility
3. To assess the *compatibility* of the current data collection system with the WStatR, and the quality of the obtained,

Cost-effectiveness
4. To asses the *cost-effectiveness* of the methodology.

1.3 Structure of the project

Literature study

Case-by-case approach

The execution of this project has been done in two parts, presenting a *literature study* and *case-by-case approach*. This approach has been used to separate the relatively easy work such as collecting general information on the AFF sectors, from the more complex discussions on waste definitions and development of methodologies.

Literature study

During the literature study the interim and final reports from those countries that participated the first round of pilot studies on waste from AFF were considered. Furthermore, valuable information could be found in the Eurostat pilot study evaluation reports, providing a good basis for this Icelandic pilot study.

Visualize structure

Other work done was to visualize the Icelandic organization structure in agriculture, forestry and fisheries, addressing topics such as: economical activities found in each sector, generated waste sorts, reuse of raw/secondary materials and waste treatment methods used, available data sources and production figures.

Case-by-case approach

The development of a methodology for collecting data followed a somewhat similar approach as used by the Netherlands. Each waste or non-waste stream was investigated individually, addressing topics such as: waste classification used according to LoW and WStatR, waste treatment methods used, discussion and national opinions on waste definitions, methodology of data collection and preliminary waste amounts.

Waste vs. non-waste

Furthermore, the borderline between waste, by-product or raw/secondary materials was considered extensively, attempting to clarify what should be considered as waste in the Icelandic AFF sectors in relation to European waste statistics and regulations. In this report, a waste classification and waste monitoring plan is proposed for those waste sorts that to our opinion might be reported under the NACE A and B statistical waste classification.

2. Structure of the economical sectors

Iceland is an island of approximately 103.000 square kilometres skirting the Arctic Circle in the North-Atlantic Ocean. It has a population of 299.404 *(December 2005)*. With an average population density of 2.8 inhabitants per km^2, almost two out of three Icelanders *(62%)* live in the greater Reykjavik area. The climate is dominated by the surrounding ocean with an average temperature ranging from +8 to +15°C in July and from -3 to +3°C in January. As can be expected in a moderate climate the weather is fairly unstable, winds and rains are frequent, particularly in the south and west, with average precipitation varying from less than 400 to over 4000mm per year. The growing season is very short, little more than three months a year. The island is young on the geological calendar, consisting almost exclusively of volcanic rocks, lava and sediment and has still many active volcanoes. Thus, there are large areas in the country, which are very vulnerable to wind and water erosion.

Table 2.1 Geographical statistics, Iceland 2002

Population	**290.570**
Capital region	181.917
Southwest	16.953
West	14.438
Westfjords	7.837
Northwest	9.145
Northeast	26.835
East	11.887
South	21.558

Area of Iceland	**103.000 km^2**
0 – 200 m	24.708 km^2
201 – 400 m	18.401 km^2
401 – 600 m	22.168 km^2
> 600 m	37.745 km^2

Vegetation	**52.389** km^2
Good vegetation cover	14.500 km^2
Reasonable vegetation cover	13.996 km^2
Rather sparse vegetation cover	15.607 km^2
Sparse vegetation cover	8.286 km^2
Cultivated land	1.290 km^2
Grass fields	1.220 km^2
Woods	1.360 km^2
Lava	11.000 km^2
Lakes	2.283 km^2
Glaciers	11.417 km^2
Wasteland	37.285 km^2
Population per km^2	2,8
Municipalities	104
Coast Line	4.970 km

Data sources: *- Icelandic Statistics and Iceland in figures - Statistics Iceland (Hagstofa Íslands)*
- Agricultural Statistics - Farmers Association of Iceland (Bændasamtökin)

2.1 Agriculture

From the geographical statistics mentioned above one might assume that Iceland is not very favourable for agricultural production. Crop production is only on a minute scale and today of minor economic importance, while animal *(meet, milk and egg)* production accounts for 75% of the total value of agricultural products. Looking at the distribution of the workforce between employment sectors, agriculture has fallen in proportion from 32% in 1940 to circa 4% today, while the employment in trade and various services has nearly doubled.

However, districts outside the Reykjavík area, employment in agriculture lies between 9 and 20% of total employment, and these figures would be substantially higher when including people employed in the dairy and slaughtering industries. In 2002, approximately 6.000 people were working in Icelandic agriculture and around 3.000 farms are operational in Iceland today.

Iceland is 100% self sufficient in most types of meat *(sheep, horse, pig poultry and goat)* except beef *(nearly 100%)*. Also for eggs, milk and diary products Iceland is 100% self sufficient. For fruit and vegetables Iceland is around 50% self sufficient and for potatoes it is normally 100%.

Agriculture sectors and activities

Within the agriculture sector in Iceland many different *sectors* and *activities* can be distinguished, each generating one or more sector-specific waste sorts. The following sectors were considered to be important during this pilot study:

- Livestock *(breeding and keeping of animals)*,
- Horticulture *(on-field and greenhouses)*,
- Aquaculture *(fresh- and saltwater fish-farming)*,
- Hunting,
- Farm tourism,
- Pelt and fur *(and eiderdown)* industry.

2.1.1 Livestock

The livestock industry constitutes by far the most important agricultural sector. Most of the approximately 4.000 farmers that pursue animal production practice work in mixed farming e.g. producing both milk and sheep products *(meat and wool)*. The livestock in Iceland mainly comprises of cattle, sheep, horses, poultry and pigs.

Cattle

The Icelandic breed of cattle is smaller than cattle in neighbouring countries. It is a hardy and fertile type of cow and produces a great deal of milk. The number of dairy farmers is gradually declining as the productivity of individual farming increases. There are currently about 1.100 milk farmers in the country and the milk production in 2002 was around 110.761.076 litre. Most milk production and cattle breeding is conducted in the south, west and north-central areas of the country, near the major urban centres. The cows are kept in barns for eight months of the year and fed on dry hay and silage. The most productive milk cows also receive feed concentrates. Cows are put out to pasture in the summer and are usually very frisky for the first few days.

Icelanders consume an average of 158 litres of milk per capita per year, which is among the highest consumption in the world. They also consume large quantities of cheese, which is a very interesting development because few varieties of cheese were produced in Iceland before the sixties.

Beef consumption has increased significantly in recent years, as both meat quality and handling methods have been improved. The slaughtering mainly takes place at slaughterhouses, which forms a part of the food processing industry, though occasionally slaughtering is also done by farmers themselves. Icelandic law forbids the use of hormones for promoting growth.

Sheep

Sheep farming is practiced throughout the country, although it is most common in sparsely settled areas. About 2.000 farmers get most of their income from sheep farming. The Icelandic sheep is a strong, hardy species that has adapted well to Icelandic conditions. Many farmers formerly allowed their sheep to graze in outlying pastures over the summer months, but as a result of the recent reductions in flocks, animals are increasingly kept in home pastures. However, large numbers are still on most of the common highland ranges from July to September. Sheep used to be sheared before they were put out to pasture. Now most farmers shear them in the autumn or winter because such wool fetches a higher price.
Sheep receive mostly non-commercial fodder, consisting of dry hay and silage. Silage production in round bales has increased because it is a great advantage for farmers to be able to process grass into silage, given the fact that Icelandic summers can be very wet.

Icelandic consumption of lamb meat is among the highest in the world. Most slaughtering is done in the autumn, making the supply of fresh lamb seasonal, in contrast to other types of meat, which are available fresh all year round. In order to increase the supply of fresh lamb, the traditional slaughtering time, which previously occurred over a short period in the autumn, has been extended.

Horses

Most farmers own some horses and quite a number of farm owners derive a reasonably good income from breeding horses and training them for riding as well as for the meat production. The sale of riding horses to urban dwellers has increased significantly in recent years. The export of horses for riding has also grown significantly. There are societies of Icelandic horse breeders throughout the world and there are a number of foreign magazines dedicated to the Icelandic breed. The interest in horsemanship has led to great improvements in the breed, with emphasis in riding horses being placed on appearance and build. Several training schools operate in Iceland.

Horsemanship has always been very popular in Iceland and many people in urban areas have taken up riding as a hobby. Several well-attended riding competitions are held every summer, where horses are shown and entered in competitions. Horse ownership is largest in southern and northern Iceland. Farmers have also begun operating horse rental services, and riding tours accompanied by guides can be booked *(see also par. 2.2.5 as Farm tourism)*. The Icelandic horse has thus never been more popular, even though mechanization has made the horse no longer necessary as a draught animal or beast of burden.

Poultry

Egg and chicken producers employ a species from Norway. Fertilized eggs are imported regularly and the eggs are hatched in a special quarantine station. The chicks are then kept in isolation for a specified period before being distributed to chicken and egg producers.

During recent decades, there has been an emphasis on producing chickens for slaughter. Ducks, turkeys and geese are also bred on special poultry farms. Modern egg and chicken farms have been built in order to satisfy the domestic demand for these products. Stringent regulations are in force concerning fowl breeding conditions as well as product standards. There is still a very old Icelandic poultry breed in existence today. The hens are small and multi-coloured, and the cocks extremely proud and colourful. Some farmers keep this breed as a hobby. It was feared for a time that this ancient variety was about to die out.

Pigs

Pig breeding has increased enormously in recent years, and there are several large operations that produce most of the pork sold on the domestic market. Ancient place names indicate that pigs were kept at the time of Iceland's settlement, but this breed died out. Pig farming was not re-established until the twentieth century. Pork consumption has increased steadily since, and has risen significantly in recent years.
Although pig breeding is a relatively young branch of Icelandic agriculture, the quality of Icelandic pork is fully comparable to that of neighbouring countries. The use of hormones in pig breeding is not permitted and there are stringent regulations concerning animal welfare.

Table 2.2 Livestock statistics, Iceland 2002

Type of livestock	Number of animals	
Cattle (total), of which:	70.168	
Dairy cows		*26.240*
Beef cows	*1.071*	
Heifers	*6.375*	
Steers	*18.876*	
Calves	*17.605*	
Sheep	473.535	
Ewes	377.066	
Horses	73.809	
Hens *(egg prod.)*	128.241	
Poultry *(meat prod.)*	28.733	
Pigs	4.561	

Data source: Icelandic Statistics

2.1.2 Horticulture

Icelandic horticulture is primarily based on grass and hay production. Natural pastures are maintained to produce fodder in the form of hay or silage. Total cultivated land and grass fields amounts to 2.500 km^2 *(5% of total areable land)* and domestic production of fodder for all livestock, including pigs and poultry, is 75-80% in terms of weight, the other 20-25% is imported as animal fodder. An increasing amount of barley is grown in Iceland, used both for bread and animal fodder production.
In 2002 the hay, silage and big-bale silage production was respectively 432.654 m^3, 56.177 m^3 and 1.902.236 m^3.

The production and consumption of potatoes, root crops and vegetables was traditionally very little in Iceland until the twentieth century and in fact the consumption of vegetables is still relatively little in comparison to other countries. Outside vegetable production is mainly limited to potatoes, turnips, cabbages, cauliflower and carrots, while in the last few decades, greenhouse production, utilizing geothermal energy and lately also artificial electric lighting in the wintertime, has considerably added to the variety of horticultural produce. Due to climatic factors, outside growth is variably successful between years, thus e.g. the potato crop has in recent years varied from 4.000 to 15.000 tonnes per year, while the greenhouse sector is less influenced by the weather.

The primary vegetal production in greenhouses is tomatoes, cucumbers and flowers, although a great variety of other types are grown on a lesser scale. The greenhouse production is mainly for the domestic market and very little is exported. In 2004 the Icelandic greenhouses covered an area of 18 hectares and most of them are located in the south part of Iceland.

Table 2.3 Crop (horticulture) statistics, Iceland 2002

Type of vegetal product	Production
Potatoes	11.366 t
Turnips	730 t
Carrots	296 t
Cereal grains	4.337 t
Tomatoes	964 t
Cucumber	1.049 t
Cauliflower	84 t
Cabbage	503 t
Pepper	195 t
Chinese cabbage	253 t
Mushroom	450 t

Data source: Icelandic Statistics

2.1.3 Aquaculture

There has been a considerable investment in salmon and trout farming in Iceland around the middle of the 1980s. It began with smolt *(young salmon)* production, but soon expanded to include the raising of fish to slaughter-size in land-based stations and sea cages as well as ocean ranching operations, though ocean ranching almost stopped to exist since 2000. There is also growing interest in halibut culture and experiments in this area are promising.

In land-based facilities, fish are raised in tanks or basins. The advantage of this type of aquaculture is that growth can, to a certain extent, be controlled, and these stations can exploit the widely available geothermal energy *(and hot water).* Geothermal energy can be used to accelerate the growth of fish and the nation has extensive experience in the handling and processing of fish products.

An increased supply of salmon from fish farms worldwide has led to a decline in market prices and financial difficulties began to plague this new branch of farming at the end of the 1980s and the beginning of the 1990s. Furthermore, salmon production had to deal with various initial difficulties such as diseases, problems with genetic distribution and variety, environmental impacts.

In general, conditions for fish farming are excellent in Iceland. Clean waters surround the country and there is an abundance of clear spring water for smolt production. An additional activity found in aquaculture in Iceland is mussel production.

Table 2.4 Aquaculture statistics, Iceland 2002

Type of fish	Production
Total, of which:	**4.070 t**
Salmon	2.645 t
Arctic char	1.320 t
Rainbow trout	105 t

Data source: Agricultural Statistics

2.1.4 Hunting

In Iceland the shooting rights usually belong to landowners, which often lease their land to hunters. Hunting in Iceland is mainly done by hobby hunters and presents a similar activity as freshwater fishing by hobby anglers *(see fisheries, par. 2.4).* There are though public grounds where any Icelander with a valid hunting licence can hunt but foreigners are only allowed to hunt on private lands. Shooting rights also depend on the type of animals hunted, whereas for birds such as geese and ducks you only need a valid hunting card, but for reindeer you also need a licence from The Reindeer Committee in Iceland. The Wildlife Management Institute forms a part of the Environmental Agency *(UST)* and is the government's organization which takes care of all hunting licences and control.

Table 2.5 Hunting statistics, Iceland 2002

Type of animal	Number of animals
Reindeer	349
Mink	8.550
Foxes	5.372
Geese and ducks	67.665
Cormorants and gannets	5.634
Grouse	127.515
Gulls and Skuas	58.521
Petrels	9.610
Passerines	3.060
Auks	233.049

Data source: Icelandic Statistics

2.1.5 Farm tourism

There has been a steady increase in tourism in the last few decades in Iceland. Farm tourism has increased vastly in recent years and is expected to expand further in the future. The relative short tourist season surely is a disadvantage, but nevertheless this activity already supplements the dwindling income of many farms and gradually has become the main source of income on quite a few farms throughout the country.

Utilization of additional resources such as fishing in lakes and rivers *(see par. 2.3 fisheries)*, collecting eiderdown *(see pelt and fur industry, par. 2.1.6)* and horseback riding has for a long time been a part of farming life in Iceland. In addition, many farmers have started providing room and board *(bed and breakfast)*.

2.1.6 Pelt and fur industry

The pelt and fur production represents only a relative small economical activity in the agricultural sector, though this type of industry has developed quite rapidly. There where approximately 55 pelt and fur farms in Iceland in 2000. Animals used for the pelt and fur production are mainly minks, foxes and rabbits. Eiderdown production presents a minor activity in Iceland and has even decreased over the last decades partly due to increased damage by birds of pray and minks that escaped captivity on mink farms.

Table 2.6 Pelt and fur industry statistics, Iceland 2002

Type of animal	Number of animals
Mink	34.899
Foxes	4.027
Rabbits	791

Data source: Icelandic Statistics

2.2 Forestry

At the time of human settlement over 1100 years ago, birch forest and woodland probably covered 25-40% of Iceland's land area. As elsewhere in agrarian societies, the settlers began cutting down the forests and burning scrubland to create fields and grazing land. Because of these activities, the extent of Icelandic birch-wood probably reached a post-glacial minimum, or about only a 1% cover, based on total land area, during the early twentieth century. Wood is used for several purposes such as for making boats and houses as well as for heating.

Potentially, with climatological circumstances in Iceland, forests can cover the land below 200m above sea level, though some higher areas are forested where climate circumstances are favourable. The highlands with strong winds and an even shorter vegetation period than on places near the ocean are generally treeless, meaning bare or only very sparsely covered with vegetation and erosion problems. This mainly affects farmers and landowners in the higher situated areas. Forestry is generally seen as the responsibility of the Ministry of Agriculture in Iceland, but has further involvement from different institutes such as:

Forestry institutes

- The Icelandic Forest Service *(IFS)*,
- The Icelandic Forestry Association *(IFA)*,
- The Icelandic Forest Owners Association *(FOA)*,
- The Soil Conservation Service *(SCS)*.

