ICELAND'S NATIONAL PROGRAMME OF ACTION

for the protection of the marine environment from land-based activities

Ministry for the Environment

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PREFACE

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The protection of the oceans is one of the most important tasks facing mankind. The oceans cover 70% of the Earth's surface and they are a crucial part in the global climate and ecosystems. The state of the marine environment affects our lives much more than most of us realize.

The seas have throughout the ages been a major source of food for mankind. In modern times many began to see a new utility in the oceans, as a convenient giant dustbin for mankind's refuse. We now know that this is an illusion, the circulation of matter in the ecosystem means that our pollutants come back to haunt us, in the seafood we consume and in the damage to an ecosystem that is vital to the web of life.

One of the most encouraging trends in global environmental affairs in recent years is that the fight against the pollution of the oceans is beginning to bear fruit. The recent Stockholm agreement, which limits the release of some of the most notorious persistant pollutants, is a big step in this direction. Another milestone was the 1995 Washington agreement on a Global Programme of Action (GPA) for the Protection of the Marine Environment from Land-Based Activities. The significance of the GPA can perhaps best be seen by the fact that 80% of marine pollution comes from land-based sources.

Iceland's National Plan of Action, which is based on the GPA, contains an assessment of land-based pollution in Iceland and a plan to reduce such pollution. The plan consists of specific actions to be taken, along with a rough assessment of the scope of each action. These actions are not all taken only on the basis of the GPA, but on the basis of other laws and commitments as well. Most or all would be needed even without Iceland's commitment to the GPA. The National Plan of Action does however, offer a comprehensive overview of actions needed for halting pollution from land-based sources, and is a useful instrument for prioritizing action and measuring progress in the coming years.

The sea around Iceland is relatively unpolluted. The pollution that does exist comes to a large extent from distant sources and is carried by winds and ocean currents to Icelandic waters. It is a valid question if Iceland should make the national implementation of the GPA a priority, considering those facts.

In my mind the answer is obvious. The Icelandic economy is overwhelmingly dependent on the bounty of the sea, and Iceland should be in the forefront in the struggle to preserve the marine environment. This entails an active participation in international cooperation, but also a commitment to reduce and stop pollution from domestic sources. This report contains a comprehensive and ambitious plan to halt land-based pollution in Iceland. Its implementation will help Iceland to prove its commitment as one of the leading countries in the global fight against pollution of the seas.

SUMMARY AND CONCLUSIONS

The Icelandic National Programme of Action for the Protection of the Marine Environment from Land-based Activities is in form and scope based on a Global Programme of Action approved by 114 states in Washington in 1995. The structure of the NPA and its approach to the issue follows that of the GPA.

The NPA aims to evaluate the threat posed by different types of marine pollution. In general, overview and knowledge could be significantly improved regarding Persistent organic pollutants, Heavy metals, Sediment mobilisation and sediment contamination, Physical alterations and destruction of habitats, and Handling and monitoring of harmful substances. Information about Nutrients and Oils is also somewhat lacking, but knowledge about Sewage, Radioactive substances and Litter is considerably better. The different state of knowledge about individual aspects in this report has inevitably effects on the proposed task list and the approach of the NPA.

After an evaluation on specific aspects of the problem, they are prioritised according to Icelandic conditions, which are not necessarily identical to the evaluation in the GPA.

Generally speaking, Icelandic waters are relatively unpolluted and the majority of the aspects in question are not considered a great problem in Iceland. The following items, however, need further consideration:

- **Persistent organic pollutants;**
- **Heavy metals;**
- **Radioactive substances;**
- **Sewage; and**
- **Handling and monitoring of harmful substances.**

In Chapter 6 of this report, proposals for specific actions for improving the present status are listed. The actions are divided into immediate projects, and long-term projects, and attempt is made to specify whether the government or 'others' (local authorities, private sector etc.) are responsible for the corrective actions.

Although much has been achieved in environmental affairs in Iceland in the past few years, much is yet to be done. The first steps in future work in this regard should be to obtain better overview over the aspects where information is insufficient and to coordinate available knowledge and actions.

Frequently, lack of funding is an obstacle for corrective actions to be taken, and/or the solutions have not been adequately defined. Individual agencies working on environment protection are generally not receiving sufficient payments for their surveillance and services, in addition to budget constraints. It is a priority task to finish issuing operating licences to all relevant enterprises, with provisions for surveillance and fees. This would lead to a better overview of potential sources of pollution, better implementation of laws, and eventually further reduction of pollution.

This programme is intended to be a flexible instrument rather than a rigid plan of action. The conclusions, evaluation and proposals are based on the information and knowledge available to the authors at the time it was prepared, and comments received during the consultation period. Those factors can change as time goes by. The programme has to adjust to such changes in scientific knowledge and prioritization, which is a natural part of all effective planning.

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1 INTRODUCTION

1.1 THE SEA

The sea covers approximately 70% of the earth's surface and contains over 97% of all the water on earth. The state of the sea is vital to all life on earth and its protection is one of the most important projects currently facing Man.

The earth's water is in constant circulation (figure 1). Water evaporates into the atmosphere as a result of thermal radiation from the sun. The water vapour condenses to form clouds and finally falls as precipitation either into the sea or onto land. A part of the precipitation that falls on land evaporates again, while a part flows into the sea in rivers and streams and groundwater [1]. The sea is a reservoir for the earth's water and it is fairly accurate to say that all water comes from the sea and that all water eventually returns to it.

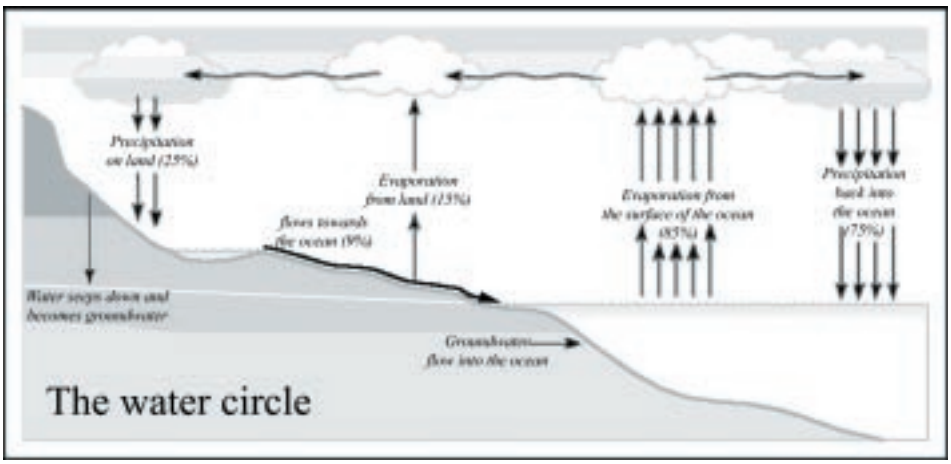

Figure 1. The circulation of water [2]

1.2 POLLUTION AND POLLUTANTS

Many definitions have been used to explain the term pollution. The following definition is contained in the OSPAR Convention on the Protection of the Marine Environment of the North-East Atlantic [3]:

"Pollution [of the sea] means the introduction by man, directly or indirectly, of substances or energy into the maritime area which results, or is likely to result, in hazards to human health, harm to living resources and marine ecosystems, damage to amenities or interference with other legitimate uses of the sea."

Substances regarded as pollutants are commonly divided into 5 categories according to type. They are:

- Persistent organic pollutants (POPs);
- Radioactive substances;
- Heavy metals;
- Hydrocarbons (originating from petroleum); and
- Nutrients.

A simple way to measure how hazardous/pollutive a substance is to the environment is to assess its stability and its level of solubility in water. Substances that degrade slowly or incompletely may accumulate in organisms and ecosystems, while other substances which are quite as hazardous degenerate into less harmful substances. Generally speaking, the following criteria are used when evaluating how dangerous substances are to the environment [1]:

- Rate and mode of degradation in the environment, particularly in water (and sea);
- Toxicity;
- Liposolubility;
- Bioaccumulation;
- Genotoxicity;
- Embryotoxicity; and
- Carcinogenicity.

Almost all pollutants released into the environment, whether from the atmosphere, water or soil, end up in the sea. It is therefore important to prevent pollution at its source if the sea is to be protected from pollution [4].

1.3 MARINE POLLUTION

Land-based operations account for 80% of all pollution released into the sea [5,6]. It is clear, therefore, that for progress to be made in protecting the sea from pollution the most effective approach is to address land-based operations.

Marine pollution can have an extensive impact. The pollution can, first and foremost, disrupt important processes that play multiple roles in the earth's biosphere. The biochemistry of the oceans plays by far the largest role in the carbon cycle, which again influences the climate and weather, controls the temperature and forms the basis for life on earth. The marine biota is an important source of food for humans, and fisheries are often the most important occupation in coastal communities, even for entire nations. Many pollutants are also regarded as a serious threat to the health of consumers of polluted marine catches [6]. Pollution also has an impact on the health of animals living in or by the sea.

Pollutants can be transported from land to sea in two ways: either as airborne pollution with the weather and winds, or as run-off from land. A distinction is also made between whether pollution derives from one specific source (point source) or dispersed sources.

Run-off from land can be divided into the following categories:

- General sewage systems;
- Industrial discharge; or
- Run-off from land (rivers/rainwater/meltwater).

Airborne pollution can reach the sea:

- as dust;
- as precipitation; or
- as evaporated chemicals or chemical compounds.

1.4 THE ACTION PLAN

In 1995, 114 states, including Iceland, approved the Global Programme of Action for the Protection of the Marine Environment [7]. The aim of the programme is to facilitate national maintenance and protection of the sea by identifying the major problems facing the sea and seeking means of improvement. It provides for the creation of regional and national plans.

This Icelandic Action Plan for the Protection of the Marine Environment from Land-Based Pollution is intended as an aid to the Icelandic government in the struggle against marine pollution. The structure of the plan and its approach to the issue is based largely on a similar plan created by the Arctic Council for the Arctic Marine Environment [8]. That plan is a regional plan for the entire Arctic area, including Iceland.

The objectives of this action plan, as in the regional Arctic plan, are the following:

- Protection of human health;
- Reduction and prevention of the decline of the marine environment and coastal areas;
- Restoration of polluted areas;
- Support of conservation and sustainable utilisation of marine resources;
- Maintenance of biodiversity; and
- Maintenance of cultural assets.

With these objectives in mind, together with the obligations already undertaken by Iceland, the individual pollutants are listed in order of priority and the overall strategy established. A schedule of individual measures intended specifically to reduce marine pollution from land-based sources is also included.

Points of emphasis within the plan may be expected to change with changed emphases relating to technical advances, increased action in the field of environmental issues, progress in pollution control and policy changes by public authorities. The action plan is intended as a dynamic document under continuous review to remain constantly in tune with the most current problems at any time.

In order to make the plan as comprehensive as possible, a large number of parties were consulted during its preparation. These included public entities as well as individuals, private enterprises and interest groups.

The structure of the report is that the scope of the problem and its individual aspects are evaluated in Chapter 2 and, based on this evaluation, specific aspects of the problem are prioritised in Chapter 3. Chapter 4 sets out the strategic targets and objectives of the action plan. Proposals for actions are described in Chapter 5 and, finally, Chapter 6 contains a description of their proposed implementation in the near future.

The structure and layout of the report is based on the chapter divisions of the Global Programme of Action. Accordingly, the following issues will be evaluated:

- Sewage;
- Persistent organic pollutants;
- Radioactive substances;
- Heavy metals;
- Oil;
- Nutrients;
- Sediment mobilisation and sediment pollution;
- Litter;
- Physical alterations and destruction of habitats; and
- Handling and monitoring of harmful substances.