Organised forestry is considered to have started in Iceland in 1899. Forestry efforts focussed on protecting birch forest remnants during the first half of the 20th century, with several forest areas being acquired by the IFS for that purpose. They, along with more recently acquired afforestation areas and experimental forests comprise the National Forest system today. Three activities within Forestry can be distinguished, which are:

Forestry activities

- Afforestation,
- Plant nurseries,
- Logging and harvesting.

2.2.1 Afforestation

During the past 50 years or so, emphasis has been on afforestation[3] through planting trees. The planting by forest societies varied between 0,5 and 1,5 million seedlings per year and has increased since 1990 to over 6 million seedlings in 2004. Almost all plantations in Iceland are owned by individuals and are for the most part well under 200 hectares.

Fertilizing is typically done by hand, though occasionally fertilizer is also broadcast on larger areas at once. No machinery is used for planting, though tractors are occasionally used for land preparation. When machinery is involved, in most cases it is owned by the farmer/landowner, or hired from neighbour farmers.

[3]) *"Afforestation" refers to the planting of trees, to convert land into forest. Reforestation refers to the replanting of trees, to cover an area again with forest. Because it is not know which areas have been forested in the past, the term "afforestation" is used.*

Because most machinery used in forestry is also used for other agricultural purposes machine-related waste may expected to be difficult to generate and therefore will be reported as waste from agriculture.

2.2.2 Plant nurseries

Most commonly, planting is carried out by farmers/landowners on their own land. The young plants are produced in plant nurseries that combine seedling production with other greenhouse activities. Plants are produced in multi-pots and these are returned to greenhouses/plant nurseries using a deposit system. The exact lifespan of these multi-pots is not known, but they are generally cleaned and used again between 5–10 times. Very few plants are produced in single plant pots and most of these pots are only used once, but are usually collected for reuse.

2.2.3 Logging and harvesting

In the Forestry sector in Iceland, logging and harvesting activities are very sparse. The reason for this is that the Icelandic forests are not yet at a sufficient stage of maturity so typically very little wood is harvested in Iceland. Most of the trees that were felled are part of thinning activities and these trees *(including branches)* are usually left in the forest. This is done for two reasons: the first is that they have very little commercial value. Secondly, in many cases forestry is being done on sites with impoverished soil so leaving the trees in the habitat brings nutrients back to the soil. Some of the trees are chipped for use mainly in the forest paths and birch is at times used for firewood. Larch is sometimes used for making furniture or wooden floors, but this is on a very small scale. There are between 8.000 and 10.000 Christmas trees felled in Iceland per year and a lesser amount is cut for greenery.

The bulk of the thinning is done using brush-saws, chainsaws are generally used to fell larger trees. At present there are no large harvesters such as feller-bunchers. Timber that is removed from the forest for production/construction purposes is removed using tractors with wenches or ATVs. Almost all of the equipment used by foresters is equipment that is also owned by farmers and therefore equipment waste will be considered as waste from agriculture.

2.3 Fisheries

Fisheries represent one of the most important economical sectors in Iceland and its contribution to the Gross Domestic Product *(GDP)* in 2002 was 7,8% excluding the fish processing, which was an additional 2,9% *(together presenting 10,7% of the GDP)*[4]. The Icelandic Statistics for 2002 show that the number of employers occupied with fishing was approximately 5.300, divided over 1.198 enterprises *(including fish processing)*. Fishery can be subdivided in two groups of activities as:

Fishery activities

- Marine fishing,
- Freshwater fishing.

It has to be emphasized that *sea fish processing* is not seen as a part of fisheries within the context of this pilot study, but as an industry and thus, waste from marine fish processing will not be included in this report.

2.3.1 Marine fishing

Sorts of salt-water fish

Marine fishery may be divided in demersal, pelagic and shellfish fishery. In 2004, ground-fish was about 28% of landings and flatfish just under 2%. The pelagic fisheries provided 68% of the catch and the shellfish and crustacean fisheries 2%. In terms of value, however, the proportions are very different. The ground-fish fisheries provided about 68% of catch value, flatfish 6%, the pelagic 15% and the shellfish and crustaceans 11%. Atlantic cod is the most important of all the marine resources in Iceland. In 2004 it represented 40% of the total seafood export value.

The foundation for the success of the fisheries is the rich marine life in Icelandic waters, which is maintained by the powerful oceanic currents meeting off the coast of Iceland. They create the conditions of nutrients and temperatures that are ideal for marine life and hardly paralleled elsewhere in the northern hemisphere.

Table 2.7 Marine fishing statistics, Iceland 2002

Type of fish	Production
Total catch, of which:	**2.133.412 t**
Demersal catch	438.251 t
Flatfish catch	32.585 t
Pelagic catch	1.468.497 t
Shellfish catch	46.820 t

Data source: Icelandic Statistics

Fishing vessels

In 2002 just over 2.000 active vessels where used in the Icelandic fishing fleet, with a total gross weight of nearly 192.000 tons. Typically in the maritime industry terms such as gross or displacement tonnage are used, which refers to a volume and not to a weight *(e.g. gram, kg or tons)*. More about estimating the weight of vessels is discussed in Annex II.
The active vessels included 1.057 undecked vessels, 875 decked vessels and 80 trawlers. In 2000, about 45% of the total catch value was landed by trawlers, 5% by small-undecked vessels and 50% by other vessels of varying sizes and capacity.

[4]) *Other economically important sectors in addition to fisheries are:*
1) Wholesale and retail trade (10,7%)
2) Financial, real-estate and business activities (21,4%)
3) Other private services (24,7%)

Undecked vessels and other small vessels are most numerous in the Westfjords. The homeports of many of the largest trawlers are in the Northeast and the capital region while some of the largest purse-seiners have a homeport in the Eastfjords.
A large increase in capacity occurred in the 1970s due to a rapid increase in the number of stern trawlers. The total capacity has decreased somewhat since 1996 in an effort to make the fishing industry more economic. Investment in new ships and vessel improvement has also decreased markedly since the late 1980s.

Table 2.8 Marine fishing vessels statistics, Iceland 2002

Type of vessel	Number	Gross weight
Total vessels in use, of which:	**2.012**	**191.437 t**
Decked vessels	875	107.160 t
Trawlers	80	79.413 t
Undecked vessels	1.057	4.864 t

Data source: Icelandic Statistics

2.3.2 Freshwater fishing

Sorts of fresh-water fish

There are five fish species in freshwaters in Iceland. These are the Atlantic salmon and Brown trout *(Salmonid species)* and the Arctic char. There are both sea-run and stationary populations of trout and char. The other two species are, European Eel and Three-Spined Stickleback. Of these species salmon is of the greatest economic importance.

In most Icelandic rivers, rod and line are the only allowed fishing gear and most fishing activities are carried out by hobby anglers. There is a fixed number of rods that may be used in each river as decided by the Directorate of Freshwater Fisheries. In some rivers there are further restrictions on the bait allowed. There is a general ban on marine salmon fishing in Icelandic waters and net fishery only takes place in the larger glacial rivers.
The fishing rights typically go with the ownership of the land adjacent to the rivers. The landowners are usually farmers. All the owners of the fishing rights in a river system form a fishery association, which manages the exploitation of the fish stocks, within the frame set by the law. Usually the association rents or leases the fishing rights to angling clubs or directly to anglers.

The catch is recorded in special logbooks usually located in the fishing lodges. At the end of each fishing season these logbooks are gathered by the Institute of Freshwater Fisheries *(Veiðimálastofnun)*. Statistical information is then processed and the information is sent back to the fisheries associations with new logbooks before the start of the next fishing season. Catch statistics from Icelandic rivers have been compiled in this way since 1974 and in some cases statistical information is available back to the 18th century.

Table 2.9 Freshwater fishing statistics, Iceland 2002

Type of fish	Weight landed	
	Rod fishery	*Net fishery*
Total landed, of which:	**141 t**	**13 t**
Salmon	70 t	13 t
Brown trout	38 t	-
Artic char	33 t	-

Data source: Icelandic Statistics

3. Waste definitions & methodologies

3.1 Methodological Framework

The methodological approach used during this pilot study is a.o. based on the research that has already been carried out during the first round of pilot studies in 2004. 14 Member States have carried out a pilot study on this subject with the objectives to provide a clear distinction between waste and non-waste streams arising in agriculture, forestry and fisheries *(AFF)*.

One of the main questions is: Which bio-organic residues should be seen as waste and which should be seen as by-products or raw/secondary materials that may be used for production activities? The issue has not yet come to settlement in many European countries. Some countries decide to include all bio-organic residues into waste statistics – based on the fact that they are listed in the LoW – where others make a clear distinction between waste and non-waste materials. Still others specified only the topics of which data could be collected and left the decision, what to be collected, untouched.

In general it can be stated that the WStatR and LoW are not providing a clear distinction between waste and non-waste. Meaning that inclusion of specific material in the list does not imply that the material is a waste in all circumstances.

Case-by-case approach

To avoid any further complications during data collection we made the decision to use a *case-by-case* approach in this study. Each waste sort, by-product or raw/secondary material that has been recognised as being generated within the AFF sectors will be discussed individually.

Discussions and National opinions

The decision between waste/not waste and which classifications must be used, may well be based on the outcome of the ongoing *discussions* and different *national opinions* on waste definitions. The three main definitions to be discussed are:

1) **Waste vs. by-product or raw/secondary materials,**
2) **Bio-organic waste,**
3) **Other sector-specific AFF waste.**

These discussions are presented respectively in paragraph 3.2.1, 3.2.2 and 3.2.3. The data sources that have been used for data collection are presented in paragraph 3.3 and more detailed information on these sources can be found in Annex III.
An Icelandic proposal for waste classification and a waste monitoring plan in AFF for those waste sorts that have been recognised is presented in paragraph 3.4. A more detailed description of these recognised waste sorts, by-products or raw/secondary materials, their treatment, individual discussions and data collection methods can be found in Annex II.

3.2 Discussion on definitions

Definitions on waste and waste sorts can be found in various European Directives and Regulations. From the pilot studies carried out in the first round it has emerged that definitions on waste from agriculture, forestry and fisheries may differ between Member States. Until today the definitions of several waste sorts are a general topic of discussion, being relevant for waste statistics and reporting.

Bio-organic materials

One reason is that different countries may have different perceptions of what should be considered as waste. This typically applies to *bio-organic materials* but also includes other materials that can be seen as *by-product* or *raw/secondary materials* used for production processes. After the first round of pilot studies, it remains unclear to which extent sector-specific waste streams should be included in these statistics.

The Icelandic situation is no different here. As the Icelandic waste legislation defines all substances or objects that are typically worthless or unwanted and thus are (to be) disposed of by the waste holder, as waste. There are several waste materials that are not considered as waste according to European legislation *(Waste Framework Directive),* but are defined as waste in Icelandic legislation. A clear example of this is livestock effluent *(e.g. manure and slurry).*

The Icelandic waste definitions will be discussed in the following paragraphs. Especially the borderline between waste and non-waste will be addressed. In addition, a reporting threshold for small waste amounts, and waste generated by other sectors that are closely related to AFF will be discussed.

3.2.1 Waste vs. by-product or raw/secondary materials

In article 1a of the Council Directive 75/442/EEC on waste, the definition of waste is reading the following:

Waste definition

> *"Any substances or objects in the categories set out in Annex I (of Council Directive 75/442/EEC) which the holder discards or intends or is required to discard".*

The translation of *"to discard"* reads as any substances or objects for which the holder has no further use, are unwanted or worthless.

By-product or raw /secondary material

From the waste definition it can be determined that any substance or object that does form a useful by-product or raw/secondary material should not be considered as waste i.e. as far it is not useless or unwanted for the holder. A by-product or raw/secondary material can be used, reused, sold or given away by the holder for further use in production processes. This specifically applies to bio-organic residues e.g. livestock effluent, guttering residues from animals *(e.g. entrails from fish or livestock)* or harvesting residues generated in agriculture, forestry and fisheries.

The difference between waste and a by-product or raw/secondary material seems quite obvious though the distinction between these two can in fact be very narrow. Because it remains problematic to present one all-over definition covering all types of waste, by-products or raw/secondary materials, a case-by-case approach might be useful to bring up a practical approach of distinction between waste and non-waste materials generated.

The discussion whether something is to be considered as waste or by-product will be further observed in paragraph 3.2.2, including bio-organic waste streams such as animal – and vegetal residues.

3.2.2 Bio-organic waste

Animal residues

Within the Waste Framework Directive *(WFD)* or other European legislation no specific definition for *animal residues* can be found. However, according to article 2b of the Council Directive 75/442/EEC, animal carcasses and agricultural waste such as faecal matter and other natural, non-dangerous substances used in farming are to be excluded from the scope of the WFD. To our opinion this judgment should be better clarified and to ensure reporting and data quality, the following description of animal residue waste will be used in this report.

Animal residues

"Animal residues as carcasses, guttering (entrails) of animals, faecal matter and other animal tissue from agriculture or fisheries, should be excluded from the waste classification and reporting obligations for NACE A and B when it applies to animal residues that have been left or buried on the production site, are reused without any further recovery process is taken, form non-dangerous substances, or presents a by-product or raw/secondary material used for other production processes".

This means that the method of waste treatment or – handling presents a very important factor in the decision to include or exclude animal residues from these waste statistics. This applies to farming, but might also apply to fishery and hunting to our interpretation.

Infected dead animals

Infected dead animals may be related to the outbreak of infections diseases. This might result in vast amounts of animal waste generated occasionally and therefore can cause big fluctuations in waste amounts reported by a Member State from one year to another, not necessarily representing the actual development of waste generation in the sector.

Production site

A *production site* can be rather difficult to define. For agricultural activities such as livestock farming, horticulture, aquaculture and the pelt and fur industry, the field or land owned by the farmer *(thus waste holder)* is assumed to present the production site. In salt-water aquaculture *(part of agriculture)* the production site may be formed by the fjord or coastal area, where the basins are located.
For hunting it would present the whole area where animals are hunted and shot. In forestry, the tree nurseries, forests and fields where trees have been planted, logged or thinning activities have been taken place may be considered as the production site. For salt-water fisheries all *(territorial)* waters and open seas typically present the production site, whereas for fresh-water fishery these may be lakes and rivers.

Livestock effluent

A comment should be made regarding *livestock effluent (animal faeces, urine and manure, including waste (spoiled) straw and hay)*, which in Iceland is all defined as waste. However, looking at the judgment made by the European Court of Justice *(ECJ)*[5], livestock effluent may fall outside the classification as waste.

[5]) *Joined cases C-416/02 and C-121/03, Commission versus Spain, 8 September 2005*

Livestock effluents are not considered to be waste under the conditions that the use as fertilizer/soil improver is operated in compliance with national legislation, and that no further recovery process takes place before reuse.
Furthermore, it should not only be limited to livestock effluent used as fertiliser on land forming part of the same agricultural holding where the effluent is generated. Meaning, livestock effluent used for agricultural purposes on fields other than on the production site, should neither be considered as waste.

Surplus

To our opinion it might be necessary to reconsider the Icelandic interpretation of livestock effluent and adjusted to the judgment of the European Court. Thus only the *surplus* of livestock effluent, which is collected separately and treated off-site by e.g. landfilling, used for composting processes or discarded into sea, should be reported as waste. In line with the above mentioned, only surplus manure going to landfill and/or incineration has been accounted for in reporting to Eurostat. Manure reused in composting activities has not been reported as waste.

Vegetal residues

Similar to animal residues, no clear definition can be found for *vegetal residues* in the WFD or other European legislation. However, according to article 2b of the Council Directive 75/442/EEC, natural substances as vegetal residues used in farming are also to be excluded from the scope of this directive. This is the same judgement as used for animal residues, and therefore might need clarification within the discussion waste/non-waste. The following description on vegetal residues will be used in this report.

Vegetal residues

> *"Vegetal residues from plants and harvesting, forestry, sludges from washing and cleaning and other vegetal residues from agriculture or forestry, should be excluded from the waste classification and reporting obligations for NACE A when it applies residues that have been left or buried on the production site, are reused without any further recovery process is taken, forms non-dangerous substances, or presents a by-product or raw/secondary material used for other production processes".*

According to current legislation vegetal residues need only to be reported as waste when it has been collected separately and treated off-site e.g. by landfilling. This applies to farming, but also to horticulture, greenhouses and forestry to our interpretation. However, according to the Icelandic waste definition, these vegetal residues should be seen as waste.

Left-on-site

Production site

In most situations the vegetal residues are *left or ploughed-under on the production site* with the purpose to bring back their useful substances *(nutrients and minerals)* into the natural lifecycle. The *production site* for vegetal residues is here typically seen as the field, land or forest where the residues have been generated. This also includes areas used for greenhouses and tree nurseries. Vegetal residues that are collected from one site and disposed on another site with the purpose of fertilization are also not considered as waste.

Waste from AFF related sectors

AFF related sectors

In Iceland there are various activities that generate waste sorts that, by looking at their composition, might be *related to waste from AFF*. This mainly concerns the food processing industry where substantial amounts of bio-organic waste are generated and comprise a vast percentage of total production waste.

According the WStatR waste from activities not covered by NACE A and B, such as the food processing industry is not included in this pilot study. Specific examples for Iceland are the slaughterhouses and the fish processing industry. Waste amounts generated by these activities have been accounted for by including them elsewhere in the national waste statistics.

Double-counting

In Iceland, however, waste streams with similar waste compositions are collected and treated together. This makes it difficult to allocate waste amounts to the sectors they were generated by. This may cause *double-counting*, which should be minimised as much as possible. The risk of double-counting has remained untouched by the other Member States that carried out this pilot studies. It is therefore to be questioned if this problem has been recognised. To ensure data quality and comparability of data sets between countries, this issue may not be overseen.

Double book-keeping

Double book-keeping

The reporting of animal and vegetal residues/waste could be done either by reporting according to the NACE, LoW or WStatR, or the country will have to maintain a *double book-keeping*, i.e. for reporting to Eurostat on the one hand and internal waste management purposes on the other. Such a double book-keeping presents the best available methodology at this moment and is therefore applied to the waste monitoring as described in paragraph 3.4.

3.2.3 Other sector-specific AFF waste

Reporting threshold for small waste amount

Small waste amounts

The literature study showed that many waste sorts generated in AFF sectors are relatively *small*. This was also reported by some of the other Member States. Nevertheless, these waste streams were still included in many studies and left the question whether it presents a relevant and important sector-specific waste stream or not, unanswered. To our opinion the main focus in the present work should be directed to those main/important waste streams, presenting typical sector-specific waste, regardless of the quantity they present.

10 tons/year

However, some reporting threshold for quantities might be beneficial and should also be applied to the treatment of AFF waste. For the purpose of this study, an individual reporting threshold of *10 tons per year* has been set for all *other sector-specific AFF waste* sorts. As the quantities concerned are relatively small and already covered by other reporting e.g. municipal waste, bulky waste, hazardous waste, mixed production waste etc., these waste streams will be excluded in this report from the waste statistics under NACE A and B. No reporting threshold however will be used for sector–specific bio-organic waste sorts from AFF.

Country specific

It has to be emphasized that this or any other reporting threshold should be established using *country specific* parameters, thus taking in consideration the different circumstances countries are facing such as: enforcement of waste management (e.g. the use of regional and national waste management plans), waste definitions, amounts of waste generated and waste treatment methods used. But also the geographical and climatological conditions might have an impact on waste generation and treatment. Therefore, the use of one all-over reporting threshold for all countries seems not realistic.

Data quality

It can be assumed that the exclusion of small waste amounts by using a reporting threshold negatively effects data comparability. What the actual effect on *data quality* and comparability will be cannot be estimated at this moment and should be further investigated during statistical updates. For Iceland the waste sorts that are to be excluded due to their small amount are however still accounted for by including them into the total generated mixed household or - production waste.

Small enterprises

In addition, a reporting threshold has been proposed in article 3.2 of the WStatR 2150/2002/EC, *"excluding all enterprises of less than 10 employees unless they contribute significantly to the generation of waste"*. The Icelandic agriculture typically comprises *small enterprises* with no or only one employee *(approximately 90% of all enterprises)* and the vast majority of them have just one establishment. Therefore, applying this threshold would result in the exclusion of many *(important)* waste sorts generated in AFF. This is expected not only to be the case in Iceland, but in other Member States as well. This threshold should therefore to be reconsidered and not yet to be applied in the present work.

Household waste

To our opinion, household waste generated in AFF should be excluded from waste statistics under NACE A and B. It does not present an important sector-specific waste stream, where typically household waste is generated by many other sectors and activities.
In Iceland there is a close connection between agricultural activities on the farms and their private households. Most farms operate with a small number of people and their household waste is generally collected together with much of the farm waste. Specifying household waste in these statistics might result in double counting.

In fishery, household waste produced on the vessel is sometimes discarded at sea. Much of the household waste generated on fishing boats is being brought to the harbour nowadays. It seems to make sense to include harbour authorities in surveys on waste generation, e.g. with regional waste management plans. A specific issue is the waste that is delivered in Icelandic harbours by foreign ships. Special attention has to be given to cruise ships that call at bigger harbours in Iceland. The amounts of waste that they deliver can be quite substantial. There clearly is a risk that this "foreign" waste will be included in the waste reporting by harbour authorities.

The registration system used in Iceland on household and similar waste is by gathering data from several different sources. These sources e.g. waste reception, - recycling and - processing companies only register wastes by sort, not by economic activity it was generated by. In order to present data on household and similar waste generated by these economic activities (agriculture and fisheries), an estimation is made on the possible waste amounts, which are presented in the final waste results (see table 3.2).

Packaging waste

Currently, packaging waste is not included in the WStatR as a waste stream. Therefore, the European Commission has drawn up a programme for pilot studies on packaging waste in order to assess the relevance of distinguishing packaging waste in the WStatR. The Environment and Food Agency of Iceland carried out a pilot study on packaging waste in 2004-2005.

During the packaging pilot study two types of packaging where investigated as *sales* and *transport packaging* for materials as glass, plastic, paper & cardboard, wood and metal. One of the main conclusions was that sales packaging is typically found in *(mixed)* household waste, and transport packaging in *(mixed)* production waste. Overturn between these groups seems to be limited, as little of transport packaging turns up in household waste and little of sales packaging in production waste.

Sales packaging

Based on the relation between sales packaging waste and household waste and the exclusion of household waste from this report, allocation of this waste to the AFF sectors seems to be irrelevant where typically sales packaging waste is generated by many sectors that are covered by NACE. For these reasons sales packaging waste should be excluded from the AFF waste statistics.
However, a rough estimation will be made, based on the average domestic sales packaging consumption per capita, giving an indication on the size of this waste stream. It may be assumed that the consumption pattern of people working and/or living in these AFF sectors is similar to that of regular households or other sectors generating this type of waste. The average sales packaging consumption per capita will be based on the total generation of packaging waste presented in the Icelandic pilot study report on packaging waste *(see references and Annex III)*.

Transport packaging

Transport packaging waste, for the greater part, has been included in this study. Especially in agriculture and fishery transport packaging presents sector-specific waste, sometimes in significant quantities. Transport packaging is also subject to several recycling and collection systems used in Icelandic AFF, especially sileage foil, fishing boxes/crates and wooden pallets. Quantities of transport packaging waste generated in AFF can directly be obtained form the packaging report. A calculation based on average domestic packaging consumption is not necessary.

According to article 3.2 of the Commission Decision 2005/270/EC on packaging and packaging waste, reusable packaging shall not be considered as waste when it is sent back for reuse. Only when reusable packaging is discarded at the end of its lifetime it shall be considered as waste. Therefore we exclude the reuse of transport packaging from this report.

Table 3.1 Sorts of packaging waste investigated

Packaging material	Sales packaging	Transport packaging
Glass	*All sorts of sales packaging waste should be **excluded** from the AFF waste statistics. An indicative waste amount will be based on the average quantity of sales packaging consumption per capita in Iceland and total employment in AFF.*	***Excluded**, transport glass packaging has not been recognised.*
Plastic		*Only sileage foil/agriculture foil (used for packing hay bails), big bags and fish crates/tubs and barrels will be investigated.*
Paper & cardboard		***Excluded**, data on the allocation of transport cardboard packaging to AFF is not available.*
Wood		*Only wooden pallets will be investigated.*
Metal		***Excluded**, data on the allocation of transport metal packaging to AFF is not available.*

3.3 Data Sources

The investigation carried out during the first part *(literature study)* of the pilot study showed that many different data sources may be used. This paragraph shortly presents the sources that have been used during the development of the waste monitoring plan, which is presented in next paragraph. These sources have been used to obtain data presenting actual waste amounts and estimations and assumptions where necessary. A more detailed description of the most relevant data sources can be found in Annex III and all of our resources used during this study are presented in chapter 6.

Previous pilot studies

- Valuable information can be found in the final reports of several Member States in the first round of pilot studies on waste generated by AFF sectors. These studies provide a deeper understanding of the actual needs for waste statistics under NACE A and B, clarified waste definitions to some extent, presented which waste classification could be used and the data collection and estimation methods available today.
- The final reports from the Icelandic packaging waste pilot study provided valuable information regarding the generation and treatment of packaging waste in Iceland in general. Furthermore, the Icelandic report presented some more detailed information on the actual use of transport packaging in agriculture and fishery.

National Statistics

- The Statistics Iceland *(Hagstofa Íslands)* provides detailed statistics on import, export, production and employment for the AFF sectors,
- The Farmer Association of Iceland *(Bændasamtök Íslands)* comprises agricultural statistics and general information regarding the structure of Icelandic agriculture,
- The Icelandic Forest Service (*Skógrækt ríkisins)* contains general information regarding the structure of Icelandic forestry,
- The Ministry of Fisheries *(Sjávarútvegsráðuneytið)* in Iceland publishes the statistics on fish catch and production in cooperation with the Icelandic Fisheries Laboratories *(Rannsóknastofnun fiskiðaðarins)*, Institute of Freshwater Fisheries *(Veiðimálastofnun)* and Federation of Icelandic Fishing Vessel Owners *(Landssamband íslenskra útvegsmanna, LIU).*

Others

- Waste treatment facilities and recycling companies such as: *SORPA, Endurvinnslan, Hringrás* and *Plastmótun* provide figures on waste generation and treatment in general and occasionally have more detailed information on sector-specific waste generated in AFF,
- Universities *(of Agriculture or Horticulture)* might provide useful information in the future due to their close cooperation with farmers and other agricultural enterprises,
- The Icelandic Recycling Fund *(Úrvinnslusjóður)* provides data on sector-specific waste generated in AFF and regards items that are levied with a deposit or recycling fee,

3.4 Waste Monitoring Plan

Based on the information gathered during this pilot study, a methodology is proposed in the form of a *"Waste Monitoring Plan"* for waste generated under NACE A and B. This plan handles all streams that have been recognised to be generated in agriculture, forestry and fisheries.

The monitoring strategy is to recognize each stream as waste, by-product or raw/secondary material individually, presenting a *case-by-case* approach. The decision to include by-products or raw/secondary materials in this report has been made because it may be expected that this data might provide a useful basis for an eventual further discussion on waste definitions at European level. In addition, it provides background information which is necessary to be updated regularly, or if further investigation of a specific waste sort is requested. Furthermore, the collected data might provide valuable information for the improvement of waste management in Iceland, especially regarding the total amounts of waste generated and waste treatment methods to be used.

There are two main waste groups that have been recognised to be generated by AFF, which can be subdivided into the following waste streams:

1) **Bio-organic waste:**
   - *Animal waste*
   - *Vegetal waste*

2) **Other sector-specific AFF waste:**
   - *Packaging waste*
   - *Chemical waste*
   - *Other waste:*
     - Machine related
     - Discarded vehicles and equipment
     - Discarded working materials
     - Construction and demolition waste
     - Household and similar waste

Table 3.2, *Waste Monitoring Plan for AFF generated waste in Iceland*, presents all waste types that have been recognised to be generated in AFF, their classification according to LoW and WStatR, sector(s) in which the waste is generated, proposed waste estimation methods, waste quantities and comments. Annex II present a more detailed description on the waste treatment methods, discussion on waste definition and methodologies and data collection

Table 3.2 Waste Monitoring Plan for AFF generated waste in Iceland

Type of waste	Sector	LoW	EWC-Stat	Estimation method	Quantity	Comments *
BIO-ORGANIC WASTE						
ANIMAL WASTE						
- Infected dead animals	*Agriculture*	*02 01 02*	*05.12*	*Agriculture*: Received from facilities that are assigned to handle infected dead animal waste.	***Agriculture*** *87 tons*	*(Iceland should maintain double book-keeping on infected dead animal waste (see also par. 3.2.2))*
- Guttering of animals	*Agriculture Fishery*	*02 01 02*	*09.11*	*Agriculture*: The amount of guttering waste from livestock in agriculture can be found in landfill year reports and in the national waste statistics. *Fishery*: The quantity of fish guts and cut-offs can be estimated using the yearly fish statistics and the waste factors for the various types of fish.	***Agriculture*** *16.000 tons* ***Fishery*** *295.144 tons*	**Excluded** [1) , 2) , 4) and 5)] *(Guts from livestock in agriculture are generated by slaughterhouses and not seen as AFF waste)* *(Guts from fish generated in marine fishing present between 10 – 20% of the total caught weight)*
- Animal tissue waste	*Agriculture Fishery*	*02 01 02*	*09.11*	*n.a.*	***Agriculture*** *10 tons (milk), 400 tons (animal carcasses)*	**Excluded** [1), 2), 4) and 5)] *(All reported milk waste is generated by the milk industry and forms no part of agriculture. Only animal waste generated in farming and sent to landfill will be included)*
- Slurry and manure	*Agriculture*	*02 01 06*	*09.31*	The quantity of surplus livestock effluent is based on the landfill year reports and national waste statistics. The total production of livestock effluent is based on the total number of livestock animals, number of days they are housed, manure and urine waste factors.	***Surplus*** *45.000 tons (manure + slurry)* ***Total produced:*** *967.525 tons (manure) and 412.043 tons (urine)*	*(Only the **surplus** of livestock effluent should be considered as waste. Manure used as fertilizer is excluded)*

Type of waste	Sector	LoW	EWC-Stat	Estimation method	Quantity	Comments *
VEGETAL WASTE						
- *Residues of plants and harvesting*	*Agriculture*	*02 01 03*	*09.12*	*n.a.*	*n.a.*	**Excluded** [1) , 2) and 5)] *(Vegetal waste generated in greenhouses should be included, but no separate registration is available)*
- *Residues from Forestry and other vegetal residues*	*Forestry*	*02 01 03*	*09.12*	*n.a.*	*n.a.*	**Excluded** [1), 2) , 3) and 5)]
- *Sludges from washing and cleaning*	*Agriculture*	*02 01 03*	*09.12*	*n.a.*	*n.a.*	**Excluded** [2) , 3) and 5)]
- *Contaminated soil*	*Agriculture Fishery*	*17 05*	*12.6*	*n.a.*	*n.a.*	**Excluded** [5)]
OTHER SECTOR-SPECIFIC AFF WASTE						
PACKAGING WASTE						
- *Wood packaging*	*Agriculture Fishery*	*15 01 03*	*07.51*	*Transport packaging*: Based on the results from the Icelandic packaging pilot study.	***Fishery*** *300 tons (pallets)*	*(Wooden sales packaging has not been recognised during the packaging pilot study)*
- *Plastic packaging*	*Agriculture Fishery*	*15 01 02*	*07.41*	*Transport packaging*: Based on the results from the Icelandic packaging pilot study. *Sales packaging*: Based on average domestic sales packaging consumption per capita and number of employment in AFF.	***Agriculture*** *1.600 tons (agriculture foil),15 tons (big bags), 197 tons (sales packaging)* ***Fishery*** *120 tons (barrels/tubs), 174 tons (sales packaging)*	Sales packaging is **excluded** [4)]
- *Paper & Cardboard packaging*	*Agriculture Fishery*	*15 01 01*	*07.21*	*Sales packaging*: Based on average domestic sales packaging consumption per capita and number of employment in AFF.	***Agriculture*** *184 tons (sales packaging)* ***Fishery*** *163 tons (sales packaging)*	Sales packaging is **excluded** [4)] *(Transport packaging could not be estimated)*