In recent years, a number of reports have been issued on pollution in and around Iceland and responses to pollution. Two reports in particular are referred to here which comprehensively discuss issues that are closely connected to the subject of this report. On the one hand are the results of a monitoring programme on pollution in and around Iceland [9] and on the other hand the report of the Pollution Hazard Committee [10]. These reports contain supplementary advisory materials that are useful to keep at hand when this report is read and its proposals evaluated.

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2 ANALYSIS AND EVALUATION OF THE SCOPE OF THE PROBLEM

2.1 GENERAL INFORMATION

2.1.1 Statistical facts on Iceland

Iceland covers an area of approximately 103,000 km² and the coast-line is approximately 6,000 km long. The continental shelf up to a depth of 200 m is approximately 115,000 km², and the exclusive economic zone (EEZ) is in total approximately 758,000 km². The exclusive economic zone also constitutes Iceland's jurisdiction as regards pollution control.

The warm Gulf Stream, which has its source in the Gulf of Mexico [1], and the East Greenland Current, which carries cold water from the Arctic, meet off the shores of Iceland. Close to land, a current flows clock-wise around Iceland (figure 2). This current forms as a result of the mixing of deep-sea currents with fresh water from land.

Iceland is sparsely populated with only approximately 280,000 inhabitants. The majority of the inhabitants, approximately 90%, live on the coast. Icelanders base their economy largely on the utilisation of marine resources. Fisheries form the basis of the nation's economy, providing 70-80%[1] of Iceland's income on exported goods. The major part of fishing operations takes place on the continental shelf.

The most densely populated area in Iceland is the south-west corner, with around 70% of Iceland's inhabitants living in the Faxaflói bay area. A large part of Iceland's industry is also located in this area.

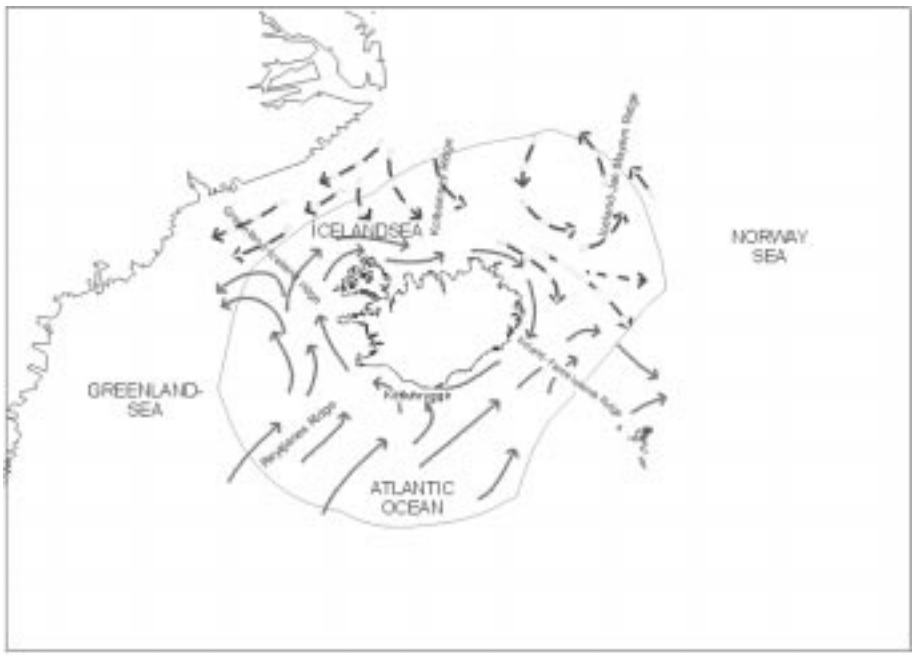

Figure 2. Currents around Iceland. Unbroken lines denote warm currents, broken lines denote cold currents [2].

2.1.2 Pollution in the sea around Iceland

Land-based sources of pollution in the marine environment around Iceland derive partly from sources in Iceland and partly from activities in other countries, near and far. Iceland is an island and relatively distant from other countries (figure 3). The marine area around Iceland is among the cleanest known (see further in Section 2), primarily as a result of the location of the island. Even so, it is vital to maintain accurate monitoring and surveillance of the state of the sea and the sources of marine pollution.

In general, it may be said that anthropogenic nutrients and oils found in the sea around Iceland are almost exclusively derived from domestic sources. Heavy metals and persistent organic pollutants, on the other hand, are derived from both local and overseas land-based sources. Very nearly all concentrations of radioactive substances measurable in the sea around Iceland are derived from overseas sources.

2.1.3 Assets at stake

There are generous fishing grounds and important breeding grounds for numerous species in the sea around Iceland. A large number of marine mammals (seals and whales) can be found around the coast, and Iceland is also one of the most important breeding grounds for many species of Arctic seabirds. Iceland's coast-line is important to the inhabitability of Iceland, as well as for various species of fauna, e.g. eider ducks [3]. The recreational value of the coastline is also substantial.

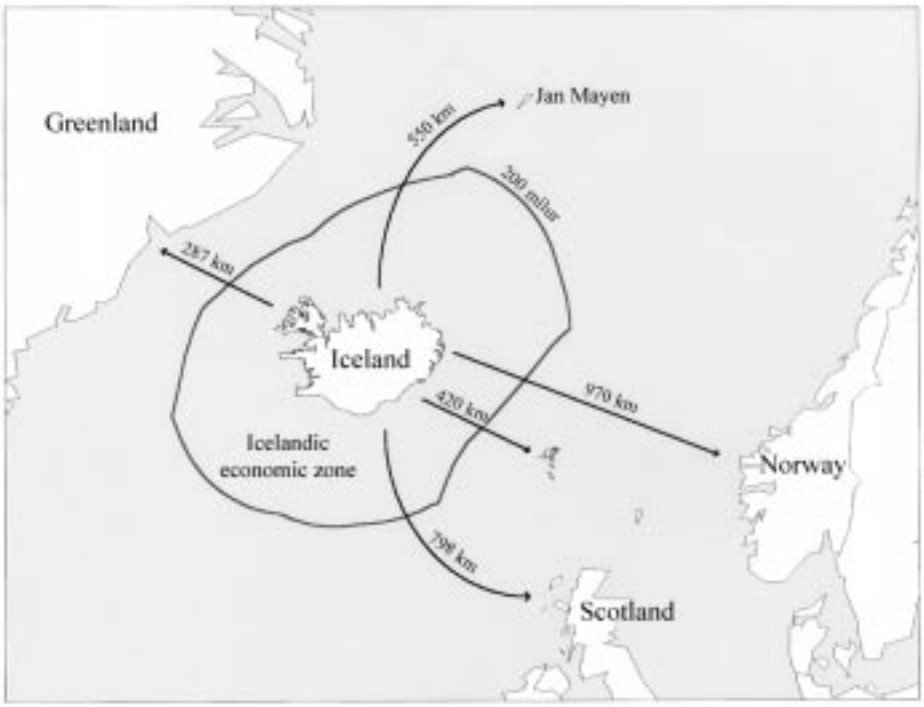

Figure 3. Distances between Iceland and other countries

2.1.4 Measurements

A number of analyses have been collected on the concentration of pollutants in the sea around Iceland during the past decade. The initiation of systematic pollution measurements from the sea around Iceland can be traced to the appointment of a steering committee on pollution measurement (SUMMIS) in 1989. A large sampling and analysis project was initiated, which was concluded with the publication of a report [4]. In 1994, the Minister for the Environment

appointed the AMSUM group to take over the tasks of the previous SUMMIS. The role of the team is also to manage the implementation of AMAP (Arctic Monitoring and Assessment Programme) in Iceland.

Systematic measurements of marine pollution around Iceland have been carried out since 1989 by the SUMMIS team and, later, by the AMSUM team [4,5]. Samples have been taken annually since then. The primary emphasis has been on persistent organic pollutants, heavy metals and radioactive substances. Measurements by the AMSUM team have been expanded since 1995 so that, in addition to the sea, the atmosphere and rivers are now monitored.

Through the work of AMSUM, in co-operation with numerous organisations, an integrated database on pollution in and around Iceland has been created. A large number of organisations and entities have also studied more narrowly defined fields and collected specialised data, although not all such data have been made accessible.

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2.2 SEWAGE

2.2.1 General Introduction

Sewage can be roughly divided into two categories, depending on source. On the one hand, there is sewage from residential areas and, on the other hand, industrial discharges. Sewage from residential areas has a similar composition, irrespective of where in Iceland it comes from, while industrial sewage differs in content depending on the kind of industry it derives from. Sewage from heavy industries and leacheate [JS2]from landfills also fall into this category.

Sewage contains various pollutants and chemical compounds. Organic material, nutrients and bacteria are the principal materials originating in residential areas. Various other substances can also be found in industrial discharges such as substances of fossil fuel origin, heavy metals and persistent organic pollutants [1]. These substances will be discussed separately in subsequent chapters, as will nutrients. Industrial sewage from heavy industry may be expected to contain higher than normal concentrations of heavy metals.

The polluting effects of sewage depend to a large extent on the capability of the receiving environment to dilute or eliminate the pollution released into it. According to Regulation No. 798/1999, on Drainage Systems and Sewage, all sewage-receiving environments must be classified and the methods of treating sewage must be based on this classification.

2.2.2 Conditions around Iceland

The largest sources of sewage in Iceland are residential areas, fish processing, livestock slaughtering and industries such as dairies, aquaculture, textile industries, tanning plants and laundries, in addition to heavy industry. Leachate from rubbish dumps may be included here, although the scope and nature of such pollution is unknown.

Sewage pollution is mainly limited to coastal areas around drainage pipes from urban areas. No doubt there is some transient and/or localised pollution due to industrial sewage, e.g. in case of accidents. In Iceland, industrial sewage and sewage from residential areas are often transported through the same drains into the sea.

Figure 4 shows an evaluation of the discharge of organic sewage based on population density and food production in each district. The figure shows clearly that the discharge of organic substances is not in direct proportion to population density, as the highest value is on the east coast. The main reason for this is the extensive fish processing in the area. Livestock slaughterhouses also increase the discharge of organic material with sewage.

2.2.3 Administrative Actions

The legal framework of monitoring and control currently in effect as regards sewage and drainage systems consists in Act No. 7/1998 on Public Health and Pollution Control together with Regulations No. 786/1999[PH3] on Pollution Control and No. 798/1999 on Sewage Systems and Sewage. These contain various rules on the treatment of sewage in Iceland, including rules to the effect that appropriate treatment of sewage from all urban areas shall be implemented before year-end 2005.

Act No. 53/1995, on Financial Support to Municipalities for Sewage Control, provides for the allocation of grants to municipalities engaging in developments with regard to their drainage systems within the aforementioned time-frame. Agenda 21 also establishes objectives regarding the treatment of waste water [2].

Overall management of the issue is in the hands of the Environmental and Food Agency. Local health committees issue operating licences for the majority of enterprises and drainage systems in urban areas, while the Environmental and Food Agency is responsible for operating licences

for heavy industry and the treatment of waste. Operating licences include requirements for pollution control.