Type of waste	Sector	LoW	EWC-Stat	Estimation method	Quantity	Comments *
- Glass packaging	*Agriculture Fishery*	*15 01 07*	*07.11*	*Sales packaging*: Based on average domestic sales packaging consumption per capita and number of employment in AFF.	***Agriculture*** *135 tons (sales packaging)* ***Fishery*** *119 tons (sales packaging)*	Sales packaging is **excluded** [4] *(Glass transport packaging has not been recognised during the packaging pilot study)*
- Metal packaging	*Agriculture Fishery*	*15 01 04*	*06.31*	*Sales packaging*: Based on average domestic sales packaging consumption per capita and number of employment in AFF.	***Agriculture*** *16 tons (sales packaging)* ***Fishery*** *14 tons (sales packaging)*	Sales packaging is **excluded** [4] *(Transport packaging could not be estimated)*
- Packaging containing hazardous residues or substances	*Agriculture Fishery*	*15 01 08*	*02.33*	*n.a.*	*< 10 tons*	**Excluded** [3) , 4) and 5)]
CHEMICAL WASTE						
- Residues of fertilizers and pesticides	*Agriculture Forestry*	*02 01 08*	*02.11*	Based on the Hazardous Waste year report from 2002	*2,4 tons (pesticides and herbicides)*	**Excluded** [3) and 5)]
- Unused medicines	*Agriculture*	*18 02 08*	*02.12*	*n.a.*	*< 1 ton*	**Excluded** [3) and 5)]
OTHER WASTE						
- Machine Related:						
Used motor oils	*Agriculture Fishery*	*13 02*	*01.31*	*Agriculture*: based on the number of tractors in use, average amount of changed oil, waste factor and frequency of oil change. *Fishery*: based on the total quantity of oil waste collected by the oil companies.	***Agriculture*** *40 tons (motor oil), 84 tons (gear and hydraulic oil)* ***Fishery*** *≈ 2.500 tons (motor oil)*	*(Oil waste is reported as hazardous waste and should be excluded from AFF waste statistics)* *(Oil waste generated by small fishing vessels is not accounted for)*

Type of waste	Sector	LoW	EWC-Stat	Estimation method	Quantity	Comments *
Oil filters	*Agriculture*	*16 01*	*?*	Based on the number of tractors in use, average weight of an oil filter and frequency of filter change.	*6 tons (motor, gear and hydraulic oil filter)*	**Excluded** [3)]
Batteries and accumulators	*Agriculture*	*16 06*	*08.41*	Based on the number of tractors in use, average accumulator weight and frequency of accumulator change.	*36 tons (accumulators)*	
End-of-life-tyres	*Agriculture*	*16 01 03*	*07.31*	Based on the number of tractors in use, average weight of tyres and average lifetime tyres.	*55 - 75 tons (tractor tyres)*	
- Discarded Vehicles and Equipment:						
Discarded vehicles	*Agriculture Fishery*	*16 01 06*	*08.12*	*Agriculture*: based on the number of tractors in use, average weight of a tractor and average lifetime. *Fishery*: based on the number of vessels sold abroad for dismantling and average weight of discarded vessel.	***Agriculture*** *2.000 tons (400 tractors)* ***Fishery*** *≈ 2.930 tons (8 vessels)*	*(Further investigation is required to develop a methodology. According to … end-of-life-vessels are not considered as waste)*
Discarded equipment	*Agriculture Fishery*	*16 02*	*08.43*	*n.a.*	*< 10 tons*	**Excluded** [3) , 4) and 5)]
- Discarded Working Materials:						
Ammunition	*Agriculture*	*16 04 01*	*02.22*	*n.a.*	*< 1 ton*	**Excluded** [3)]
Fishing nets and lines	*Fish.*	*02 01 04*	*07.42*	Based on figures presented by Icelandic Recycling Fund and plastic recycling company.	*1.100 tons*	
Rock wool substrate	*Agriculture*	*01 04 99*	*12.31*	Based on total area covered, thickness, density, lifetime, volume decrease of rock wool substrate.	*7 tons*	**Excluded** [3)]

Type of waste	Sector	LoW	EWC-Stat	Estimation method	Quantity	Comments *
- Construction and Demolition Waste:						
Wood	*Agriculture*	*17 02 01*	*07.53*	*n.a.*	*n.a.*	**Excluded** [4) and 5)]
Concrete and bricks	*Agriculture*	*07 01 01*	*12.11*	*n.a.*	*n.a.*	**Excluded** [4) and 5)]
Greenhouse plastics	*Agriculture*	*17 02 03*	*07.42*	Based on domestic plastic production figures and import statistics.	*< 1 ton*	**Excluded** [3)]
Greenhouse glass	*Agriculture*	*17 02 02*	*07.12*	*n.a.*	*< 10 tons*	**Excluded** [3) and 5)]
- Household and Similar Waste:						
Household waste	*Agriculture* *Fishery*	*20 03 01*	*10.1*	Based on the amount of household waste generated per capita and total employment in AFF.	***Agriculture*** *1.500 tons* ***Fishery*** *1.325 tons*	
				Total generated, of which: *Defined as waste* *Reported under NACE A* *" " NACE B* **Total waste generated in AFF** *Percentage of total waste generation*	**≈ 1.705.000 tons** *60.007 tons* *50.750 tons* *8.275 tons* **59.025 tons** *12,7%*	*(In 2002, total waste generation in Iceland were 465.000 tons)*

** This waste stream should be **excluded** from the statistical waste classification under NACE A and B because:*

1) *According to article 2b is excluded from the scope of the Council Directive 75/442/EEC,*
2) *It presents a waste stream that is left on the production site, brought back into its natural lifecycle or presents a valuable by-product or raw/secondary material to be used in production processes,*
3) *It presents a small waste quantity that is estimated not to exceed the reporting threshold,*
4) *It presents a waste sort that should be allocated to other NACE sectors than A and B, or causes double counting of waste amount,*
5) *No or very little data is available on this waste sort.*

4. Conclusions

General
The methodology that was developed during this pilot study is based on information from previous pilot studies by other Member States, national statistics and available data on waste generation and – treatment. Where no data proved available, it was necessary to make estimations or assumptions. The main objective of the study was to make a well based decision about those waste sorts that should be included under the statistical waste classification of NACE A and B, and which ones might or should be excluded. The second objective was to try to improve data quality for AFF related waste thus optimising reporting accuracy and reliability of data.

A literature study on waste management in AFF made clear that in general sufficient information on the generation and treatment of sector-specific AFF waste seems not to be available widely in Europe. Specific registration on waste generated in agriculture, forestry and fishery seems to represent a weak point in the European waste statistics. Therefore, more clarity on reporting obligations in AFF related waste seems to be needed, both in relation to more specific definitions in this field as well as a better data registration and improvements in comparability of data within the EU.

Waste sorts generated
Two main waste streams have been identified to be generated in the Icelandic AFF sectors, which are *bio-organic waste* and *other sector-specific AFF waste*. Bio-organic waste or residues can be subdivided in *animal* – and *vegetal residues* or *waste*. Other sector-specific AFF waste can be subdivided into *packaging waste*, *chemical waste* and *other waste.*

For **bio-organic waste** or residues Iceland proposes to exclude all animal – and vegetal residues or waste generated in AFF sectors when they have been left or buried on the production site, are reused without any further recovery process is taken, form non-dangerous substances, or presents a by-product or raw/secondary material used for other production processes.

This leaves only bio-organic residues or waste that has actually been collected for further treatment or disposal and thus should be reported as waste. Bio-organic waste generated by other activities that are closely related to AFF e.g. slaughterhouses or the fish processing industry, should be excluded from these waste statistics as well, as they are covered by other registers in the waste reporting tables. Resulting in waste streams as the surplus of livestock effluent, dead animals and greenhouse waste going to landfill that have been recognised in Iceland to be the only bio-organic waste sort that should be reported. To the Icelandic opinion the remaining 5 out of the 8 bio-organic waste sorts, should be excluded from these waste statistics.
However, bio-organic waste sorts as ´infected dead animals´ and ´contaminated soil´ require further investigation. Typically, in Iceland very little data is available on these waste streams, however, both waste streams are subject to several regulations aiming to prevent spreading of diseases or avoid pollution.

For **other sector-specific AFF waste** two criteria might be used to determine if it should be reported as waste or not. The first criterion is the *relevance* of a waste sort where only the typical sector-specific waste streams should be reported as waste. Relevant waste streams present those waste sorts that typically are only to be found in these AFF sectors. Based on this criterion, sales packaging waste, household waste, construction and demolition waste should be excluded from these waste statistics. They present waste streams that are generated in many sectors covered by NACE and including them in these statistics might lead to double counting of waste amounts. It has to be emphasized that these waste streams have already been accounted for where they are included in the total generated, which is presented by the national waste statistics.

The second criterion is a *reporting threshold* regarding small waste quantities and will be further explained under in the next paragraph.

From the 22 other sector-specific AFF waste sorts, 12 were recognised to be either irrelevant to be reported, or present waste amounts that did not exceed our reporting threshold, and should be excluded from these waste statistics.

In total, circa 1.705.000 tons of AFF waste, by-products and raw/secondary materials were generated in Iceland in 2002. The greater part of this quantity is covered by livestock effluent *(78%)* and other animal tissue waste/residues generated during slaughtering *(livestock)* or guttering *(fishes)* of animals *(18%)*. From this total, 60.007 tons *(4%)* are seen as waste within the frame of Icelandic waste definitions of which 59.025 tons should be reported as waste under NACE A and B. Based on the total amounts of waste generated in Iceland in 2002 *(465.000 tons)*, almost 13% of this waste is generated by Icelandic agriculture, forestry and fisheries, given the above mentioned definitions.

Reporting threshold
The literature study showed that many waste sorts generated in AFF sectors are relatively small. This was also reported by some of the other Member States. Nevertheless, these waste streams were still included in many studies and left the question whether it presents a relevant and important sector-specific waste stream or not, unanswered. To our opinion the main focus in the present work should be directed to those main/important waste streams, presenting typical sector-specific waste, regardless of the quantity they present.

Therefore, a reporting threshold seems practical to exclude small non-relevant waste amounts in order to reduce the burden of data collection. When establishing a reporting threshold one should take country-specific circumstances in consideration. However, this might make it difficult to compare figures that Member States report. Differences in waste definitions and treatment methods used might result in (large) fluctuations of data accuracy between countries. In addition are the geographical and climatological conditions that might influence the waste generation and - treatment. To our opinion, one all-over reporting threshold for all countries seems not realistic. For the benefit of this study we choose a reporting threshold of *10 tons per year* for other sector-specific AFF waste. For bio-organic waste no reporting threshold was introduced.

A reporting threshold based on the number of employees working in these specific sectors, as has been proposed in WStatR 2150/2002/EC, seems not very realistic for Iceland, as most agricultural enterprises operate with only one employee, leaving the sector completely out of these waste statistics. The same goes for smaller fishing vessels that are quite abundant in Iceland. Applying this threshold would not give a realistic image of the Icelandic situation.

Updating statistics

The results presented in this report are preliminary and with reference year 2002. Not all data could be obtained before the deadline of this project, but they are expected to become available during the revision of the current statistics by the end of 2006. When these statistics are to be updated, 2004 will be the next reference year and updating will be done on a yearly basis from that year on.

5. Recommendations

This chapter presents our recommendations to improve statistics on waste management in agriculture, forestry and fishery. We have taken in consideration the questions proposed in the Terms of Reference and the recommendations presented in the final pilot study reports from other participating Member States.

Taking the results from all AFF pilot studies in consideration, Eurostat might present a clearer opinion on what they believe are relevant waste streams to be reported under NACE A and B. Furthermore, improved clarity about which waste sorts should be excluded, and which ones should be allocated to other NACE sectors. A very important question to be answered is: What level of quality and detail does the user of these statistics demand?

To our opinion all countries should base their waste statistics for AFF on the List of Waste *(LoW)* and the Waste Statistics regulations *(EWC-Stat)* in order for all countries to use the same nomenclature, instead of independent classifications.

Definitions on the generation and treatment of bio-organic residues have to be clarified by European legislation. To ensure comparability of data it will be necessary that all countries use the same definitions. For some waste streams such as animal – and vegetal residues that have been left or buried on the production site, the national opinions have already come close together, however, differences between countries remain.

Taking the Icelandic situation in consideration, we recommend combining data collection on sector-specific AFF waste with the development of the Regional Waste Management Plan *(RWMP)*. These RWMP´s present a.o. environmental issues and the types of waste which according to the Icelandic legislation should be reported by municipalities or waste treatment facilities. Examples of typical waste streams in Iceland are: mixed household and – production waste, hazardous waste, C&D waste, industrial waste *(including slaughterhouse and fish-processing waste),* surplus manure, end-of-life vehicles, tyres and packaging waste.
Because most of these RWMP´s are still under construction, it presents the perfect opportunity to combine the demand for sector specific waste data with the further development of these plans.

The use of waste factors/parameters seems to present a realistic solution for estimating waste amounts, though they should be based on easily accessible data or parameters such as: the production area, the number of farm kept animals, number of workers and production amounts. Wherever possible, data from independent data sources should be compared to enhance reliability.
However, considering the current stage of development on AFF waste statistics, a full scale data comparison between European countries seems not yet realistic. The reliability, consistency and accuracy of the waste parameters used in this report needs further improvement as well.

In the scope of this pilot study, forestry proved to be of minor importance in Iceland, as it produces very little sector specific waste, and most of the remnants are left on the production site. In Iceland, agricultural and forestry activities are closely related, and typically the same treatment methods are used. It is therefore suggested to harmonise the reporting obligations on waste treatment for agriculture and forestry, as has been done in this report.

No questionnaires have been used during this pilot study. Previous studies show that the response rate and quality of questionnaire is often very low and demands lots of resources, especially when it applies to these specific sectors as agriculture and fishery. It has been proposed to base the methodology on data already available and to try to obtain missing data using other methods, e.g. estimations and by using information from involved parties, such as ministries, sectorial organisations and specialists.

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ANNEX I – TERMS OF REFERENCE

Technical description for a pilot study on statistics on waste management in Agriculture, Forestry and Fisheries (NACE A and B)

1. Background

According to Annex I, Section 1 of the Waste Statistics Regulation (No 2002/2150/EC), statistics shall be compiled on waste generated, according to all NACE groups including A and B (Agriculture, Hunting and Forestry and Fishing). Article 4(1b) foresees a transitional period. Member States may request for derogation from the provision of data reporting on these two groups for a period of three years maximum, after the entry into force (2002) of this Regulation.

According to Article 4(3) in the Waste Statistics Regulation, Member States shall conduct pilot studies on how to implement statistics on agriculture, hunting and forestry and fishing:

> "*The Commission shall draw up a programme for pilot studies on waste from the economic activities referred to in Article 4(1b) to be carried out by Member States. The pilot studies shall aim to develop a methodology to obtain regular data, which shall be governed by the principles of Community Statistics, as laid down in Article 10 of Council Regulation (No 322/97)*".

In late 2003 and beginning of 2004, 15 projects started to investigate the waste management practices and the respective data collection possibilities. The majority of the participating countries belong to the "old" Member States, 5 studies are being carried out by "new" Member States and one study is being conducted by the National Statistical Institute of a country belonging to the European Economic Area. By the beginning of 2005, 9 studies were finalised and most of the remaining studies will finish in the first quarter of 2005.

In the agriculture sector it is necessary to clarify in detail which materials or substances fall under the definition of waste, which are the cases where wastes are recycled on the site of production and how to report on wastes generated by other economic sectors but treated within the agricultural sector.

As regards data collection, due to the large variety of waste types generated by these economic activities a combination of different methods will be most appropriate. The use of different registers or administrative systems for waste registrations seems most favourable. Waste factors connected to available activity data are also feasible, but require detailed studies for establishing reliable waste factors. Statistics available through regular farm surveys will have to be taken into account as a data source for the development of estimation models.

For this third call for proposals the Technical description for a pilot study on statistics on waste management in Agriculture, Forestry and Fisheries are adapted based on the results of pilot studies already carried out on this subject.

A proposal for new pilot study should take into account the experiences and results made in earlier pilot studies, the reports are available on Circa.

A proposal for a new project can be either in the form of a study or in a workshop involving representatives from other National Statistical or Environmental Institutes, in both cases the objectives as outlined below are to be met.

2. Objectives

Development of European statistics on waste generated and treated by NACE A and B

The study should be based on the progress reached and should carry out the following tasks:

i. Investigation and discussion on, and finally suggestions for the waste categories to be included under these economic activities. A proposal for classifying of these categories according to the EWC-Stat Rev 3 and underlying LoW, and, if necessary, for a more detailed breakdown of waste categories in EWC-Stat should be made. Discussions at the subgroup meetings on waste statistics should be taken into account.

ii. Investigation on and description of waste treatment operations carried out in the agricultural sector and suggestions for harmonised reporting on waste treatment in agriculture and forestry.

iii. With regard to bio-organic residuals (e.g. manure, harvest residues, logging residues) the national opinion on the borderline between waste / non-waste should be documented and proposals should be elaborated for waste amounts to be covered by waste statistics.

iv. Further development of estimation- and modelling methodologies for the sectors, to be able to make use of already collected data (e.g. production figures, livestock figures).

In the conclusions of the study specific attention should be given on the questions:

v. What is a realistic and manageable way of collecting the data in the Member States?

vi. What is the (expected) degree of precision or data quality for each of the selected waste streams?

The Commission shall, based on the results of these pilot studies, adopt the necessary implementing measures and make a proposal for amending the Regulation 2150/2002/EC on waste statistics in accordance with the committee procedure (Art 7; Comitology).

ANNEX II – WASTE MONITORING PLAN

ANIMAL WASTE

Infected dead animals

Classification
LoW: 02 01 02 (Animal-tissue waste)
EWC-Stat: 05.12 (Animal infectious health care waste)

Treatment *(Agriculture)*
Infected dead animals from livestock farming in Iceland are either send to landfills receiving slaughterhouse waste, or buried on the field or production site (without a permit). When it concerns a highly dangerous infection, acute treatment is required and transportation is prohibited, incineration of carcasses at the field is allowed *("force majeure").* A small number of infected dead animals are used for pathological examination. Infected dead fish from salt- or freshwater aquaculture is generally landfilled. Fortunately, so far the country has been free from most diseases that are common in Europe, such as foot-and-mouth disease and bird-flu. Scrapie in sheep is dormant but sometimes suddenly coming up, making culling necessary to prevent further spread of the disease. Occasionally salmonella and campylobacter emerge but this has not been the case for the last few years.

Methodology and data collection *(Agriculture)*
In Iceland dead animals are seen as waste and it is foreseen that the country will have to maintain a double book-keeping *(see par. 3.2.2).*

Guttering of animals

Classification
LoW: 02 01 02 (Animal-tissue waste)
EWC-Stat: 09.11 (Animal waste of food preparation and products)

Treatment *(Agriculture and Fishery)*
Animal residues arising during the guttering (and slaughtering) of livestock are mainly generated by slaughterhouses. These residues are either landfilled, with or without pre-treatment, or reused/recycled were they are used in animal fodder. Most farmers do some slaughtering of the livestock themselves for their own consumption. The waste is either buried on the field or production site or disposed in a container for household waste (used in remote areas). Animals that are shot during hunting activities are gutted (and cleaned) in the field and their remains are typically left in the field.

Most fish caught at sea is guttered at sea and residues are thrown overboard. The residues that form valuable by-products are collected and brought ashore to be used as raw material in production processes for e.g. gelatine, fishmeal or fish-oil.

Methodology and data collection *(Agriculture and Fishery)*
Amounts of animal residues generated by slaughterhouses may be obtained from waste year reports provided by the landfills that receive slaughterhouse waste. Consistent time series are available, but recent figures are more reliable than historical data. Data could possibly be provided by veterinarians as well. Because this waste stream may expected to be small, the use of general figures on animal death (mortality and loses) should be acceptable.

The total amount of fish guts and cut-offs generated during guttering at sea is difficult to estimate. Typically, the amount of waste thrown overboard is not registered. Secondly, fish can be guttered and cleaned in different ways e.g. guttered with head-on or head-off, resulting in different waste amounts. Based on the parameters presented below, a rough estimation on the total quantity of fish guttering waste, generated by the Icelandic fishing fleet can be estimated:

- Considering the 12 species of fish that are mostly caught in Iceland. In 2000, they presented a total of 1.833.534 tons *(whole ungutted fish)* which presented 97,4% of the total Icelandic fish catch in that year,
- Assuming that each fish is gutted with head-on. The head forms a valuable by-product and typically is separated during fish processing ashore and not at sea,
- Fish-waste factors can be obtained from the FAO[6] Conversion model. Waste factor presents the percentage of fish that is removed during guttering. The average factor lies between 1,1 and 1,2 for marine fishing, thus 10 to 20% (by weight). In addition, 5 to 10% of the fish is removed during cleaning/preparation, which is done ashore in the fish processing industry.

Animal tissue waste

Classification
LoW: 02 01 02 (Animal-tissue waste)
EWC-Stat: 09.11 (Animal waste of food preparation and products)

Treatment *(Agriculture and Fishery)*
Animal tissue waste other than *´infected dead animals´, ´guttering of animals´* or *´slurry and manure´* are for example: animal carcasses, skins, fur, bones or milk. Most of this tissue waste is send to landfill or buried on the field or production site. Milk waste, contaminated with penicillin, is discharged into sea or rivers with or without pre-treatment. In case of a milk over-production, the milk is given to calves or breeding-steers and not discarded. Whole carcasses caused by massive fish death in aquaculture are landfilled.

Carcasses of caught fish with no further use are mostly discarded back into sea, together with other fish residues generated on board.

Discussion *(Agriculture)*
Milk waste may assume to present as small waste stream and typically is the responsibility of the milk industry, which forms no part of agriculture. Only milk contaminated with penicillin, used for the treatment of “mastitis” (udder decease) is discharged into sea or rivers. This does not present a fixed waste streams and can fluctuate significantly between years, such as infected dead animal waste *(see paragraph 3.2.2, page 23).* It is therefore questions if this waste should be reported as AFF waste.

[6]) *FAO stands for Food and Agriculture Organization of the United Nations*

Slurry and manure

Classification

LoW: 02 01 06 (Animal faeces, urine and manure effluent, collected separately and treated off-site)
EWC-Stat: 09.31 (Slurry and manure)

Treatment *(Agriculture)*

Livestock effluent such as urine (wet fraction), manure (dry fraction) and slurry (mixture of urine and manure) are collected from stables and other animal houses often includes spoiled straw and hay. Manure and slurry are used as fertilizer on the fields, or used for land reclamation. The surplus of manure and slurry is often landfilled, whereas the urine, mainly from pig farms, is discharged into sea.

Discussion *(Agriculture)*

Only the **surplus** of livestock effluent should be considered as waste. However, a methodology presenting the total production of livestock effluent in Iceland might be beneficial for further discussion on this waste sort.

Methodology and data collection *(Agriculture)*

A relatively good registration is kept on the disposal of livestock effluent on the larger landfills in Iceland. Data on the discharge of urine into sea can only be estimated. Verifying quantities by surveying both the producer and receiver of the waste could improve accuracy and reliability of the statistics. Based on the following parameters the total amount of livestock effluent that is yearly produced in Icelandic agriculture can be estimated:

- Considering typical year-production of manure, urine, etc. of the 9 most general species of farm animals, i.e. cattle (cows, steers and calves, together 90% of total cattle), horses, sheep, hens, pigs, minks and foxes,
- Manure and urine factors can be obtained from the Farmers Association of Iceland and are presented yearly in the Agricultural Handbook,
- The number of days that the animals are kept in houses and during which the manure and urine is collected can be estimated on a yearly basis.

The number of animals, days kept in stables and their manure and urine factors can be found in Annex III *"Waste calculation"*.

VEGETAL WASTE

Residues of plants and harvesting

Classification

LoW: 02 01 03 (Plant tissues-waste)
EWC-Stat: 09.12 (Vegetal waste of food preparation and products)

Treatment *(Agriculture)*

Most of the plant residues generated during harvesting activities in agriculture are left on the field. Straw collected after harvesting is used (recycled) as floor covering in stables. Vegetal residues from greenhouses are generally landfilled due to the nylon strings and other impurities that go with the waste, making recycling (composting) problematic, also from a hygienic point of view.

Discussion *(Agriculture)*

Vegetal residues of plants and harvesting should be excluded from these waste statistics. During this study no suitable methodology could be developed to estimate the total generated. Plant waste – or harvesting factors are currently not available or reliable enough. Further investigation might from a possible solution to present these waste amounts in the future and could be done in cooperation with the Agricultural University.

Residues from forestry and other vegetal residues

Classification

LoW: 02 01 03 (Plant tissues-waste)
EWC-Stat: 09.12 (Vegetal waste of food preparation and products)

Treatment *(Forestry)*

Vegetal residues specifically generated in forestry such as trees, branches, leaves, roots and sawdust are left on the field. Occasionally the logs and branches are chipped and used for making pathways at the production site.

Discussion *(Forestry)*

In contrast with agriculture, vegetal residues from forestry are not automatically excluded from the scope of the directive. Because of the similarities in waste treatment between forestry and agriculture, it is our opinion that vegetal residues generated in forestry should be excluded from these waste statistics. The recycling of vegetal waste, by chipping trees/branches and using it for pathways, has been estimated to be very little (< 1 ton a year) and may therefore be neglected in reporting.

Sludges from washing and cleaning

Classification

LoW: 02 01 03 (Plant tissues-waste)
EWC-Stat: 09.12 (Vegetal waste of food preparation and products)

Treatment *(Agriculture)*

Sludges are typically generated during agricultural activities such as: washing, cleaning, peeling, centrifuging and separation of vegetables and potatoes after harvesting. Typically the sludge generated is left on or brought back to the field. Sludge generated by fish farms in the aquaculture (filtering of water) is discharged into the sea, spread on fields or landfilled.

Discussion *(Agriculture)*

Sludges from washing and cleaning can be placed in the same category as vegetal residues from agriculture. Amounts of sludge are assumed to be very little and it is typically left on the production site thus brought back into the natural lifecycle. There is generally a poor registration of sludge amounts and treatment in Iceland. Sludge generated in aquaculture, according to Icelandic regulations, has to be reported by the fish farms holders. Some of the larger fish farms have been recognised to report amounts of sludge generated, though detailed information is sparse and its quality can be questioned. It is our opinion that sludges generated in agriculture should be excluded from waste statistics.

Contaminated soil

Classification

LoW: 17 05 (Soil and dredging spoil)
EWC-Stat: 12.6 (Contaminated soils and polluted dredging spoils)

Treatment *(Agriculture and Fishery)*

According to Council decision 33/2002/EC contaminated soil is seen as waste if the contamination exceeds certain levels. In Iceland, soil contaminated with oil is generally used as coverage layer on landfill sites, where it is mixed with manure, stimulating bacterial degradation. This method is only used when little amounts of contaminated soil are involved. Contaminated soil with low levels of heavy metals is occasionally used as construction materials (e.g. road construction).
When it concerns higher levels it is kept in storage (large amounts) or exported to Denmark as hazardous waste for further treatment. PCB contaminated soil is typically exported to Denmark as hazardous waste.

Contaminated soil can also be found in the fishery industry as contaminated *´sediments´* from harbours floors. Only on a very limited scale contaminated sediment is removed from harbours in Iceland, but it may be foreseen that waste amounts arising from harbour cleaning will generate an increasing amount of waste for treatment. As harbour sludge is only partly generated because of fishing boats and thus not AFF sector-specific waste it is our opinion that this type of waste should not be included in the waste reporting in the field of AFF generated waste to Eurostat.

Discussion *(Agriculture and Fishery)*

In Iceland, the problem of soil contamination is relatively recent and the establishment and implementation of legislation is still under construction. The results from a first inventory (2005) showed a significant number of (possible) contaminated sites in Iceland. The sites that were recognised mostly comprise landfills, fuel filling stations, fuel storage tanks, quarries, scrap metal recyclers, shipyards, harbours and electricity/power plants. Contaminations of agricultural sites have not been recognized during this investigation.

Although contaminated soil should be considered as waste, allocation to NACE A and B sectors seems not to be relevant. Amounts of contaminated soil should be reported as one waste stream, not divided by sector. Further investigation is required to recognise the number and size of (possibly) contaminated sites in agriculture and fishery. It is our opinion that the same approach might be feasible as with manure, i.e. that only material going to final treatment (landfill, incineration) should be reported, e.g. as “surplus contaminated soil”, as the trend seems to be in Europe to use light polluted soil for construction purposes. It is expected that this issue will be covered by specific legislation and does not affect reporting on AFF waste for the time being.

PACKAGING WASTE

Wood packaging

Classification
LoW: 15 01 03 (Wooden packaging)
EWC-Stat: 07.51 (Wooden packaging)

Treatment *(Agriculture and Fishery)*
Wood transport packaging such as pallets and crates are mostly collected for recycling or recovery, though in some occasions are also landfilled.

Discussion *(Agriculture and Fishery)*
The Icelandic pilot study on packaging waste showed that wood transport packaging waste in Iceland is mainly generated by the commerce and trade industry. Because the recovery rate for wood waste is almost 100%, the allocation of wood packaging waste to specific AFF sectors in relation to the scope of the study seems to be irrelevant. Wooden sales packaging has not been found during the packaging pilot study and is therefore excluded from this report.

Methodology and data collection *(Agriculture and Fishery)*
The outcome of the Icelandic packaging study showed that a few landfillers receive wooden pallets that have been used in the fish industry. Their quantities can be obtained from the packaging report. No reporting has been done for wooden pallets generated in agriculture or forestry.

Plastic packaging

Classification
LoW: 15 01 02 (Plastic packaging)
EWC-Stat: 07.41 (Plastic packaging wastes)

Treatment *(Agriculture and Fishery)*
Plastic *sales* packaging is either brought to waste collection facilities and used for recycling, or discarded in the *household bin* or local container and landfilled or incinerated with energy recovery. Plastic *transport* packaging such as sileage *foil* (used for packing hay rolls and -bales) has been landfilled or incinerated with energy recovery in the past. However, sileage foil is levied with a recycling fee since 2004 in order to stimulate its collection and recycling. Other transport packaging as *big bags* used for the transportation of e.g. animal fodder are collected for reuse and recycling.

Plastic *sales* packaging waste generated on ships is sometimes discarded with other household waste. Efforts are now being made to minimise this kind of waste dumping into open sea and bring it to the harbour instead. Plastic *transport* packaging waste such as *fish barrels* and *tubs* are reused many times and therefore typically has a long lifetime. When finally discarded they are often collected for (domestic) recycling, incineration with energy recovery or landfill.

Methodology and data collection *(Agriculture and Fishery)*
Sales packaging: The total quantity of plastic sales packaging, discarded with the household – or similar waste, is based on the average domestic sales packaging consumption per capita and number of employment in AFF.

Transport packaging: Sileage foil that ends up as waste may be based on the total amount imported, which is well registered. In addition, the registration on the payments by the Recycling Committee could provide an accurate back-up method for comparison. Big bags are reused up to several times and at the end of their lifetime they are mostly collected for recycling. Their quantity can be obtained from the only recycling company in Iceland.

Most fish barrels and tubs are collected for recycling after they are discarded. Their quantities can be obtained from a recycling company that recycles big bags (and fishing nets).

It may be expected that this method does not cover the total plastic packaging waste generated in Icelandic agriculture and fishery, though presents the best method available for the time being. From the Icelandic pilot study on packaging waste it was concluded that estimations based on the average lifetime or production figures seem not applicable and therefore have not been further elaborated on in this report.

Paper & Cardboard packaging

Classification
LoW: 15 01 01 (Paper and cardboard packaging)
EWC-Stat: 07.21 (Waste paper and cardboard packaging)

Treatment *(Agriculture and Fishery)*
Paper and cardboard *sales* and *transport* packaging waste are recycled, landfilled or incinerated. When separately collected a small amount is used for domestic recycling, though most is baled and shipped for recycling abroad. No estimation method was found for cardboard or transport packaging waste and was therefore excluded from these waste statistics.

Methodology and data collection *(Agriculture and Fishery)*
Sales packaging: The total quantity of paper sales packaging, discarded with the household – or similar waste, is based on the average domestic sales packaging consumption per capita and number of employment in AFF.

Glass packaging

Classification
LoW: 15 01 07 (Glass packaging)
EWC-Stat: 07.11 (Glass packaging)

Treatment *(Agriculture and Fishery)*
Glass *sales* packaging waste is either collected for recycling or discarded with other household waste going to landfill or incineration.

Methodology and data collection *(Agriculture and Fishery)*
Sales packaging: The total quantity of glass sales packaging, discarded with the household – or similar waste, is based on the average domestic sales packaging consumption per capita and number of employment in AFF.