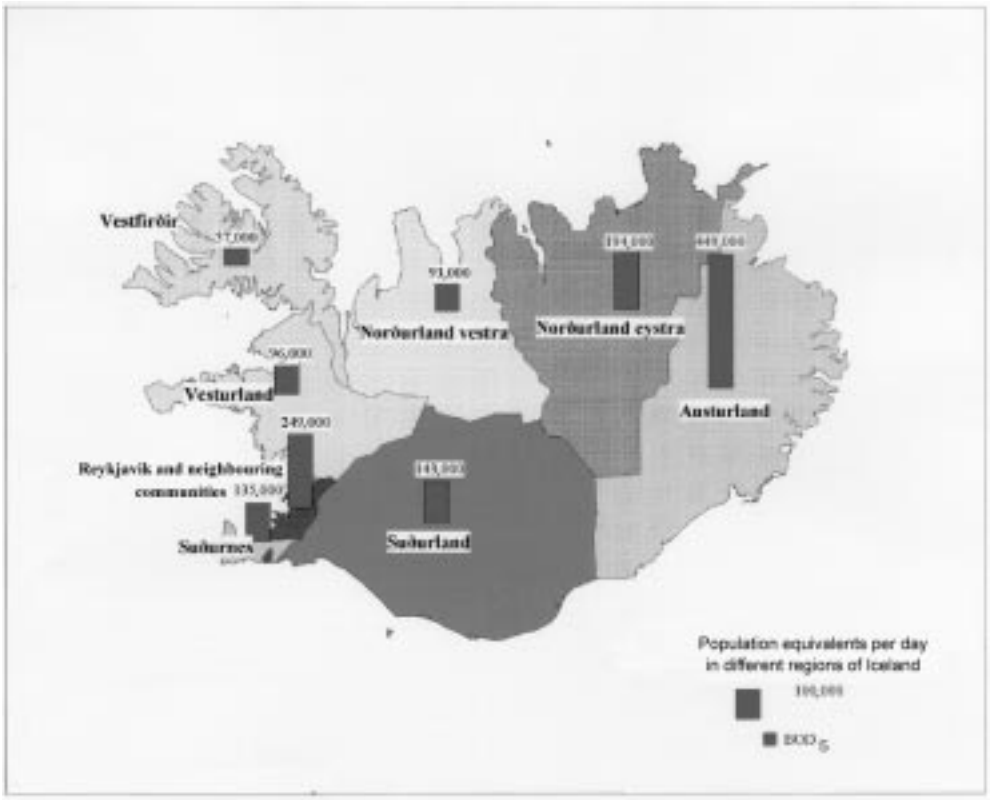

Figure 4. Discharge of organic materials in sewage in relation to population density and food production. Based on unpublished data from the Environmental and Food Agency.

2.2.4 Situation and Actions

Measurements made in the Reykjavík drainage system show that pollution in sewage is similar to that of neighbouring countries (table 1). Although the pollution cannot be regarded as extensive, the concentration of compounds is higher than background values for unpolluted water [3,4].

A draft monitoring plan which includes surveillance of discharges from treatment stations and monitoring of recipients has been issued by the Environmental and Food Agency. The plan has been implemented in the West Fjords and in North-western Iceland [5].

Most municipalities in Iceland have begun to turn their attention to implementation actions for sewage treatment. A few places have concluded their classification of receiving environments and the design of treatment stations is well under way or completed. Even so, the sewage treatment station at Ánanaust in Reykjavík is so far the only station for which an operating licence has been issued. Emphasis needs to be placed on speeding up implementation actions in drainage systems and water polluting industries.

Table 1. Concentration of heavy metals in effluent sewage [JS4]to treatment plants in a few cities in Scandinavia [4].

Substance	VEAS Oslo 1990	Vik, Helsinki 1987	Tammelund Helsinki 1987	Henriksdal Stockholm 1989	Ålborg Denmark 1991	Reykjavik, 1991
Lead	11.3	56	4.8	10-40	9-44	10-33
Cadmium	0.7	0.79	0.32	0.45-0.8	ND-0.7	0.7-3.5
Copper	80.0	69.5	30.7	41-200	50-80	9-27
Mercury	1.0	-	-	0.2-0.65	ND	0.3
Zinc	122	309.1	102.6	64-190	240-420	20-130

NOTES Concentration analysed in effluent sewage to treatment plants in mg/l.
ND=Not Detected
- = Not measured

2.2.5 Evaluation

Iceland is a sparsely populated country and the sea around it is, in general, a good receiving environment, i.e. it is quite capable of handling the dilution or elimination of the pollution released into it. It should, therefore, be a simple matter to keep sewage-derived pollution to a minimum in Iceland. However, the current status of drainage systems is that the majority of sewage enters the sea untreated. With the developments proposed in legislation, which in some places has already begun, the situation is expected to improve in the near future.

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2.3 PERSISTENT ORGANIC POLLUTANTS

2.3.1 General Introduction

Persistent organic pollutants (POPs) degrade slowly in the environment. The compounds bioaccumulate owing to their high liposolubility and low excretion, and their concentration is in many cases multiplied the higher the organisms are in the food chain. Many of these compounds are also toxic.

POPs are for the most part present in the environment as a result of human activities. The main sources are various kinds of industries, agriculture and waste incineration. Plastics, solvents, secondary substances resulting from the treatment of water with chlorine and paper bleaching, and pesticides are examples of these types of compounds. Natural processes, such as grass fires and forest fires, are also sources of these compounds as, in a minor way, the functions of plants on land and algae in the sea.

POPs reach the sea by air, rivers and through drainage systems. There are many indications that air currents are the primary transport media for many of these compounds, as they are found in significant concentrations far from known sources. Volatile POPs can be found in equal or higher concentrations in the polar regions as in the vicinity of their places of use. Research also indicates that they can accumulate in cold areas close to the polar regions [1,2,3].

POPs can affect the health of humans and other living organisms, especially in the upper reaches of the food-chain. Many of these compounds have been shown to have extremely harmful effects on humans and other living organisms. They can cause changes to the reproductive organs of living organisms and effects can also appear in generations following the one which came into contact with the compound. Some of them are carcinogenic and some of the most toxic compounds known are chlorocarbon compounds [4].

Many compounds in this class were formerly used because of their high chemical stability, but this stability is precisely the reason for their persistence.

POPs are variable in structure. They are basically divided into two main groups. The former group includes organohalogens, organic compounds contain halogens, especially chloride. PCB, dioxin, and furan, along with HCH compounds and various types of insecticides and herbicides such as DDT, may be mentioned as examples of chlorocarbons. The other group consists of petroleum-derived compounds (PAHs, Polycyclic Aromatic Hydrocarbons) formed by the incomplete burning of fossil fuels [5] and is also found in fossil fuels.

Polychlorinated biphenyls (PCBs) is a collective name for over 209 closely related compounds containing variable numbers of chloride atoms and whose position in the molecule is also variable. The manufacture of PCB compounds began around 1930 and increased steadily until the beginning of the 70's. When their harmful nature was discovered their manufacture decreased rapidly and had for the most part ceased by 1980. The compounds were used, among other things, in condensers, transformers, hydraulic lubricants, insulating liquids, heat exchangers, paint, glue, plastics etc. The total manufacture of PCBs was between 1.2-1.5 million tons. Approximately 30% of this amount has been released into the environment and of that amount approximately 97% is in the sea or in marine sediment [6].

HCHs differ from other chlorocarbons in that their solubility in water is higher than that of other persistent pollutants, as is their vapour pressure. This leads to that HCHs are dispersed very rapidly around the globe with air currents. The result is that great quantities of these compounds have accumulated in the arctic regions and are now beginning to be transported by ocean currents back to more southern latitudes [4]. The best known HCH that has been used in Iceland is lindane. Lindane was formerly used extensively in dips to control parasites on domestic animals, especially sheep, as well as in gardening. The compound was used in Iceland during the period between 1950 and 1986 and it is estimated that approximately 16 tons of pure lindane were used in dips for domestic animals. Owing to their high water solubility, HCHs do not accumulate to any extent in the fatty tissue of animals, so that despite the toxicity of the compounds they are generally a small percentage of the organochlorides in living organisms.

Tributyltin (TBT), an organic compound containing tin, is yet another of these compounds. It has primarily been used in the antifouling paint of ships to prevent the growth of plants and animals on the hulls. The compound has been shown to cause deformity in dogwhelks. The use of TBT has been very limited since 1990, and after 2003 all antifouling with TBT hull paint will be banned globally.

For further discussion on the formation, structure, nature and effects of persistent organic pollutants, as well as their dispersion around the globe, reference is made to the AMSUM report [4], which also contains discussion and explanations of persistence and associated terms.

2.3.2 Conditions around Iceland

Measurements on the concentration of POPs in living organisms and in sediment around the Icelandic coast have been carried out by the AMSUM group. Only a few of the large number of existing compounds were measured, i.e. HCH, PCB, hexachlorobenzene (HCB) and DDT [2,4]. According to these measurements, the concentration of POPs in marine sediment around Iceland is, in general, comparable to or less than in the North Sea, in the Kattegat and on the Atlantic coasts of France and Spain.

A similar comparison with neighbouring marine regions shows that the concentration of POPs in the marine biota around Iceland is, in general, among the lowest measured. It has furthermore been demonstrated that concentrations of PCBs and DDT in cod have decreased significantly between years while concentrations of HCBs are stable [4].

Pollution from POPs around Iceland can largely be attributed to overseas sources. However, a certain percentage of the compounds derive from Icelandic land-based activities, especially drainage systems. Figure 5 shows the concentration of PCBs in marine sediments in a few localities around Iceland and the clearly increased concentrations in the vicinity of Reykjavík and the outer part of Eyjafjörður. Measurements have shown that an appreciable amount of PCBs is released into the sea through the drainage system in Reykjavik [7] and PCB pollution has been found in other marine areas around Iceland [4,8].

Research on dogwhelks has shown that the effects of TBT pollution are felt in many marine areas around Iceland [9]. This has been particularly apparent in the Faxafloi bay, but also in and around other harbours from the south-west coast to the west fjords [4].

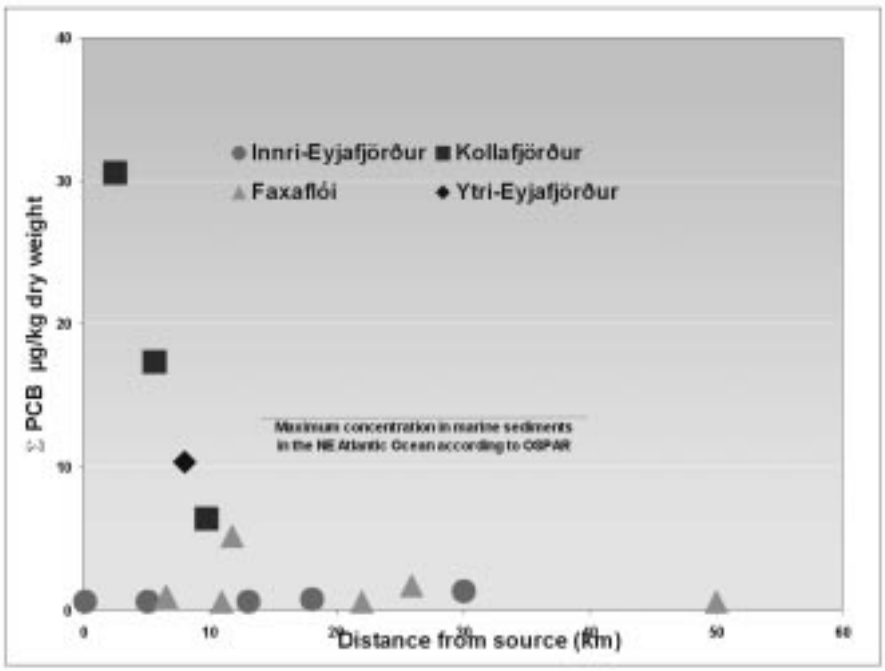

Figure 5. PCB concentrations in marine sediments around Iceland shown as a function of distance[PH5] from probable source [4].

2.3.3 Administrative Actions

The legal grounds for action are principally specific acts and regulations on the manufacture, sale, use and disposal of individual compounds or compound categories (see table 2). Icelandic authorities take an active part in international co-operation on a global ban on the manufacture and use of POPs.