Metal packaging

Classification
LoW: 15 01 04 (Metallic packaging)
EWC-Stat: 06.31 (Mixed metallic packaging)

Treatment *(Agriculture and Fishery)*
Metal *sales* packaging waste is either collected for recycling or discarded with other household waste going to landfilled or incineration. Metal *transport* packaging waste is mostly collected by the municipalities and later fetched by scrap metal recyclers that pre-treat and ship it for recycling abroad.

Discussion *(Agriculture and Fishery)*
As concluded from the packaging pilot study, metal transport packaging presents a small waste steam in general. Most of this waste is generated by the commerce and trade industry and very little is known about its existence in the AFF sectors. Therefore, metal transport packaging was excluded from this report.

Methodology and data collection *(Agriculture and Fishery)*
Sales packaging: The total quantity of metal sales packaging, discarded with the household – or similar waste, is based on the average domestic sales packaging consumption per capita and number of employment in AFF.

Packaging containing hazardous residues or substances

Classification
LoW: 15 01 08 (Packaging containing residues of or contaminated by dangerous substances)
EWC-Stat: 02.33 (Packaging polluted by hazardous substances)

Treatment *(Agriculture and Fishery)*
Packaging containing hazardous residues or substances e.g. herbicides or pesticides, chemicals and oils, are separately collected as hazardous waste.

Discussion *(Agriculture and Fishery)*
During the Icelandic pilot study on packaging waste no information could be found on the exact quantity of hazardous packaging waste that is generated in the country. It may be assumed that this waste stream presents a small amount, below our reporting threshold and therefore was excluded from this study.

CHEMICAL WASTE

Residues of fertilizers and pesticides

Classification
LoW: 02 01 08 (Agrochemical product wastes containing dangerous substances)
EWC-Stat: 02.11 (Agrochemical product wastes)

Treatment *(Agriculture and Forestry)*
Hazardous residues from e.g. fertilizers and pesticides can be brought to service/collection point from which it is send to a hazardous waste treatment facility.

Discussion *(Agriculture and Forestry)*
Fertilizers and pesticides are only used on a small scale in Icelandic agriculture and forestry. Most of the residues are kept in storage by the farmer until they are finished.

Methodology and data collection *(Agriculture and Forestry)*
In 2002 a hazardous waste report[7] was published for the first time by the Icelandic Recycling Fund. This report presented the total amount of fertilizer, pesticide and herbicide waste or residues generated in Iceland. Although, it may be assumed that small amounts are generated by other sectors as well, in the present work all amounts are assumed to be generated by the agriculture and forestry sector.

Unused medicines

Classification
LoW: 18 02 08 (Medicines other than mentioned in 18 02 07)
EWC-Stat: 02.12 (Unused (discarded) medicines and chemicals)

Treatment *(Agriculture)*
Medicines are mostly kept until their finished. When not used, they are often given back to veterinarians.

Discussion *(Agriculture)*
No registration on unused medicines is currently available. Their amounts are assumed to be very small, lower than the reporting threshold. This has been confirmed by veterinarians, estimating the total amount to be less than 1 ton. Based on our reporting threshold, unused medicines should be excluded from these waste statistics.

OTHER WASTE

Machines and machine related waste

Used motor oils

Classification
LoW: 13 02 (Waste engine, gear and lubricating oils)
EWC-Stat: 01.31 (Used motor oils)

Treatment *(Agriculture and Fishery)*
Oil waste such as used motor –, gear – and hydraulic oils are collected as hazardous waste by municipalities or is brought by the farmers themselves to service points at e.g. car garages, recycling centres or other collection points.

Oil waste generated by ships and vessels is collected at the harbours as hazardous waste. Both larger and smaller vessels (both cargo and fishing) dispose of their waste oil at special service points in the harbour from where the oil is collected by oil companies. Oil waste is either used in the cement production process or incinerated with energy recovery e.g. for heating and electricity. Increasing amounts of oil waste are shipped for recovery abroad.

Discussion *(Agriculture and Fishery)*
The total amount of oil waste generated in these sectors is difficult to estimate due to the combined collection from vessels and vehicles used on land. Oil waste from agriculture is partly separately collected and reported, though farmers also bring their oil waste to collection points that also receive oil waste from other sources. Today oil waste generated in Iceland is reported under “hazardous waste”, thus making a distinction between ship-related oil somewhat theoretical. It is our opinion that oil waste from ship should be excluded from waste statistics for AFF generated waste.

[7]) *First edition of Hazardous Waste Report 2002, Spilliefnanefnd Ársskýrsla 2002, Úrvinnslusjóður*

Methodology and data collection *(Agriculture and Fishery)*
In agriculture oil waste is mainly generated by tractors. In addition are the harvesters and small diggers, though amounts are small. Furthermore, agricultural machinery is often used for other activities outside farming. It is our opinion that only tractors and tractor-related waste should be considered in relation to AFF generated work. The quantity of oil waste may be estimated by considering the average number of tractors used in agriculture, combined with the following parameters:

Table A2.1 Oil waste parameters for agriculture

Parameters[1)]	**Motor oil**	**Gear and Hydraulic oil**
Liters required for 1 oil change	*11*	*49*
Oil density	*0,864 gr/cm^3*	*0,896 gr/cm^3*
Waste oil factor (spilling)	*30%*	*3%*
Average frequency of oil change per year	*1*	*1/3*

1) Parameters have been collected from the pilot study report made by Austria and information provided by the Farmers Association of Iceland.

Approximately 6.000 tractors were operational in 2002 in Iceland. This is based on the number of actual operational farms at that time (around 3.000 farms) and the average number of tractors used on each farm (2 tractors per farm).
There are several types of tractors being used in agriculture with different engine power classes and each requiring different amounts of motor –, gear – and hydraulic oil. In order to simplify the calculation, for all tractors used in the Icelandic agriculture an average quantity for the parameters presented in table A2.1 was used.

Registers on oil waste collected from ships is done by Olíudreifing ehf. Though it is theoretically possible to make a division between oil waste from cargo ships and fishing vessels, this is obviously not very practical. In cooperation with the Icelandic Recycling Fund the total amount of oil waste has been published in the hazardous waste report.

Oil filters

Classification
LoW: 16 01 (End-of-life-vehicles and their components)
EWC-Stat: 8.43 (Other discarded machines and equipment components)

Treatment *(Agriculture and Fishery)*
Waste oil filters, which is generated during maintenance and repairing of vehicles, is collected in Iceland as hazardous waste.

Discussion *(Agriculture and Fishery)*
Waste oil filters is only reported in Iceland as total generated, registered by the Icelandic Recycling Fund. Allocation of waste oil filters to the specific AFF sectors is not seen as being practical, nor relevant. The methodology proposed in the final report from Austria might be a realistic method to estimate this waste stream for Icelandic agriculture. This is by taking the average weight of oil filters used for tractors and the average frequency that the filters are changed. Regarding waste oil filters generated in fishery, no method could be developed and has thus been excluded from this report.

Import figures on oil filters might be a way of estimating amounts of waste oil filters, but in several (remote) places in Iceland electricity is produced by diesel-generators, typically using the same sort of (bigger) oil filters. This makes it almost impossible to trace oil filters exclusively generated in fishery.

Methodology and data collection *(Agriculture)*
The quantity of waste oil filters may be estimated using the following parameters:

- Number of tractors used in agriculture,
- Average weight of oil filters used,
- Frequency of oil filters change.

6.000 tractors are used in agriculture *(see "Used Motor oils").* The average weigh of a motor oil filter is 0,6kg and 1,1kg for a gear and hydraulic oil filter. The frequency of filter change is the same as for oil change, respectively once a year and every third year.

Batteries and accumulators

Classification
LoW: 16 06 (Batteries and accumulators)
EWC-Stat: 08.41 (Batteries and accumulators wastes)

Treatment *(Agriculture and Fishery)*
Batteries and accumulators are collected by scrap metal recyclers and hazardous waste collection points and shipped for recycling abroad.

Discussion *(Agriculture and Fishery)*
Similar to oil waste and waste oil filters, the amounts of collected batteries and accumulators is reported as hazardous waste on a national basis. Allocation of this waste to specific AFF sectors is not possible under the current situation. Therefore a similar method as used for waste oil might present a realistic method to be used in Iceland. Regarding accumulator waste generated in fishery, no method could be developed.

Methodology and data collection
Agriculture
The quantity of accumulator waste could be estimated using the following parameters:

- Number of tractors used in agriculture,
- Average lifetime of an accumulator,
- Average weight of an accumulator.

6.000 tractors are used in agriculture *(see "Used motor oils").* The average lifetime of an accumulator is estimated to be 5 years and has an average weight of 30kg.

Tyres

Classification
LoW: 16 01 03 (End-of-life-tyres)
EWC-Stat: 07.31 (Used tyres)

Treatment *(Agriculture)*
Waste tyres or end-of-life-tyres in Iceland are landfilled, recycled or incinerated with energy recovery. An increasing amount of tyres is now shipped for recycling abroad, but no actual figures proved to be available at the moment. Shredded tyres are sometimes used as a drainage layer on landfill sites, which is an approved recycling method under the current Icelandic legislation. The collection of tractor-tyres is combined with the collection and processing of other end-of-life-tyres and is not registered specifically in Iceland.

Methodology and data collection *(Agriculture)*
The quantity of waste tyres could be estimated using the following parameters:

- Number of tractors used in agriculture,
- Average weight of tractor tyres (distinction made for front- and rear tyres),
- Average lifetime of the tyre.

6.000 tractors are used in agriculture *(see "Used motor oils").* The average weight of a front tractor tyre is estimated to be 15kg and for a rear tractor tyre 75kg. The average lifetime of the tyre is assumed to be the same as the tractors lifetime or 15 years *(see discarded vehicles).*

An additional method is by assuming that the number of imported tyres is equivalent to the number of discarded tyres. The number of imported tyres can be obtained for the Icelandic Recycling Fund as tyres carry a recycling levy in Iceland. However, these data might include tyres from other (non agricultural) machinery as well.

Discarded Vehicles and Equipment

Discarded vehicles

Classification
LoW: 16 01 06 (End-of-life-vehicles drained of liquids and emptied of hazardous components)
EWC-Stat: 08.12 (Other discarded vehicles)

Treatment *(Agriculture and Fishery)*

The most common vehicle used in agriculture is the tractor. When discarded they are left often abandoned some place at the farm, used for spare parts, or collected by a scrap metal recycler. Very little is known about the second hand market for tractors in Iceland, but is assumed to be very small. Almost all vehicles used for forestry activities are owned by farmers and are accounted for under agriculture.

The vehicles in fishery such as ships and vessels generally have a very long lifetime, mostly between 25 and 40 years and even longer. End-of-life-vessels are often sold abroad (e.g. Denmark) for maintenance, repairing or dismantled for scrap metal recycling. A small number of vessels are dismantled in Iceland, which is done by scrap metal recyclers.

Discussion *(Agriculture and Fishery)*
Discarded private vehicles such as cars are not considered as waste generated by agricultural or fishery and are therefore excluded from this report.

Information on the use of agricultural vehicles in Iceland is limited. There are no clear figures presenting the exact number of tractors in use, though a fairly good estimation of 6.000 operational tractors could be made based on the number of farms operating in Iceland and the average number of tractors used on each farm.
Data provided by National Statistics *(Hagstofa Íslands)* on the import of vehicles, and from the National Vehicle Registration *(Umferðarstofa)* seem not practical as their numbers also include other agricultural-related vehicles such as small diggers or harvesters. Because these vehicles are also used for other, non-agricultural activities this waste stream was excluded from this report. Only tractors were considered as end-of-life-vehicles from agriculture.

In fishery an even more complex problem occurs. Typically when a vessel is purchased it is registered in the National Vessel Register, which is available at the Icelandic Maritime Administration *(Siglingastofnun Íslands)*. In most cases only a few of the vessels´ original parts remain in place when a ship is maintained as many new parts are used. This regards both small parts e.g. used for machinery, but also large parts such as a complete new cockpit or bow.
The quantity of waste generated during these activities remains unknown. It may even be questioned if this waste sort should be reported under NACE B as waste from fishery. To our opinion it would be better classified as waste generated by *´manufacturing of machinery and equipment´* under NACE DK. Therefore, waste generated during repairing and maintenance operations from fishing vessels was excluded from the present work.

When fishing vessels are sold abroad, either for repairing or scrap metal, they are taken out of the National Vessel Register. From this registration estimation can be made on the number of vessels are actually sold abroad for scrap metal. However, the weight of vessels is typically presented in *´gross tonnage´*, which does not refer to the actual weight of a vessel, but to its volume. The reason for this is that vessels have traditionally been a rather difficult object to place on a scale. Typically, one has to rely on the Archimedes´ Law to determine the weight of a vessel. The methods to estimate the weight of a vessel has been a topic of discussion among maritime specialists for many years and has not yet resulted in a reliable and accurate methodology.

Methodology and data collection *(Agriculture and Fishery)*
The quantity of end-of-life-vehicle waste can roughly be estimated using the following parameters:

- Number of tractors used in agriculture,
- Average lifetime of a tractor,
- Average weight of a tractor.

Based on questions direct to agriculture specialists an average lifetime of a tractor has been estimated to be 15 years. A tractors weight varies between the different types used, though an average of 5 tons per tractor seems realistic.

During this pilot study no appropriate methodology to estimate the amount of end-of-life vessels could be developed. A rough estimation is presented based on number of vessels sold for scrap metal, combined with their registered gross weight. Further investigation will be required to present a more accurate method.

Discarded equipment

Classification
LoW: 16 02 (Discarded equipment and its components)
EWC-Stat: 08.43 (Other discarded machines and equipment components)

Treatment *(Agriculture and Fishery)*
Discarded equipment is collected for recycling (plastic or metal), landfilled or incinerated with energy recovery if burnable. Most holders keep the old equipment for spare parts that can be used for repairing.

Discussion *(Agriculture and Fishery)*
In fact, there is very little known on the generation and treatment of equipment waste from agriculture or fishery. In order to collect more information visual or questionnaire survey might present a possible solution. During this pilot study it was not thought possible or relevant to develop a specific methodology to assess this waste stream.

Discarded Working Materials

Ammunition

Classification
LoW: 16 04 01 (Waste ammunition)
EWC-Stat: 02.22 (Waste ammunition)

Treatment *(Agriculture)*
Ammunition waste e.g. empty cartridges are typically left in the field, but are increasingly collected and brought to waste collection points by hunters.

Discussion *(Agriculture)*
During this study no possible or relevant methodology could be developed for this waste sort. According to sources as the Nature Conservation Agency and hunting organisation in Iceland, the amounts of ammunition waste is assumed to be very small, even less than 100 kg/year. Based on our reporting threshold, ammunition waste was excluded from this pilot study.

Fishing nets and lines

Classification
LoW: 02 01 04 (Plastic wastes (except packaging))
EWC-Stat: 07.42 (Other plastic wastes)

Treatment *(Fishery)*
Though some of the waste from fishing nets and lines in Iceland will be left in the sea, this waste is generally brought ashore to special collecting points in harbours. After collection, parts and materials suitable to be reused are removed and the remaining plastic or nylon is send for recycling or landfill.

Discussion *(Fishery)*

In Iceland an agreement has been established between the national authorities and the fishing industry, implying that as set recycling targets for fishing gear and –nets are met, there will be no recycling fee levied on these products. The recycling target that was set for fishing nets is 45% by 2006, 50% by 2007 and 60% by 2008.

Methodology and data collection *(Fishery)*

The Icelandic Recycling Fund *(Úrvinnslusjóður)* and the Federation of Icelandic Fishing Vessel Owners *(Landssamband Íslenskra Útvegsmanna)* carried out a study where the types and amount of fishing nets used in Iceland were investigated. This study presented the amounts of plastics, metal and other materials used for fishing nets. The results where used to set a recycling target for fishing nets and – gears, see above. In addition, the quantity of fishing nets and lines that are actually recycled can be obtained from the only plastic recycler situated in Iceland. A negligible amount of fishing nets is incinerated with energy recovery in Iceland.

Rock wool substrate

Classification

LoW: 01 04 99 *(Waste not otherwise specified)*
EWC-Stat: 9.12 *(Waste of naturally occurring minerals)*

Treatment *(Agriculture)*

Only a few greenhouses in Iceland use rock wool as substrate for growing plants. When discarded, the substrate is generally landfilled as it cannot be used for composting e.g. due to the presence of nylon string, roots and possible contents of plant-pathogens. Rock wool pots are used as well and are reused between 2 or 3 times before they are discarded and landfilled.

Discussion *(Agriculture)*

Rock wool substrate could be classified as insulation material (LoW: 17 06 04 or EWC-Stat: 12.13), though it should than be labelled as *´Mixed construction waste´*. Taking into consideration the use as substrate it should rather be labelled as *´Vegetal waste of food preparation and products´* (EWC-Stat: 9.12 or LoW: 02 33 99). A classification according to the EWC-Stat seems most favourable. However, amounts used in Iceland are very small, thus making rock wool used in greenhouses an irrelevant waste stream.

Methodology and data collection *(Agriculture)*

The amount of rock wool waste may be estimated using the following parameters:

Table A2.2 Rock wool substrate parameters for agriculture

Parameter	
Area of greenhouses using rock wool as substrate	*4.200 m^2*
Average thickness of rock wool substrate	*0,08 m*
Average density of rock wool substrate	*60 kg/m^3*
Average lifetime of rock wool substrate	*2 year*
Average volume decrease per year	*20 %*

** Parameters based on final pilot study report from Austria and data from the Farmers Association of Iceland.*

The parameters as area and thickness were used to calculate the total volume of rock wool used as substrate. Combining the volume with the rock wool density, yearly volume decrease and average lifetime, the yearly discarded quantity can be estimated.

Construction and Demolition Waste (C&D)

Wood

Classification
LoW: 17 02 01 (Wood)
EWC-Stat: 07.53 (Other wood wastes)

Treatment *(Agriculture)*
Wood waste, generated during construction, repair and demolition of buildings is either reused as material or collected with other wood waste and incinerated with energy recovery, recycled or landfilled.

Discussion *(Agriculture)*
Wood C&D waste should not be allocated to NACE A or B, but rather to NACE F as *´Construction´*. Wood waste from C&D was therefore excluded from these waste statistics.

Concrete and bricks

Classification
LoW: 17 01 01 (Concrete)
EWC-Stat: 12.11 (Concrete, bricks and gypsum waste)

Treatment *(Agriculture)*
Most of the buildings used in agricultural are left abandoned when they have no further use. If demolished, the concrete and bricks are landfilled or used as construction material for road building.

Discussion *(Agriculture)*
Similar to wood waste, concrete and bricks should be classified as waste under NACE F. Concrete and brick from C&D were therefore excluded from these waste statistics.

Greenhouse plastics

Classification
LoW: 17 02 03 (Plastic)
EWC-Stat: 07.42 (Other plastic wastes)

Treatment *(Agriculture)*
Greenhouse plastic is used in horticulture for the construction of small sized greenhouses. When discarded it is typically collected with other waste generated by greenhouse activities and landfilled or incinerated.

Discussion *(Agriculture)*
According to greenhouse owners, greenhouse plastic is used between 2 to 4 years before it has to be renewed. However, during unpredictable circumstances such as strong winds, the plastic has to be renewed more often. Based on the domestic production and import figures, greenhouse plastic waste has been estimated to present less than 1 ton each year. This amount is below our reporting threshold and therefore was excluded from these waste statistics

Greenhouse glass

Classification
LoW: 17 02 02 (Glass)
EWC-Stat: 07.12 (Other glass wastes)

Treatment *(Agriculture)*
Greenhouse glass is used for windowing in greenhouses. When discarded it is typically collected with other waste generated by greenhouse activities and landfilled.

Discussion *(Agriculture)*
Based on visual surveys and questions directed to greenhouse owners it was concluded that this presents a very small waste stream. No exact amounts could be estimated, though one may assume that they are lower than our reporting threshold. Therefore this waste stream was excluded from these waste statistics.

Household and Similar Waste

Household waste

Classification
LoW: 20 03 01 (Mixed municipal wastes)
EWC-Stat: 10.1 (Household and similar waste)

Treatment *(Agriculture, Forestry and Fishery)*
Household waste generated in agriculture and forestry is collected by municipalities or in order of them and finally landfilled or incinerated.

Household waste generated on ships may, according to the MARPOL Convention, be disposed at sea. Household waste brought ashore is collected with other generated (household) waste and landfilled or incinerated. It has been estimated that the production of household waste on ships is around 1,6kg per person per day.

Discussion *(Agriculture and Fishery)*
The amounts of household waste generated per person in agriculture are assumed to be somewhat higher than from regular households, caused by the farm-related tourism and recreation activities at farms. According to our opinion *(see par. 3.2.3)* household waste generated by agriculture and fisheries should be excluded from these waste statistics, as it is accounted for in municipal waste registration.

Methodology and data collection *(Agriculture and Fishery)*
In order to present an indication on the importance of this waste stream, an estimation based on the average quantity of household waste generated per capita and the number of people working in AFF seems to be the most realistic method.
The Icelandic waste statistics show that in 2002 around 72.000 tons of mixed household waste was generated by 287.559 inhabitants, thus presenting 250 kg per capita. In the same year, around 6.000 people were working in agriculture and 5.300 in fishery *(excluding fish processing).*

ANNEX III – WASTE CALCULATIONS

Calculations for Bio-organic waste

Table A3.1 Livestock and other animal effluent production, Iceland 2002

Type of Animal	Number of animals [1]	Urine Factor [2] and 4)		Manure Factor [2] and 4)		Months Housed [2]	Manure Production		Urine Production	
		m^3/mnd	kg/mnd	m^3/mnd	kg/mnd		tons (housed)	tons (year)	tons (housed)	tons (year)
Cattle, of which:	**67.225**									
Cows	*25.508*	*0,30*	*300*	*0,80*	*640*	*8*	*130.601*	*195.901*	*61.229*	*91.829*
Beef cows	*1.298*	-	-	-	-	-	-	-	-	-
Heifers	*6.395*	-	-	-	-	-	-	-	-	-
Dry Cattle / Steers	*17.350*	*0,20*	*200*	*0,40*	*320*	*8*	*44.416*	*66.624*	*27.760*	*41.640*
Calves	*16.674*	*0,05*	*50*	*0,15*	*120*	*8*	*16.007*	*24.011*	*6.670*	*10.004*
Sheep (Ewes)	*376.110*	*0,03*	*30*	*0,10*	*80*	*7*	*210.622*	*361.066*	*78.983*	*135.400*
Horses	*71.267*	*0,15*	*150*	*0,45*	*360*	*5*	*128.281*	*307.873*	*53.450*	*128.281*
Hens [3] and 5)	*160.537*	-	-	*0,05*	*40*	*12*	*7.706*	*7.706*	-	-
Pigs	*4.075*	*0,10*	*100*	*0,05*	*40*	*12*	*1.956*	*1.956*	*4.890*	*4.890*
Mink [3]	*33.751*	-	-	*0,01*	*8*	*12*	*324*	*324*	-	-
Foxes [3]	*3.333*	-	-	*0,02*	*16*	*12*	*64*	*64*	-	-
						Subtotal	*539.976* (A)	*965.525* (B)	*232.972* (C)	*412.043* (D)

Total production in 2002, of which:	**1.377.568 tons** *(B + D)*
Produced when housed	*772.948 tons (A + C)*
Produced when grazing / on the field	*604.620 tons ((B + D) – (A + C))*

1) *Data source: Icelandic Statistics 2003,*
2) *Data source: Handbók Bænda 2005, Farmers Association of Iceland,*
3) *Waste factor is per 10 animals,*
4) *1 m^3 of Urine = 1.000kg / 1 m^3 of Manure = 800kg,*
5) *Manure factor from ´Hens´ is reported as slurry factor.*

Table A3.2 Fish residues generated in Icelandic fisheries 2002

Fish species	Fish catch [1] tons	Conversion factor [2]	Waste factor	Fish residues tons
Cod	*238.324*	*1,15*	*15%*	*35.749*
Haddock	*41.698*	*1,15*	*15%*	*6.255*
Saithe	*32.947*	*1,18*	*18%*	*5.930*
Redfish	*116.297*	*1,15 [4]*	*15%*	*17.445*
Catfish	*15.043*	*1,15 [4]*	*15%*	*2.256*
Herring	*287.663*	*1,25*	*25%*	*71.916*
Capelin	*892.405*	*1,15 [4]*	*15%*	*133.861*
Whiting	*259.157*	*1,08*	*8%*	*20.733*
Total generated [3]	**1.883.534 tons**			**294.144 tons**

1) *Whole un-gutted fish,*
2) *Percentage of guts and cut offs, all gutted with head-on,*
3) *Total fish catch in 2002, excluding shellfish, was 1.933.965 tons,*
4) *No conversion factor found, estimated based on average.*

Calculations for other sector-specific AFF waste

Table A3.3 Sales and transport packaging waste generated in AFF, Iceland 2002

x tons	Glass	Wood	Plastic		Paper & Cardboard		Metal	
	sales	transport	sales	transport	sales	transport	sales	transport
Total packaging waste generated	6.453	7.473	9.428	9.905	8.837	12.798	785	427
Packaging waste in kg/capita [1]	22	n.a.	33	n.a.	31	n.a.	3	n.a.
Generated in agriculture [2]	135	??	197	1.615	184	??	16	??
Generated in fisheries [3]	119	300	174	120	163	??	14	??
Subtotal	254	300	371	1.735	347	??	30	??
						Total generated in AFF	**3.037 tons**	

1) *Total number of inhabitants in Iceland 2002 was 287.559,*
2) *Employment in Icelandic agriculture in 2002 were 6.000 employees,*
3) *Employment in Icelandic fisheries in 2002 were 5.300 employees.*

Table A3.4a Tractor waste – Used motor oils, Iceland 2002

Parameters	Motor oil	Gear and Hydraulic oil
Liters required for 1 oil change	11	49
Oil density	0,864 gr/cm^3	0,896 gr/cm^3
Waste oil factor (spilling)	30%	3%
Frequency of oil change per year	1	1/3
Number of tractors in use	6.000	
Liters of oil changed	66.000	98.000
Liters of oil, after spilling	46.200	95.060
Subtotal	40 tons	85 tons
Total generated		**125 tons**

Table A3.4b Tractor waste – Batteries and accumulators, Iceland 2002

Parameters	
Average lifetime of accumulator	5 year
Average weight of accumulator	30 kg
Number of tractors in use	6.000
Number of accumulators discarded	1.200
Total generated	**36 tons**

Table A3.4c Tractor waste – End-of-life-tyres, Iceland 2002

Parameters	Front tyre	Rear tyre
Average lifetime of tyre	*15 year*	*15 year*
Average weight of tyre	*15 kg*	*75 kg*
Number of tractors in use	*6.000*	
Number of discarded tyres	*12.000*	*12.000*
Subtotal	*12 tons*	*60 tons*
Total generated		**72 tons**

Table A3.4d Tractor waste – End-of-life-tractors, Iceland 2002

Parameters	
Average lifetime of tractor	*15 year*
Average weight of tractor	*5 tons*
Number of tractors in use	*6.000*
Number of discarded tractors	*400*
Total generated	**2.000 tons**

Table A3.5 Rock wool substrate waste from greenhouses, Iceland 2002

Parameters	
Area of greenhouses using rock wool as substrate	*4.200 m^2*
Average thickness of rock wool substrate	*0,08 m*
Average density of rock wool substrate	*60 kg/m^3*
Average lifetime of rock wool substrate	*2 year*
Average volume decrease per year	*20%*
Total discarded per year	*121 m^3*
Total generated	**7 tons**

Table A3.6 Household waste in agriculture and fisheries, Iceland 2002

Parameter	Household waste *tons*
Total household waste generated [1)]	*75.000*
Household waste in kg/capita [2)]	*261*
Generated in agriculture [3)]	*1.500*
Generated in fisheries [4)]	*1.325*
Total generated	**2.825 tons**

1) Excluding waste that has been collected for recycling or recovery,
2) Total number of inhabitants in Iceland 2002 was 287.559,
3) Employment in Icelandic agriculture in 2002 were 6.000 employees,
4) Employment in Icelandic fisheries in 2002 were 5.300 employees.

ANNEX IV – EXCISTING DATA SOURCES

Hagstofa Íslands
Statistics Iceland

Statistics Iceland is the National Statistical Institute of Iceland and was founded in 1914. The legal basis for Statistics Iceland and its work is the Act of 1913, as well as other acts on official statistics, the Act and statutes on the Central Government Administration, the legislation on civil registration and the National Register of Population and other legislation. Statistics Iceland also operates in accordance with the United Nations Fundamental Principles of Official Statistics, the European Statistics Code of Practice as well as the Act on the Protection of Privacy regarding the processing of personal data. Furthermore Statistics Iceland has laid down its own Rules of Procedure for Treating Confidential Data. Statistics Iceland is divided into four divisions – resources and services, social statistics, economic statistics and the National Population Registry:

- The *Resources and Services* division is responsible for support of and services for the operation of Statistics Iceland,
- The division of *Social statistics* comprises four departments as: Education and culture, Labour market and Social statistics, Population statistics and Wage statistics,
- The division of *Economic statistics* comprises five departments as: Business statistics, Public finances and sector accounts, External trade, National accounts and Price statistics,
- The *National Population Registry* gathers and registers data on births and deaths, personal names, marriages, divorces, addresses etc.

Statistics Iceland was responsible for the administrative registers of enterprises until 1 July 2003 when those tasks were transferred to the Internal Revenue Directorate. The present organisation chart of Statistics Iceland is effective as of February 2006.

More information can be found on www.statice.is

Bændasamtök Íslands
Framers Association of Iceland

All farmers are members of the Farmers Association of Iceland, which was established in 1995 when the Agricultural Society of Iceland, tracing its origin to the year 1837, and the Farmers Union were amalgamated into one organization. The basic units of the Farmers Association are 15 district agricultural associations and 13 sectional producers' societies. These organizations vote 48 members to the Agricultural Assembly, which is the highest authority of the Farmers Association. As well as representing the interests of farmers and agriculture at large, the Association supervises the enforcement of many laws, such as those concerning agriculture and animal breeding. It also provides advisory services in all spheres of agriculture, together with the district associations - and participates in policy making as well as providing information to Government and public authorities.

More information can be found on www.bondi.is

Úrvinnslusjóður

Icelandic Recycling Fund

In recent years, understanding has increased of how necessary it is to gain control of the growing quantity of waste that has accompanied today's consumer society. Demands are placed by individuals, municipalities and the commercial sector on systematic solutions for waste and on products not causing damage to the environment. At the level of the European Economic Area, rules with this objective have been set for the Area as a whole, as well as by the governments of individual member states. These rules build on the "polluter pays principle", meaning that whoever causes waste should pay for its reuse, recovery or disposal. The trend is towards shifting responsibility to an ever greater extent onto those who put the product on the market, regardless of whether they are manufacturers or importers. This is referred to as "producer liability". Iceland's authorities have set the goal of systematically reducing waste formation and channelling waste into reuse and recovery. The Act on Recycling Fees was passed in an effort to achieve this end, charging the Icelandic Recycling Fund with creating conducive economic conditions for reuse and recovery, lowering the volume of waste going into final disposal and ensuring the proper disposal of hazardous substances.

More information can be found on www.urvinnslusjodur.is

Siglingastofnun Íslands

Icelandic Maritime Administration

The Minister of Transport and Communications is responsible for centrally administrating maritime, harbour and lighthouse affairs, except where otherwise provided for in a different law. The Minister of Transport and Communications shall, upon receipt of a report from the Maritime Council, appoint a Director General of the Icelandic Maritime Administration (IMA), for a period of five years at a time. The Director General employs other personnel to the Administration. The IMA, with a staff of around 70, handles numerous activities in the field of maritime administration and supervision, such as operation of lighthouses and navigational systems, vessel registration and supervision of ship surveys, manning and certification. The IMA also conducts research into ship stability and ship and harbour security and harbour development, coastal changes and coastal protection.

More information can be found on www.sigling.is

Landssamband Íslenskra Útvegsmanna

The Federation of Icelandic Fishing Vessel Owners

The Federation of Icelandic Fishing Vessel Owners (LIU) was founded on January 17th 1939. The founders' purpose was to represent all Icelandic fishing vessel owners in one unified organisation in order to safeguard their mutual interests. The main functions of LIU are to speak on behalf of fishing vessel owners, promote progressive developments within the field of fisheries, negotiate salaries and catch premiums with the trade unions and to look out for the economic, financial, legal, technical and social interests of fishing vessel owners.