Responsibility for the issue is divided among several agencies, which diffuses management and control of the issue and makes it difficult to obtain an overall picture. It may also be possible that legislation and measures overlap.

2.3.4 Situation and Actions

Systematic pollution measurements carried out by the AMSUM group on the concentration of POPs in marine biota extend back to the year 1989 [2,4]. Studies of lesser scope have also been carried out for individual compounds in limited areas. The impact of TBT pollution has been explored in various parts around Iceland [9] and concentrations of PCBs have been measured in shellfish in the eastern fjords [8,9]. Research has shown TBT pollution in the southern part of Faxafloi bay. This is apparent, e.g., from the malformation of dogwhelks in the area from Álftanes to Hofsvík on Kjalarnes [4].

Iceland is a party to international conventions dealing to some extent with POPs. According to UNEP resolution 18/32 [10] there are 12 compounds which are to be targeted internationally. Table 2 lists these compounds and describes the actions initiated in Iceland. It must be borne in mind that some of these compounds have not been used in Iceland for many years or, in some cases, have never been used at all.

In order to combat TBT pollution a ban is in place, pursuant to Regulation No. 619/2000, on the use of antifouling containing TBTs on ships under 25 m and on equipment connected with fisheries or intended for use under water. All antifouling manufactured in Iceland is TBT-free.

In the year 2001, two international agreements have been completed with the intenion of retarding the distribution of POPs. Firstly, the Stockholm Convention on Persistant Organic Pollutants where the aim is to reduce the production and distribution of the aforementioned 12 POP compounds (table 2). Secondly, the International Convention on the Control of Harmful Anti-fouling Systems on Ships, where applicaction and reapplication of organotin compounds is forbidden after 1 January 2003.

Foreign studies have shown that waste incinerators are the primary sources of dioxins and furans. Few measurements of these compounds have been conducted in Iceland and there is, therefore, little to be said about them. Reference is made to the website of the Environmental and Food Agency (www.hollver.is/english) for the latest information. Open burning of waste has been banned and other methods of disposal are being sought for waste which is currently disposed of with low-temperature incineration. This action promotes reduction of dioxin releases into the atmosphere in Iceland.

The probable areas of POPs distribution may be estimated using the above criteria. Drainage systems from larger municipalities are likely sources of PCBs in this respect. Dioxins and furans are probably released into the atmosphere in places that still operate waste incinerators. Figure 6 shows the probable sources of POPs in Iceland. However, it must be noted that there are no concrete measurements supporting this illustration, which is primarily based on the nature of the enterprises and the population density in each place.

Table 2. Icelandic actions to combat a number of targeted POPs [10].

Icelandic Legislation	Chemical Name	Actions
Regulation No. 323/1998 on the Importation, Utilisation and Disposal of PCB, PCT and Environmentally Hazardous Substitute Chemicals.	PCB	Import and use prohibited. Rules on disposal
Regulation No. 177/1998 Prohibiting the Use of Certain Toxic Chemicals and Hazardous Substances, as amended by Regulation No. 466/1998.	aldrin, DDT, dieldrine, endrine, heptachloride, hexachlorobenzene, chlordan, mirex, toxafen.	Import sale and use as a pesticide in agriculture and horticulture or for the extermination of pests prohibited.
Regulation No. 807/1999 on the Incineration of Hazardous Wastes	dioxin, furan	Restrictions on release into the environment.

2.3.5 Evaluation

It is a stated opinion of the Icelandic Authorities that pollution caused by POPs is the most serious threat to the sea [10]. This is a difficult problem to tackle, especially as a major part of this pollution derives from sources outside Iceland and may even be from very distant areas.

If pollution caused by POPs increases around Iceland, there is a risk that Icelandic seafood will lose its image as clean and unpolluted food. Taking into account the importance of fisheries in the national production this could pull the rug out from under the Icelandic economy.

Knowledge of the distribution of POP-derived pollution around Iceland is limited. Domestic sources have not been mapped nor the volume issuing from them. Concentrations and sources of certain compounds, such as dioxin and furan, are also unknown.

Even though knowledge of the effects and distribution of POPs is in some ways limited, various measures have been implemented in Iceland to limit their distribution. These include actions concerning drainage systems and waste disposal, limitations on imports and general pollution control. Iceland's participation in international co-operation on POPs is also extensive, and Icelandic authorities have shown initiative in the effort to impose global restrictions and bans on the use of these substances.

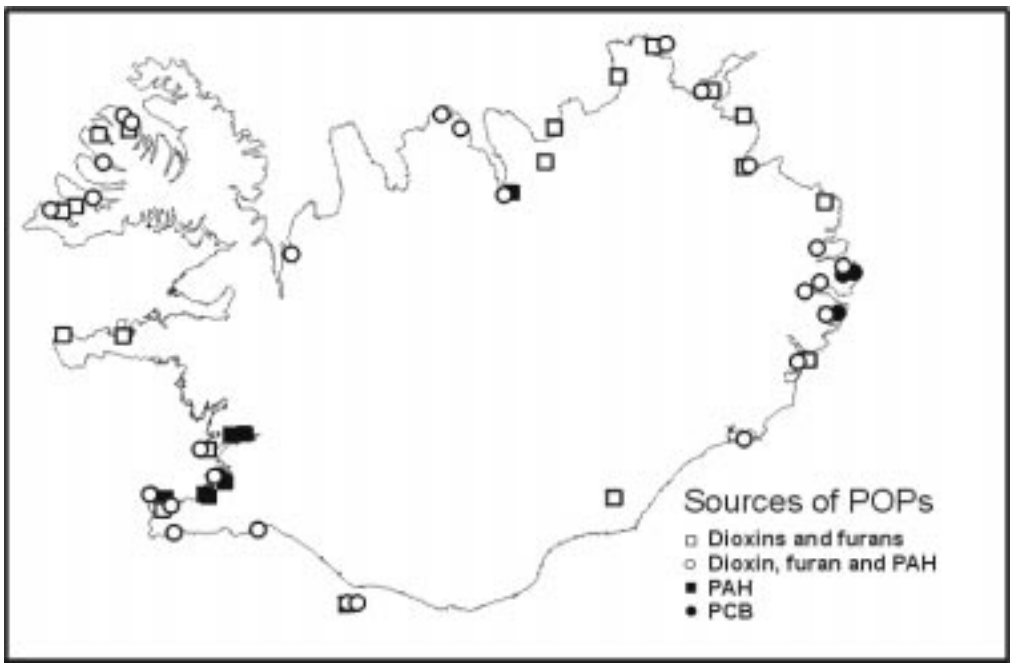

Figure 6. Probable POP sources. Based on unpublished data collected by the Environmental and Food Agency.

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2.4 RADIOACTIVE SUBSTANCES

2.4.1 General Introduction

Radioactive substances are present in the environment both as a result of human activities and as a part of nature. Natural radioactive substances are found in rocks and soil and ionising radiation is also transported from space [1].

The substances most commonly used to measure radiation pollution are strontium (Sr-90) and cesium (Cs-137) isotopes. Cesium's chemical properties are similar to those of potassium (K) and it therefore easily penetrates the body's soft tissue, while strontium is similar to calcium (Ca) and accumulates in bones.

These isotopes have a relatively long life as the half-life of Sr-90 is 29 years while that of Cs-137 is 30 years. This long half-life is the reason that the above isotopes are measured, together with their easy accumulation in organisms, which makes them potentially hazardous to the biota.

A common reference value for radiation in food (international trade) is 1000 Bq/kg for Cs-137.

2.4.2 Conditions around Iceland

The source of anthropogenic radiation in the environment is to a large extent due to the use of some type of nuclear power. The primary sources are nuclear testing in the atmosphere, nuclear power industries (especially from reprocessing plants) and nuclear accidents.

The division of radioactivity in the East Greenland Current according to source has been estimated to be as follows [2].

1. Testing of nuclear weapons in the atmosphere, may also include, in small part, other sources (so-called “pre-1970 values”, approximately 45-50%).
2. Reprocessing plants (Sellafield, approximately 30-40%).
3. The Chernobyl accident (approximately 15%).
4. Other sources.

The major pollutant in Iceland is probably radioactive iodine, which is used medically, mainly against thyroid cancer. Radioactive iodine is short-lived (half-life of 8 days). It is released from the patient into sewage and then pumped away from land. The resulting impact, however, has not been measured in the marine environment around Iceland.

2.4.3 Administrative Actions

Overall responsibility for issues concerning radioactivity around Iceland is in the hands of the Radiation Protection Institute. The institution handles statutory controls and research into radioactivity in the environment. The Institution co-operates with the Coast Guard, the Meteorological Office, the Environmental and Food Agency, the National Civil Defence and other parties with regard to reactions in the event of a nuclear disaster, and participates in Nordic training programmes on reactions to such disasters.

The legal framework comprises the Radiation Protection Act No. 117/1985, together with Regulations No. 356/1986, No. 516/1993 and No. 517/1993. Since monitoring and surveillance are in the hands of a single institution, information and overall view are, on the whole, quite comprehensive.

2.4.4 Situation and Actions

Measurements in the sea around Iceland show that concentrations of radioactive substances (Cs-137) vary in marine areas around Iceland (figure 7). The highest concentrations are off the north-west coast in the East Greenland Current. The sea in that area originates partly in the North Sea and contains radioactive substances from the Sellafield reprocessing plant in England. Concentrations in other areas around Iceland are a great deal lower and are lowest off the south coast, where warm Atlantic Ocean waters are predominant [3].

Measurements of radioactive cesium (Cs-137) in the sea and in marine organisms have been carried out in Iceland since 1989 [3,4,5]. The concentrations measured have been well within reference limits and substantially less than in many other areas [6]. It is important to note that it takes radioactive substances 7-10 years to be transported from Sellafield in England into the East Greenland Current to the north of Iceland, and dilution on the way is approximately 1000-fold.

The reprocessing plant in Sellafield has, in recent years, reduced its releases of cesium (Cs-137), while instead the discharge of technetium (Tc-99) has increased approximately 50-fold since 1994 [4]. This increase in the release of technetium is a matter of concern for Icelanders. It is estimated that technetium will be measurable in the sea around Iceland within a few years. The half-life of Tc-99 is 213,000 years, which is many times greater than the half-life of Cs-137 and Sr-90. The long-term effects of the substance are not known for certain, but it does not bind to the body in the same way as Cs-137 and Sr-90 and its accumulation in the body is therefore slight. The Radiation Protection Institute has already begun preparations for the measurement of technetium. An OSPAR ministerial meeting decided in July 1998 that the release of radioactive substances within the convention area in excess of background values should be ceased before the year 2020 [7]. This decision will oblige the U.K. to reduce and virtually cease the release of Tc before that time.

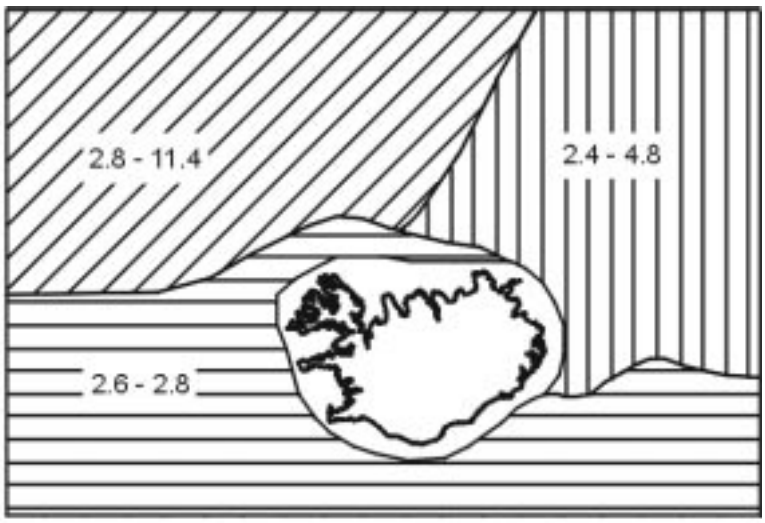

Figure 7. Radioactivity in the sea around Iceland in Bq/m^3. A distinction is made between warm Atlantic Ocean sea (horizontal lines), cold polar sea (diagonals) and temperate arctic sea (vertical lines). Types of sea simplified from [8], measuring values based on data from [6].

2.4.5 Evaluation

Generally speaking, almost all radioactivity measured around Iceland which is not derived from natural sources can be traced to sources outside Iceland. There are no anthropogenic sources of radioactive substances in Iceland. The current situation does not indicate the presence of dangerous concentrations, but the image of Iceland as a country that produces wholesome food could very easily be disrupted by slight changes, even if radioactive substances did not reach hazard levels.

There is always the threat that radioactive substances may be released into the environment and transported to Iceland. It is difficult for Icelanders to prevent such pollution except as participants in international co-operation, as the sources of radioactive substances are largely outside Iceland. Technetium releases from Sellafield in particular must receive special attention in coming years. It must be ensured that the decision of the OSPAR ministerial meeting [7], on the reduction of releases of radioactive substances to near zero by the year 2020[PH7], is implemented.

An increase in concentrations of radioactive substances around Iceland could, therefore, have a substantial economic impact even if the pollution is still far below hazard levels and even the mere suspicion of radioactive pollution could cause a market collapse [9].

Compared with other aspects of this action plan, knowledge of the status of radioactive substances in the sea around Iceland is fairly extensive, as are the means to obtain any missing information needed. An obvious advantage is that only one institution is responsible for this matter, which simplifies the flow of information and all decision making.

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2.5 HEAVY METALS

2.5.1 General Introduction

Heavy metals are chemical elements that are all found, in some quantity, in natural concentrations in the sea, usually very low concentrations. Their natural concentration varies regionally and depends on the geology and biota of the area in question. The principal heavy metals are cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb) and zinc (Zn). Arsenic (As) is usually included in discussions of heavy metals [1].

Some heavy metals are necessary to living organisms but can be toxic if their concentrations are too high, e.g. copper and zinc. Other metals, such as lead, cadmium and mercury have no known role in the bioat and are toxic even at low concentrations.

Metals do not degrade in the environment; instead, they accumulate in soils and sediments. Clean-up is very difficult. Some heavy metals have a tendency to accumulate in living organisms. This accumulation can be dangerous to the marine biota and to consumers of seafood.

The primary sources of heavy metals are industry and traffic. Heavy metals can also be released into the sea with sewage and leachate from landfills in addition to the substantial quantity that is released into the sea by natural methods. Heavy metals released into the sea by sewage systems or as any other kind of run-off from land, usually accumulate in sediments rather close to the shore and are not transported long distances. Overseas studies indicate that a high percentage of heavy metals is transported into the sea by air and that heavy metals can be transported for long distances in such a manner.

One of the clearest examples of the harmfulness of heavy metals is the Minimata disease which appeared in the Minimata bay in Japan in the fifties, where the consumption of seafood contaminated with mercury-rich industrial waste led to the death and loss of health of people living by the bay.

2.5.2 Conditions around Iceland

Although heavy metals are natural in the environment, their concentrations in the sea around Iceland are usually low. Even so, studies indicate that the background values of some heavy metals, primarily cadmium and chromium, are higher here than in many other areas [1,2]. Volcanic activity is regarded as the probable reason that the background values of some heavy metals are high in the Icelandic environment. The concentration of many metals in Icelandic rivers increases substantially in connection with eruptions [1].

Concentrations of some heavy metals found in the environment in Iceland can be traced almost exclusively to natural processes, while the accumulation of others are mainly traced to human activities. Sources of manganese, for instance, are almost solely natural while lead in the environment exists mainly as a result of human activities. The largest source of lead in Iceland used to be petrol combustion, but this has been decreasing rapidly. The permitted concentration of lead in petrol is now less than 10% of the concentrations in petrol in the mid-eighties. In western Europe this proportion was decreased further, to 3%, on 1 January 2000. Sale of leaded petrol ceased in Iceland in 1996. Lead may be found in various products that are still imported, e.g. in shots, car batteries and various types of equipment for the fisheries industry.

The primary industrial sources of heavy metals in Iceland are shipyards, tanning factories and electrolytic plants (zinc and chrome). Figure 8 shows the location and type of heavy-metal releasing industry in Iceland.

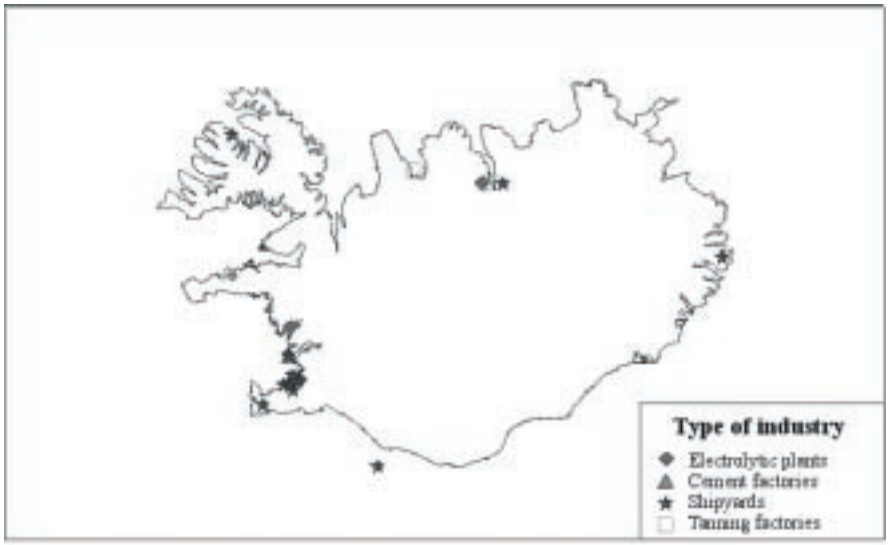

Figure 8. Primary heavy-metal releasing industry in Iceland. Based on unpublished data collected by the Environmental and Food Agency.

2.5.3 Administrative Actions

The principal legal basis involved in the release of heavy metals in Iceland are Act No. 7/1998 on Public Health and Pollution Control, Act No. 32/1986 on the Prevention of Marine Pollution and Act No. 52/1988 on Toxic Substances and Hazardous Substances, including subsequent amendments and regulations established on the basis of these acts. The Environmental and Food Agency is responsible for most of the legislation and regulations concerning heavy metals.

2.5.4 Situation and Actions

Measurements conducted on waste water from Reykjavík have shown that heavy metal contamination exists in the sewage system but not in large quantities. The concentrations of heavy metals in Reykjavík's sewage system are usually below the allowable maximum concentrations in drinking water, although this is not invariably the case [3]. A comparison of the studies conducted on waste water in Stockholm shows that concentrations in Icelandic waste water are similar or lower than those in Sweden [3,4].

Heavy metals are transported to the sea, both with water and as airborne pollution. Table 3 shows the estimated release of heavy metals of anthropogenic origin into the atmosphere in Iceland in 1990. This estimate is not based on measurements but rather calculated from population density and the activities conducted. There is reason to believe that releases have decreased substantially since that time, especially releases of lead.

Heavy metals have been measured in sediments and living marine organisms since 1989 [5,6]. Measurements of heavy metals in living organisms do not indicate that their contamination is a serious problem in the marine environment around Iceland. Most heavy metals are found in small quantities in Icelandic fishing grounds. Even so, the concentration of heavy metals in fish from Icelandic fishing grounds is greater than in other fishing grounds in the North Atlantic. This difference can probably be traced to different background concentrations [5,6]. Mussels in the marine environment around Iceland, however, seem to be an exception. Concentrations of copper, zinc and cadmium in mussels have been found to be greater than reference values in other countries[6]. Concentrations of cadmium in cod liver have also been found to be in excess of reference values. It is believed that there are biological explanations for these two anomalies [5].

Measurements of heavy metals in sediments around Iceland show that some heavy metals are found in relatively high concentrations in sediments around Iceland e.g. when compared to Norway, the Netherlands and the U.K., while concentrations of other heavy metals in Icelandic marine sediments are low in comparison with the above marine areas. The reasons for this can probably be traced to natural processes rather than pollution [5,6].

Table 3. Estimated releases of heavy metals into the atmosphere from human activities in Iceland in 1990 [7].

Type of heavy metal	Ton/year
Arsenic	0.134
Lead	6.38
Copper	2.14
Cadmium	0.166
Chromium	0.353
Mercury	0.048
Nickel	4.73
Zinc	4.12

2.5.5 Evaluation

The majority of heavy metals in the sea are from natural sources and the background values of some heavy metals are higher in the Icelandic marine environment than in many other areas. The reasons can probably be traced mainly to volcanic activity and soil erosion. Concentrations of some heavy metals have been measured in excess of reference limits in the marine environment around Iceland. This is particularly true of cadmium, copper and zinc in mussels and also of cadmium in cod liver [5,6]. Most indications point to this being a result of natural processes not connected with human activities.

It is important to remain alert with regard to heavy metal pollution. Some of these metals are toxic in small concentrations and, unlike many other substances, they are non-degradable. Their effects can, therefore, be long-term after they have been released into the environment. There is a need to collect information on the importation and cycle of heavy metals in Iceland and little is still known about anthropogenic releases. Important progress, however, was made when the addition of lead to petrol was, to a large extent, terminated.

Heavy metal pollution in the marine environment around Iceland seems to be mainly tied to limited areas close to sources. It is important to address this pollution in operating licences for heavy metal polluting operations in order to limit the number of these point sources and reduce the volume of their releases.

2.5.6 References

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2.6 OILS

2.6.1 General Introduction

Oils is a collective name for various substances such as petroleum (crude oil), various organic solvents, petroleum derivatives, lubricants and various types of wax. Many chemicals in oils, especially aromatic polycyclic compounds, are carcinogenic and hazardous to life [1].

It is estimated that approximately 2.3 million tons of oil are released into the world's oceans each year. A part of this oil is of natural origin (approximately 11%) but most is due to human activities. It is estimated that approximately 60% of the total volume of oils released into the sea derive from land-based sources, or approximately 1.4 million tons annually in the entire world. Most of the oils released into the sea from land are refined fossil fuel products.

All oil dissolves to some extent in water but not equally well and therefore has differing effects on the biosphere (see figure 9). Light, liquid oils such as petrol and diesel, dissolve more easily in water than heavier oils (heavy fuel oil) and therefore have easier access into the biota. In this way they can have severe toxic effects. Heavier and more viscous oils, such as petroleum, mix much less easily with the water mass. They float on top of and in the upper layers of the sea and cause a great deal of surface pollution on coast-lines. The oil fouls birds, shellfish, littoral vegetation, seaweed and the biota in general. Oils, light as well as heavy, settle on sediment particles which are stirred up in the sea and are transported with them to the seabed. Oils can thus have toxic effects on the marine biota, contaminate habitats, taint seafood and substantially reduce the recreational value of coastal areas. The impact of oil pollution from land is localised for the heavier oils, but the impact of the most volatile oils extends further from the source. Figure 9 shows the principal results of marine oil pollution.