The organisation represents fishing vessel owners, organised in 11 regional organisations which together form the LIU. The Annual General Meeting of LIU elects the 15 member Board of Directors. The board appoints 5 of the directors to form the Executive Board of LIU under the leadership of the Chairman. LIU places considerable emphasis on presenting the viewpoints of its members to the Icelandic legislature and the executive branch of government and endeavours to study and follow up issues of concern to the fisheries which will be dealt with by the various government institutions. The organisation employs a specialised staff to assist in meeting its objectives. In addition to the chief executive, these include a staff economist, an advisor who assists members in operating under the rules of the Icelandic ITQ system, a specialist in marine technology, and a population ecologist specialising in fisheries biology and environmental issues.

More information can be found on www.liu.is

Skógrækt ríkisins

The Icelandic Forest Service

The Iceland Forest Service (IFS) was established in 1907. It is the state forestry authority in Iceland and is under the Ministry of Agriculture. The IFS manages over 40 national forests throughout Iceland, totalling about 7000 ha or 5% of Icelandic forests and woodlands. The national forests employ a full-time staff of around 30 people. Until recently, the IFS was the main producer of tree seedlings in Iceland, as between 1950 and 1990 the main emphasis of the IFS was on afforestation through planting. Tree planting has now become a minor part of IFS activities and seedling production has been privatised.

More information can be found on www.skogur.is

SORPA

Waste sorting and bailing plant

Solid waste and solid waste-disposal are prominent modern urban services throughout the industrialized world. Iceland has close to 300.000 people, about 186.000 (62%) of whom live in Reykjavík, Iceland's capital and its adjoining municipalities. Since 1991, The City of Reykjavík and six other municipalities have coordinated their solid waste disposal through an independent firm named SORPA, which these seven municipalities jointly own and run. Municipalities with ownership are: Reykjavík, Kópavogur, Hafnarfjörður, Garðabær, Seltjarnarnes, Mosfellsbær, Bessastaðahreppur. The formation of SORPA received a strong push from increased debate on environmental issues. Simultaneously, its formation was influenced by an Icelandic government policy issued in the early 1990s to reduce solid waste, step by step. The most densely populated area, which is in and around the Capital, had already induced problems in waste disposal that had to be dealt with. Open waste areas at city borders and areas with unsorted waste covered by thin layers of earth had been the only options. Aesthetic problems were obvious, pollution evident and recycling absent. SORPA was designated to tackle the problems. SORPA has 74 employment positions.

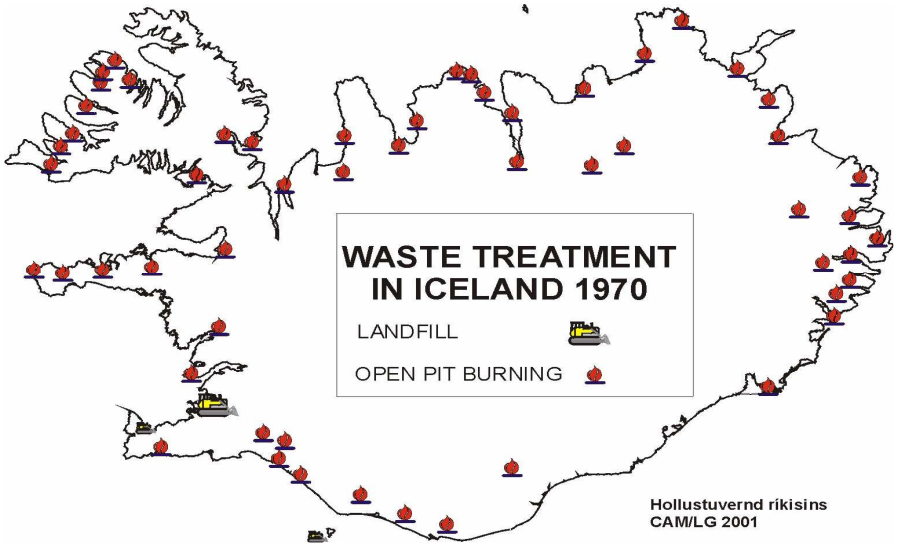
More information can be found on www.sorpa.is

ANNEX V – ICELANDIC WASTE MANAGEMENT

Waste management in Iceland 1970-2004

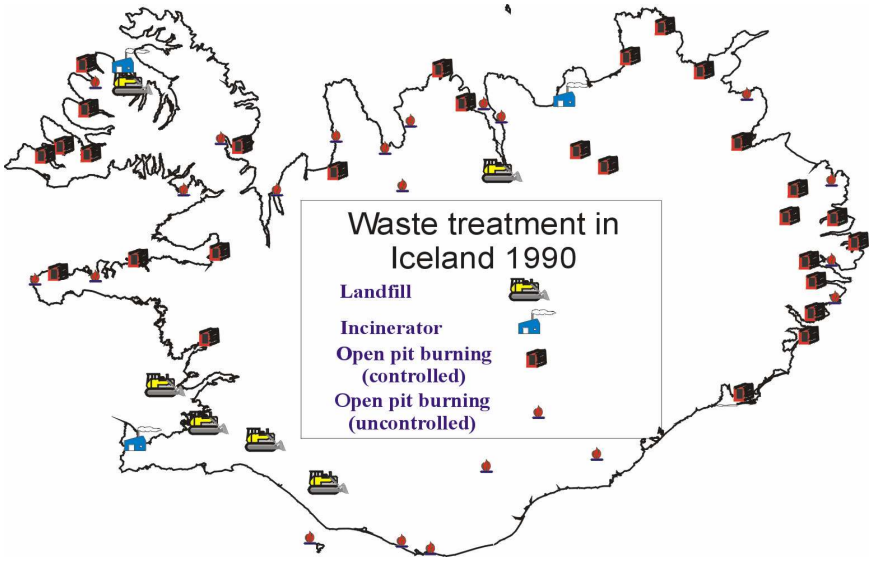
Since the 1970s Iceland has made considerable progress regarding waste management. The main treatment option in the 1970s was open-pit burning, resulting in many widely dispersed small open dumps emitting smoke *(see figure A5.1)*.

Figure A5.1 Waste management in Iceland 1970



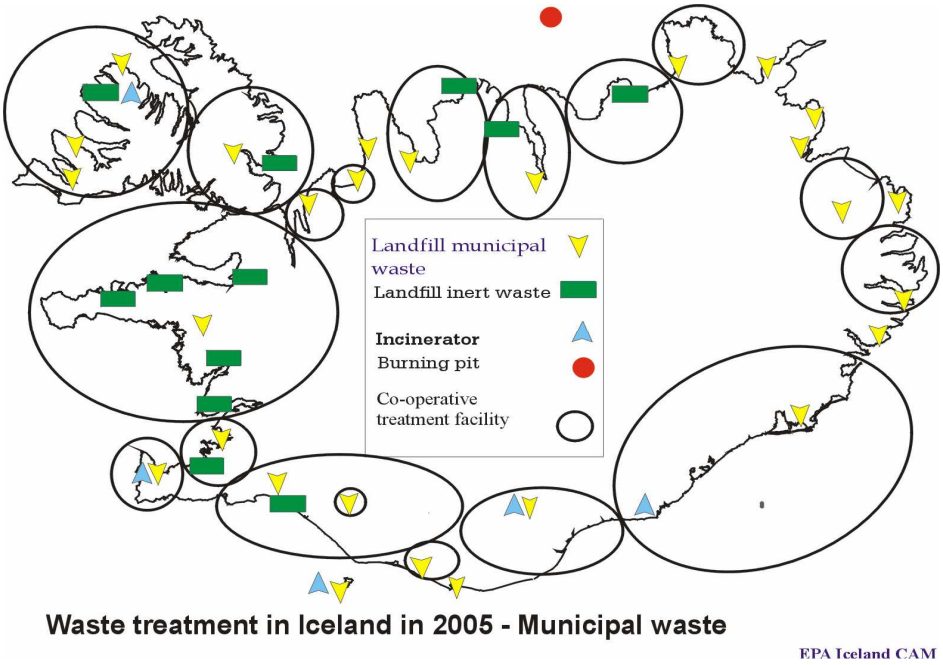
In the 1990´s the obvious disadvantages of widely spread uncontrolled open-pit burning had been recognized. Therefore, many municipalities installed incineration tanks, typically concrete "boxes", preventing waste from blowing away, but still resulting in incineration at relatively low temperatures. At the same time landfill became more common *(see figure A5.2)*.

Figure A5.2 Waste management in Iceland 1990



In 2000 open-pit burning had gradually been stamped out as being no longer acceptable. Instead, landfill became the most common way of final treatment, but also some (small) incineration plants were built, some of which boasted energy recovery. Furthermore, recycling options became more viable, as a result of increased cooperation between local authorities *(see figure A5.3).*

Figure A5.3 Waste management in Iceland 2005



Waste management in Iceland has gradually become a business activity. Establishment of collection systems and sites has created ways for public and business to dispose of their waste in a sound way.
Waste treatment facilities are now fewer than earlier and those remaining have increased in size, due again to increasing co-operation between local authorities. However, despite an almost two-fold increase in the recovery of waste over the past 10 years, the quantity of waste bound for permanent landfills has not diminished. Today around 70 per cent of municipal waste is still going to landfill, only around 3 per cent is incinerated with energy recovery, and 26 per cent is recycled or recovered by means other than incineration with energy recovery, meaning total recovery is around 28 per cent of the total generated waste.

New legislation

Law no. 55/2003 on Waste Management was designed to address the more stringent demands on contemporary waste-management. The objective of the law is to decrease the quantity of waste by preventing generation of waste, increase recycling and recovery and reducing the quantity of waste deposited in landfill sites.

Based on law no. 55/2003, the following three new regulations were issued to implement the landfill directive (1999/31/EC) and the incineration directive (2000/76/EC):

- Regulation no. 737/2003 on treatment of waste,
- Regulation no. 738/2003 on landfill of waste,
- Regulation no. 739/2003 on incineration of waste.

The Waste Management Law no. 55/2003 and Regulation no. 737/2003 on waste treatment interpret the following EU targets into Icelandic law:

1. To reduce the total weight of organic household waste to be landfilled by 25 per cent by no later than 1 January 2009, by 50 per cent by no later than 30 June 2013, and by 65 per cent by no later than 30 June 2020,
2. To reduce the total weight of other organic waste, such as biodegradable organic waste to be landfilled, by 25 per cent by no later than 1 January 2009, by 50 per cent by no later than 30 June 2013 and by 65 per cent by no later than 30 June 2020,
3. To recover packaging waste by between 50 per cent as a minimum and 65 per cent as a maximum by weight, to recycle between 25 per cent as a minimum and 45 per cent as a maximum by weight of the totality of packaging materials contained in packaging waste, with a minimum of 15 per cent by weight for each packaging material, all on a yearly basis,
4. To reuse and recover end-of-life vehicles *(ELV)* by no later than 31 December 2005 by 15 per cent as a minimum, and to reuse and recover the average total weight of vehicles by 20 per cent as a minimum,
5. To collect and treat in an appropriate way an average of 4 kilos of Waste Electrical and Electronic Equipment *(WEEE)* per capita annually.

Regulation no. 737/2003 on treatment of waste makes the local authorities responsible for collection, handling and treatment of municipal waste.

In addition, the Regulation no. 738/2003 provides for a ban on disposal by landfill of a range of materials including metals, end-of-life vehicles, liquid wastes, hazardous waste, contagious and radioactive medical waste and tyres.
The ban on landfilling of tyres will take effect from 16 July 2006, but until then it is allowed to landfill shredded tires. By 16 July 2009, all landfill operators must either comply with the regulation or shut down their operation.

It is expected that in response to the new law and regulations on waste the costs of waste management will further increase. The law no. 55/2003 on Waste Management provides for the setting up of a special Coordination Committee to monitor the Implementation of Laws. The role of the Committee is, amongst other things, to monitor the compliance of the law, assess the cost-effectiveness of the programme and, if necessary, ensure funding for the programme in the future where needed.

Regulation no. 737/2003 on treatment of waste makes the local authorities responsible for collection, handling and treatment of municipal waste. Several municipalities there operate cooperative (regional) waste treatment facilities. In the capital area of Reykjavik this is managed by SORPA, a company owned by several municipalities (covering around 62 per cent of the total Icelandic population).

SORPA also operates eight container parks and has collection points (where the public sort and deposit their own waste) in city centres. The public and small operators can take a wide range of recyclable items to the collection points free of charge. However, private individuals pay to drop off waste at the collection points which is not collected by the municipalities, such as building waste, garden waste, rubbish arising during house purchase, waste associated with vehicle repairs, waste associated with pets, etc. From the collection points, the material is taken to the SORPA consolidation and baling centre in Gufunes where it is sorted for either recovery or disposal, typically for landfill in Álfsnes. Larger companies may take their (bulk) waste directly to SORPA.

Companies that bring their waste directly to the sorting centre in Gufunes have to pay a gate fee depending on the amount and type of waste, with exemption for those materials subject to the recycling fee, which can be dropped off free. The gate fees at Gufunes are as follows (effective 1 July 2005): ISK 3,65 per kg for newspapers and magazines, while it costs ISK 3.24 per kg to drop off writing and computer paper. The rate for mixed waste is ISK 9,11 per kg and for bulk mixed waste ISK 13,15 per kg. However, for economical and environmental reasons SORPA pays the waste holder up to ISK 5,42 per kg for sorted corrugated cardboard ready for recycling and also for sorted plastic film up to ISK 12,45 per kg, depending on the amount brought.

It is expected that the costs of waste management will rise in response to the new waste law and regulations. To predict and manage increased costs, law 55/2003 provides for the setting up of a special Coordination Committee on the Implementation of Laws. The role of the Committee is, amongst other things, to monitor the fulfilment of targets, assess the cost-effectiveness of the programme and, if necessary, ensure unimpaired funding for the programme in the future

National Waste Management Plan 2004-2016

Law no. 55/2003 on Waste Management stipulates that the UST must draw up a National Waste Management Plan (*NWMP*). The (first) NWMP was released in April 2004.

The main objectives of the National Waste Management Plan are:

- Compliance with the “polluter-pays” directive,
- Obligation on local authorities to submit annual reports on quantity and composition of treated waste,
- Compulsory management of asbestos, hazardous waste and contaminated soil,
- Managing waste within national borders where it makes economic sense,
- Creating the most cost-effective conditions possible for the recycling of waste.

The following timetable applies for the implementation of the Programme:

- From 1 January 2006, a minimum of 85 per cent of all ELVs must be reused or recovered (in addition, a minimum of 80 per cent of the average weight of the vehicles must be either reused or recycled),
- From 16 July 2006, ban on the landfill disposal of tyres, both whole and shredded,
- From 1 December 2006, a minimum of 4 kg of WEEEs per capita must be treated appropriately,

- From 1 January 2009, organic household and industrial waste going to landfills must be decreased by 25 per cent, compared to the amounts produced in 1995,
- From 1 July 2013, organic household and industrial waste going to landfill must be decreased by 50 per cent, compared to the amounts produced in 1995,
- From 1 January 2015, the reuse and recovery of ELVs must be at least 95 per cent (85 per cent of the average weight of ELVs must be either reused or recycled),
- From 1 July 2020 organic household and industrial waste going to landfill must be reduced by 65 per cent, compared to the amounts produced in 1995,
- The Plan also includes the new provisions of the EU Directive 2204/12/EC of 11 February 2004 amending Directive 94/62/EC on packaging and packaging waste: the Icelandic government has to make provisions for the implementation of this directive before 2013 and is expected to give its waste management operators up to 3 years to meet the new requirements.

In order to meet the targets of the National Waste Management Plan, the recovery of organic waste, packaging waste and WEEE has to increase significantly. Although it is feasible to recover organic waste by means of energy recovery, if the 6 relatively small incineration plants in Iceland continue to operate on current efficiency levels, recovery of organic waste will have to be increased by other means, e.g. by composting or anaerobic digestion.

Regional Waste Management Plans

Based on the NWMP, local authorities have to draw up and activate local (or regional) waste management plans (*RWMP*) by 1 April 2005, elaborating on how the municipalities will comply with the objectives of the national plan.
Guidelines for local authorities making their local plans were released in October 2004. The national plan and local programmes will be reviewed every 3 years. The key factor in monitoring the success of the RWMP will be the collection of more reliable and accurate data on the quantity and quality of waste that is generated on a local (regional) level. Despite improvements in data collection over the past few years, there are big local differences in quality of data that hamper effective policy-making and regional co-operation. Therefore, the first regional waste management plans of 2005 had to focus especially on data collection.