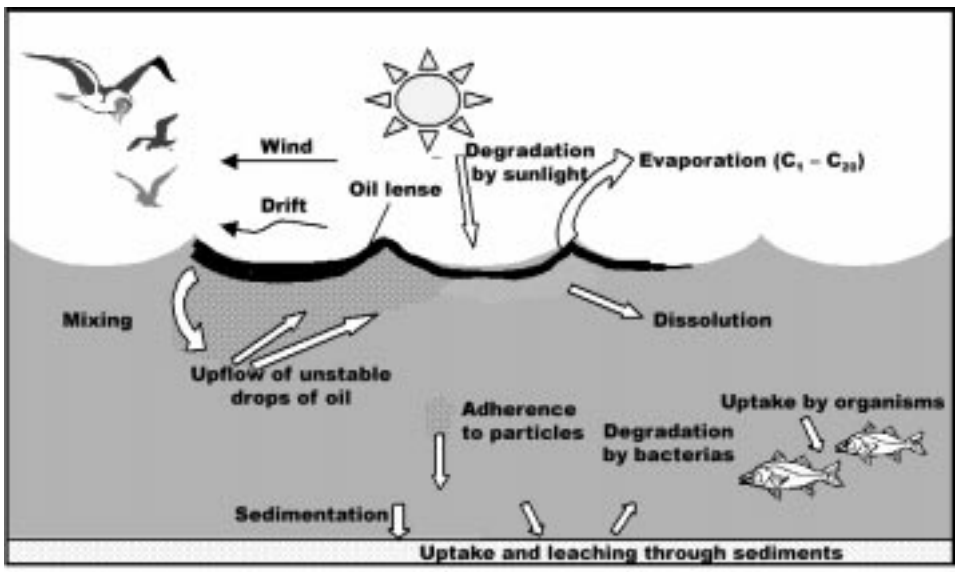

Figure 9. Simplified cycle of marine oil pollution [5]. See text for further discussion.

2.6.2 Conditions around Iceland

The main sources of oils from land are waste-water from urban areas and industries, evaporation as well as involuntary releases and accidents. Oil pollution is probably mainly due to minor accidents. These accidents are often not reported and it is difficult to prevent them completely. Although each incident does not change much, the cumulative impact is substantial.

Iceland imports approximately 600,000 tons of oil annually [6]. It is stored in supply depots in most of the harbours around Iceland. The biggest depots are in Keflavík, Hafnarfjörður, Reykjavík and Hvalfjörður. Other large depots are in Akureyri, Seyðisfjörður, Vestmannaeyjar and Akranes.

The oil supply depots are a large risk factor in oil pollution. The biggest risk of pollution accidents is during pumping operations at the depots. The biggest accidents that have taken place in Iceland have been as a result of avalanches falling onto supply depots [6].

Another dimension, largely unknown, involves the operation of other enterprises, e.g. service stations, fishmeal processing plants and various industrial companies where oils are stored and used, often in substantial quantities. Current operating licences normally contain requirements for oil pollution control, but there is still a long way to go before operating licences have been issued to all the companies that this applies to.

Figure 10 shows the size and placement of oil supply depots in Iceland. Supply depots in Suðurnes and Hvalfjörður belonging to the U.S. naval base are not included in the illustration. Figures 11 and 12 summarise reported accidents in Iceland to end-year 1998. The list of accidents occurring on land, however, is subject to the reservation that reporting minor accidents on land to the authorities is not mandatory.

Transportation of oil can be risky. It is estimated that approximately half of all the oil imported to Iceland is distributed by road vehicles [7].

There is no continuous oil monitoring in Iceland. Chemical measurements of oils were carried out in waste water in Reykjavík in 1991. Those measurements indicated that oil pollution in waste water in Iceland is comparable to the Nordic countries [1].

2.6.3 Administrative Actions

The legal framework comprises primarily Act No. 32/1986 on the Prevention of Marine Pollution, Act No. 7/1998 on Public Health and Pollution Control, Act No. 52/1988 on Toxic Substances and Hazardous Substances and Act No. 46/1980 on Resources, Health and Safety in the Work-Place. A number of regulations have been issued based on these acts, especially for prevention against pollution resulting from the importation, storage and transportation of oils.

Regulation No. 35/1994 on Protection Against Oil Pollution from Land-Based Activities, contains rules to be observed by oil supply depots, petrol stations and other entities that handle and store oils. Appropriate improvements in oil supply depots shall be completed before 2005 according to the regulation.

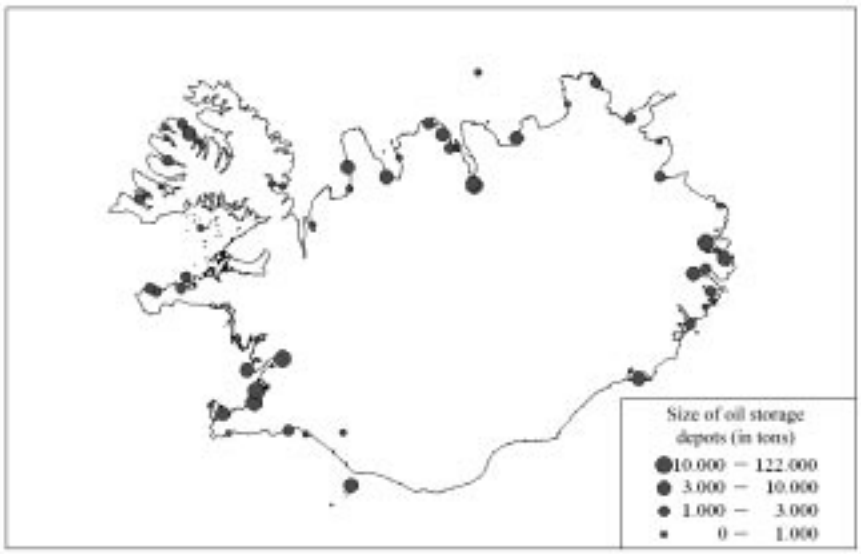

Figure 10. Size of oil supply depots in Iceland [8].

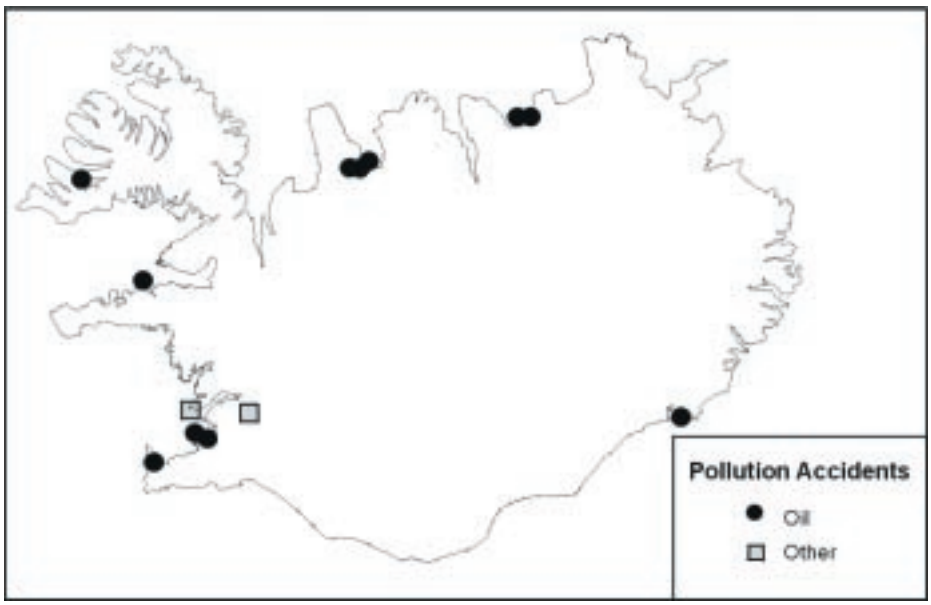

Figure 11. Oil accidents on land in the period between 1974 to 1995 that have been reported to the Environmental and Food Agency.

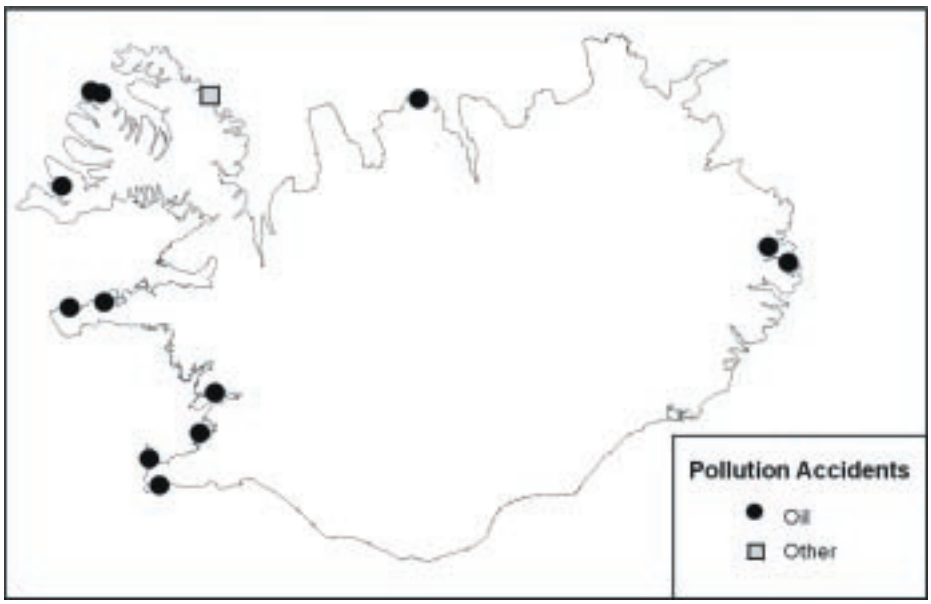

Figure 12. Oil accidents on land during 1996, 1997 and 1998 which have been reported to the Environmental and Food Agency.

Regulation No. 456/1998, on Responses to Acute Marine Pollution, provides for preventive measures, responses and methodology regarding acute pollution accidents. Reaction plans for each harbour must be formulated and harmonised in co-operation with the Environmental and Food Agency. The objective of the regulation is to harmonise the measures to be taken when the sea and coast are suddenly polluted by oil accidents or similar accidents.

In some harbour regulations, e.g. for the Ports of Reykjavík, Akureyri and Akranes, there are rules on oil pumping.

The transportation of oil on land is covered by Regulation No. 984/2000 on the Transportation of Hazardous Cargo. The regulation is based on the ADR rules on the transportation of hazardous cargo in force in the European Economic Area. The Regulation provides for the kind of equipment to be used in transportation and methods of transportation, as well as providing for the monitoring of transport vehicles in some cases.

The activities of petrol stations, lubrication stations and various kinds of service stations, where oils are end products or where there is a risk of oils being released into the environment, are subject to operating licences issued by local health committees.

Supervision of this issue is in the hands of the Maritime Administration, the Environmental and Food Agency, the Administration of Occupational Safety and Health and/or the relevant health authorities, depending on circumstances.

The action plan for sustainable development in the Icelandic community establishes aims regarding the procurement, distribution and use of fossil fuels and means of attaining these objectives [9].

2.6.4 Situation and Actions

A major milestone will be reached in 2005 when improvements on oil supply depots are scheduled for completion by law, as the objective of the improvements is better surveillance and pollution control. There are also provisions obliging oil companies to prepare operating manuals for all petrol stations. Work on such manuals has already begun.

The issue of operating licences for petrol stations, vehicle and machine service stations and similar industries is the responsibility of local health committees pursuant to Regulation No. 785/1999, on Operating Licences for Businesses that May Cause Pollution, but not all areas have made the same progress [10].

Preparations have been begun for a number of the actions and emergency plans provided for in Regulation No. 465/1998. Oil waste, collected in Iceland, is burned in the Cement Works plant in Akranes.

An information booklet on oil polluted soil and cleaning methods has recently been issued in co-operation with the oil companies and various government organisations [10].

2.6.5 Evaluation

Pollution from land due to oil around Iceland can probably be traced mainly to domestic sources, as oil pollution is for the most part localised. The biggest risk of damage is if a major accident occurs close to the coast. The risk of accidents is greatest in pumping operations in the depots.

There is some way to go before the pollution sources of oils in Iceland are fully known and comprehensive knowledge of the issue is available. According to a new Act No. 75/2000, on fire prevention, it is an obligation to report pollution accidents, and the response is assigned to the Fire brigades. When the oil companies have taken up a more comprehensive registration process a better overview of the issue can be obtained and thus a better definition of the problem.

It is urgent to complete, as soon as possible, the compilation of reaction plans concerning acute marine pollution, the setting up of pollution control equipment and the negotiation of an agreement on the involvement of institutions in acute accidents required by Regulation No. 465/1998 on Reactions to Acute Marine Pollution.

The actions that are presently in the pipelines, or have already begun, are expected to provide sufficient data to make it possible to draw up an overall picture of the problem. It will subsequently be possible to implement the necessary actions for the protection of the sea against pollution.

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2.7 NUTRIENTS

2.7.1 General Introduction

The nutrient salts phosphate and nitrate are necessary to marine algae which are the first link in the marine food-chain. Dissolved silica is in some cases regarded as a nutrient because it is necessary to silica algae and is often found in limiting quantities in the sea. During the summer months the algae utilises the nutrients in the uppermost layers of the sea, often almost exhausting them. In such conditions, algal growth decreases substantially or stops.

A large quantity of nutrients in the sea can result in a dangerous chain reaction. Then the nutrients cause an algal growth explosion which again leads to a situation where large portions of them are not utilised by animals as food with the result that they sink to the seabed and decompose. The decomposition can then lead to a shortage of oxygen if mixing is not sufficient, which in turn causes the death of sedentary species. The lack of oxygen can also lead to the deoxidation [JS8]of dissolved sulphate, which causes the formation of hydrogen sulphide which has a strong toxic effect on living organisms. Finally it should be mentioned that there are many examples of eutrophication leading to the explosive growth of toxic algae.

A large amount of nutrients is released into the sea in various parts of the world, especially in half-enclosed internal waters or other delimited marine areas. The primary anthropogenic sources of nutrients are sewage, waste water from the food industry, animal husbandry as well as the leaching of synthetic fertilisers from agricultural regions. Climate, precipitation and meltwater are instrumental in the transportation of nutrients to the sea. Waste water is one of the main sources of nutrients and their outflow is very closely connected to the outflow of sewage (figure 13).

It is estimated that the outflow of nutrients in streams/rivers in the world from anthropogenic sources is at least as great as the flow from natural sources, and probably rather more [1].

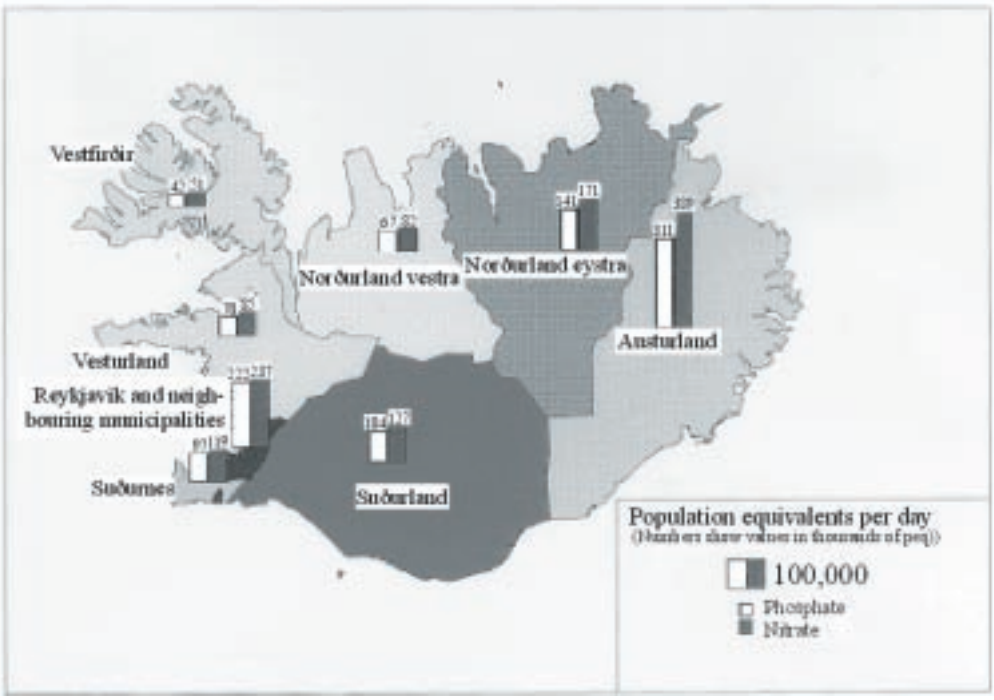

Figure 13. The release of nutrients with waste water in Iceland divided by area. Based on unpublished data collected by the Environmental and Food Agency.

2.7.2 Conditions around Iceland

In direct contradiction to the prevailing global opinion, nutrients have not been regarded as pollutants in Iceland. Water exchange in the shallow waters off the Icelandic coast is usually quick which leads to the assumption that the release of nutrients into the sea is not likely to cause eutrophication in the sea. Due to the rapid mixing of sea around Iceland, available nutrients are quickly released into the Icelandic marine area and form the basis of the primary production which is essential to the nation's fisheries.

The concentration of nutrients in Icelandic streams is considerably lower during summer than in winter, especially the concentration of nitrate. This is mainly due to photosynthesis but also in part to the melting of snow and glaciers. The annual mean concentrations of nitrate and phosphorus in Icelandic rivers is lower than the concentrations of these chemicals in the sea. Concentrations of nutrients in rivers during the summer are also lower than the mean concentrations in the sea at the same time [2]. This is why effluence from land does not have an impact on the concentration of the chemicals in the sea. According to available measurements, the differences in the concentrations of nutrients in rivers at the edge of the highland interior in the South Iceland and the lowlands appear to be negligible [3].

Despite the fact that pollution resulting from nutrients does not, in general, seem to be measurable, it is impossible to exclude localised effects which are due to eutrophication and environmental reasons. Furthermore, it is well known that large concentrations of nutrients are occasionally released quickly into the environment for short periods of time (e.g. slaughterhouses, industrial farms and the spread of fertilisers). This may well have an occasional impact, and there are some examples of algal blooms on the Icelandic coastline having pulled the rug out from under aquaculture operations.

2.7.3 Administrative Actions

Nutrient pollution around the Icelandic coast is, in general, not viewed as a problem with the exception of some limited areas and incidents. Regulations No. 785/1999 on Operating Licences for Businesses that may Cause Pollution, No. 796/1999 on Water Protection[PH9], No. 798/1999 on Sewage Systems and Sewage and No. 804/1999 on the Protection of Water from Pollution from Nitrogen Compounds from Agriculture and Other Businesses, contain various provisions regarding nutrients and protection against eutrophication.

2.7.4 Situation and Actions

Studies of the nutrients in the sea around Iceland began prior to 1960 and were first and foremost carried out to evaluate the fertility of Icelandic waters. A summary report on these studies was published in 1991 [2] which showed that there was no eutrophication due to nutrients in the coast around Iceland. Subsequent studies [3,4] confirm these results. However, localised pollution close to sewage outlets may be expected in some places.

A substantial amount of nutrients is released into the sea from the Reykjavík metropolitan area [3,5]. Strong currents in the Faxaflói bay quickly dilute the sewage to background concentrations, and due to the sparse population it is only a drop in the ocean compared to the amount of nutrients transported here by ocean currents. Measurements of nutrients in the sea around Iceland, especially around the Reykjavík area, do not show any indications of eutrophication [3,5].

Releases of nutrients are expected to decrease in the future, due, on the one hand, to municipal actions in sewage issues and the statutory treatment of sewage in the whole country (see Section 2.2), and, on the other hand, to requirements for improved utilisation of raw materials and increased utilisation of organic fertilisers.

2.7.5 Evaluation

The results of research show that nutrients are not, in general, a pollution problem on Iceland's coast-line. Our knowledge of the effluence pathways of nutrients to the sea is fairly good.

Conditions in the sea around Iceland with regard to nutrients will probably improve with effective action in the treatment of sewage if other conditions do not change. Conditions will of course be monitored and any increase in the amount of releases of these substances into the sea will be carefully considered, especially in densely populated areas and where water exchange is too slow to prevent localised increases in concentrations.

There is ample reason to monitor areas where there is a possibility of eutrophication and to look for indications of possible increases in nutrients. Any discovery of such result must result in appropriate reaction.

Phosphorus is a limiting resource in the world, and natural supplies, primarily found in phosphorous-rich rock, have been depleted rapidly [6]. Thus, it may be expected in the future that actions and criteria will not solely revolve around eutrophication but also sustainable development and the utilisation of waste as fertiliser.

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2.8 SEDIMENT MOBILISATION AND CONTAMINATION

2.8.1 General Introduction

Natural marine sediment is a mixture of many different components; rock granules, deposits, organic material etc. Marine sediment around Iceland has primarily been formed by stream sediment loads and by glacial erosion. This part of the sediment has a similar chemical composition as the bedrock and is usually fairly coarse (sand and even gravel). Clay minerals are the finest part of the sediment. They are carried to the sea by rivers in the form of suspended material. However, relatively small quantities of clay minerals are carried into the sea in Iceland and the sediment is first and foremost comprised of rock granules. A prominent part of the sediments close to the volcanic zones consists of volcanic materials carried to the sea either by the wind or with streams and rivers. Biologically formed material (especially organic materials and shells) is often a substantial part of the sediment. Its composition is often very different to that of the bedrock [1].

The effects of human installations on sediments in the sea are basically of two kinds. On one hand, there is the disruption of natural sediment mobilisation and on the other an increase in the concentration of pollutants in the sediment.

Natural sediment transport is important to coastal zones. Changes in this transport can disrupt the natural balance, regardless of whether the change consists in increased or decreased sediment transport. An excess of sediment can bury habitats on the seabed and increased quantities of suspended particles can decrease the amount of light carried down into the water. Too little sedimentation can also have negative effects on natural balances. Various elements can influence sediment transport. These include changes in land-use, dredging and construction of harbours, along with other major operations in coastal areas and the damming of rivers, to name a few.

Pollutants can be carried into the sediment through sewage systems, streams and rivers or directly from various kinds of operations in and close to harbours. Dredging operations can cause a risk of polluted sediments being transferred to unpolluted areas. Pollutants can also be released from the sediment due to such operations (e.g. the disturbance of the material during dredging). Pollutants in sediment are mainly heavy metals and persistent organic pollutants. They are usually more common in fine sediment because it is richer in organic carbons to which pollutants have a tendency to adhere [2]. Changes to the concentration of pollutants according to depth in sediment can indicate whether the level of pollution has changed over the course of time.

2.8.2 Conditions Around Iceland

Natural sediment transport in rivers is considerable. Icelandic rivers carry a sediment load of 50-100 million tons annually [3]. In comparison, it is estimated that during a glacial burst in the river Skeiðará in 1996, approximately 200 million tons of suspended sediments were carried to sea [1,3], which illustrates that the natural capability of sediment transportation can vary substantially.

Power development operations in the Thjórsá-Tungná area have reduced the sediment load of Thjórsá by 3 million tons to 1.7 million tons annually. The total amount of the suspended sediment load from the southern lowlands is currently 2-3 million tons, so the power development of streams in the Thjórsá area has clearly reduced the sediment load carried from there substantially [4].

A great deal of vegetation and soil erosion has occurred since the settlement of Iceland. Only 1% of Iceland is currently forested while it is estimated that this number was 25% when the settlers arrived. Organised land restoration operations began in Iceland in 1907, when a law was enacted on reforestation and defences against the wind erosion of topsoil. This is possibly the oldest law of its kind in the world [5]. The State Soil Reclamation Service (subsequently the State Land Reclamation Service) was also formed at that time. The situation has improved since, and although wind erosion still occurs it is less of a problem than in former times. The sediment carried to the sea by the wind is substantially less than that carried by rivers [6].

Approximately 100-500 thousand cubic meters of material has been annually dredged from the sea around Iceland during the last decade or so. Some of this material has been used in landfills and some has been dumped at sea [7]. The trend in the past few years has been that a larger and larger share of the dredging materials is used for landfill and less is dumped at sea.

Material is usually excavated from the sea to deepen harbours which are also the places where there is the greatest risk of the presence of pollutants. When the material is dumped into the sea it is usually dumped just outside the harbours. There is the risk that in some cases polluted sediment is being taken and dumped in unpolluted places, thus promoting the distribution of pollution. Figure 14 shows the disposal of dredged material in Iceland between 1984 and 1996.

2.8.3 Administrative Actions

Indirect discussion of sediment disruption is found here and there in various acts and regulations. Mention may be made, e.g., of Nature Conservation Act, Land Reclamation Act, Reforestation Act, acts and regulations dealing with building and planning issues, the Environmental Impact Assessment Act etc. The overview of this issue is not uniform, among other things because it is subject to various regulatory bodies.

The management of dredging operations falls within the responsibility of the Icelandic Maritime Administration and larger individual ports, such as the Port of Reykjavík and the Port of Hafnarfjörður, while the monitoring of dredging is in the hands of the Environmental and Food Agency. Act No. 32/1986 on the Prevention of Marine Pollution and the international convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (the London Convention) contain comprehensive rules on the measurement of pollutant concentrations in dredging materials and their disposal. Provisions and guidance in the OSPAR Convention of 1992 on the Protection of the Marine Environment are also worth mentioning in this context. With reference to the OSPAR Guidelines, the Environmental and Food Agency has published guidelines for the management of dredged material.

2.8.4 Situation and Actions

Adequate information relating to the anthropogenic transport of sediment and the influence of these transfers on natural balances for the purpose of assessing the actual status around Iceland is not available. It will be necessary to conduct various basic studies, e.g. on natural sediment shifts, the influence of power development projects and of settled areas before this is possible. The charting of the seabed around Iceland would need to be improved.

Measurements of heavy metals and POPs in marine sediment around Iceland have been conducted since 1990 [1,2]. The results show that the heavy metal content in the sediment around Iceland is usually close to background values. Concentrations of POPs are usually low and substantially lower than in marine areas near the coast of the European mainland [1]. Available data, however, show that concentrations of heavy metals and PCBs are invariably higher when measured close to urban areas than when they are measured further from land.

In accordance with the provisions of the Prevention of Marine Pollution Act, the concentration of heavy metals and PCBs has been measured in dredged material in the Port of Reykjavík [8,9] and in the Port of Hafnarfjörður [10]. It was discovered that concentrations of chemicals in the sediment of the Old Harbour in Reykjavík are higher than the background values for the area. The concentration varied depending on where in the sediment the measurements were taken. The highest concentrations were found in the uppermost layers of the sediment while it decreased to probable background values deeper in the sediment. The highest concentration was measured around the premises of the Reykjavík Shipyard but there were also high readings close to the harbour entrance channel. The likeliest explanation is that this is due to a fairly even distribution of marine sediment pollution close to urban areas resulting from pollutants in waste water [9]. Polluted sediment has been removed and closed off in landfills in the course of dredging operations in the Port of Reykjavík.

No overall assessment has been made of the source of pollutants in the marine sediment around Iceland, their courses from sources into sediment or their geochemical behaviour in the Icelandic environment.

Figure 14. Disposal of dredged material during the years between 1984-1996 in wetweight tons. Based on unpublished data from the Environmental and Food Agency.

2.8.5 Evaluation

The rate of natural sediment mobilisation of rivers is high and its volume can vary greatly due to volcanic activity, among other things. The effects of anthropogenic sediment shift on the biota and habitats of the Icelandic coast are unknown. From the limited information available it may be deduced that the effects are not major except, in the worst case, in isolated areas.

Some pollution in sediments is to be expected in the larger and older ports in various places around Iceland. The initial information on localised concentrations of heavy metals and PCBs indicate reasonably dispersed pollution around urban areas and especially in areas close to sewage drains [1,9].

A larger and larger share of dredging materials in Iceland is being used in landfills, which minimises potential problems resulting from the dumping of material into the sea. Significant quantities of sediment pollution have not been measured on the Icelandic coast. The status of disposal methods of dredging materials is therefore believed to be adequate.

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2.9 LITTER[PH10]

2.9.1 General Introduction

Regulation No. 805/1999, on Waste, defines household waste as: "*waste from households, such as foodstuffs, paper, plastics, glass and any type of equipment collected by municipal waste collection services"*. According to UNEP guidelines on the compilation of action programmes [1] this includes all persistent manufactured or processed solid material discarded, disposed of or abandoned in the marine and/or coastal environment.

Litter can cause damage to the marine biota by entangling animals, causing suffocation or digestive problems. Litter in the marine environment can have various negative effects on habitats and may even destroy them. Litter on beaches also causes significant visual pollution [2].

In addition to the above, litter can cause marine pollution in other ways. For example, the uncontrolled incineration of litter, especially some plastic wastes, can result in the emission of POPs (such as dioxin and furan), heavy metals and hydrocarbons (oils) which can then be carried into the sea. Furthermore, landfills are often placed close to the shore and thus leachate does not have far to go to the sea.

2.9.2 Conditions Around Iceland

The main sources of litter in the sea and on beaches are poorly managed landfills, various types of waste carried by wind from urban areas and waste carried by sewage systems and rivers into the sea. Shipping is also a major source of litter in the sea and along the Icelandic coastline, although this issue is outside the scope of this action plan, which only addresses land-based anthropogenic effects.

The amount of litter generated in Iceland is approximately 246 thousand tons annually, of which approximately 28% is believed to be recycled [3]. Waste from agricultural activities, heavy industry and septic tank sludge is not included in this figure. Approximately 4 thousand tons of litter are annually delivered to receiving points in Iceland's ports [4].

There are 36 waste disposal plants operating in Iceland (figure 15). All except 5 have operating licences, or 86%. The larger waste disposal plants, without exception, all have operating licences. The waste disposal plants operated under operating licences serve over 99% of the population [3]. Approximately 94% of all waste is buried, while approximately 6% is incinerated. Uncontrolled incineration of litter has decreased substantially in recent years, and such disposal plants are not granted operating licences. Corrective measures are usually in progress in such cases which means that the current situation is temporary. The issue of operating licences to all waste incineration plants is practically completed.

Various materials that previously were buried are now disposed of in a sounder manner in order to prevent pollution. There was much less surveillance in former times and hazardous waste was often buried with other waste. The bottom sealing of waste dumps along with the construction of treatment plants to prevent leakage of pollutants into the environment was also unknown.

At least 66 shipwrecks lie unattended around the Icelandic coast [5]. For a long time no effort was made to remove stranded ships; instead they were allowed to break apart in the surf and/or sink into the sand. This conforms neither to current regulations, public opinion nor government policy [6].

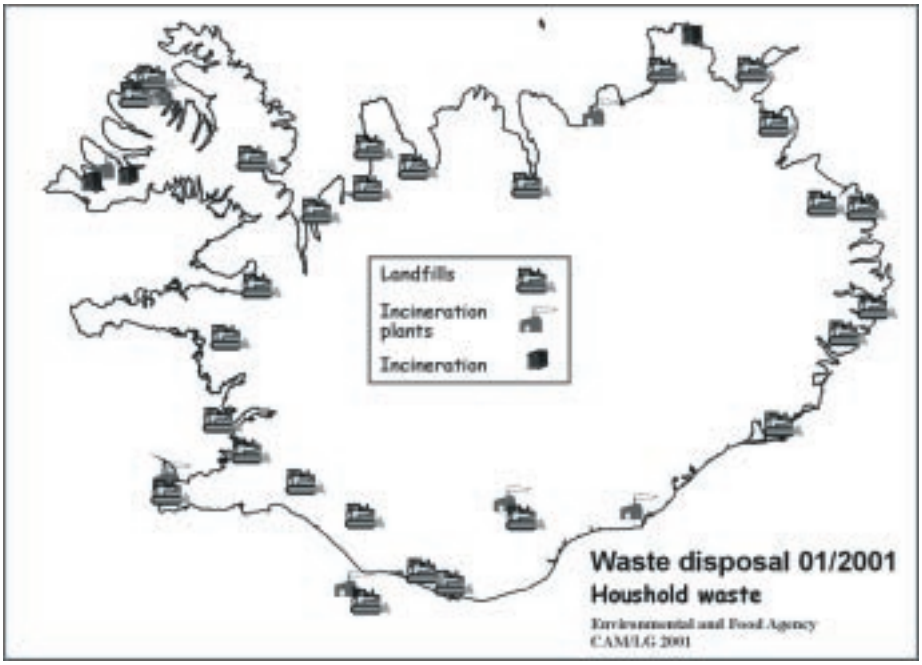

Figure 15. Waste disposal plants in Iceland by the end-year 2000. Based on unpublished data collected by the Environmental and Food Agency.

2.9.3 Administrative Actions

The principal legal provisions regarding litter collection are contained in Act No. 7/1998 on Public Health and Pollution Control, Health Regulation No. 149/1990 as subsequently amended and regulation No. 805/1999 on Waste.

The Regulation on Waste provides for the obligation of municipal collection sites, landfill sites and litter incineration plants to apply for operating licences and contains general provisions on the control of pollution resulting from waste.

The operating licence provides for the surveillance of litter disposal. The Environmental and Food Agency issues operating licences and is responsible for the surveillance. Waste disposal plants without operating licences are, without exceptions, working on application for such licences.

A great deal has been done to prevent the dumping of litter into the sea. Act No. 32/1986 on the Prevention of Marine Pollution stipulates that dumping of materials or objects into the sea from ships is not allowed. It also states that port authorities are under obligation to ensure receiving facilities for litter in Iceland's harbours. Regulation No. 107/1998 provides for rules governing these receiving stations. In 1989, Iceland ratified Annex V to the International Convention on the Prevention of Pollution from Ships, which deals with the handling of waste resulting from the operation of ships. At the same time, a great effort were initiated to reduce the release of waste into the sea and establish adequate receiving points for litter in Iceland's harbours [4].

Administrative actions regarding measures on land are, in addition to regulation No. 785/1999, on Operating Licences for Businesses that May Cause Pollution, provisions on the treatment of drainage water in Regulation No. 798/1999, on Sewage Systems and Sewage, which will reduce the transfer of litter with waste water to the sea (see Section 2.2). In addition, the OSPAR Convention provides for the prevention of marine pollution from land-based sources.

Act No. 44/1999, on Nature Conservation, states unequivocally that municipal authorities are under obligation to ensure the removal of beached vessels. The disposal itself is subject to the provisions of regulation No. 805/1999, on Waste, Regulation, No. 806/1999, on Hazardous Waste, the Health Regulation, Act No. 32/1986 on the Prevention of Marine Pollution, etc. [5].

2.9.4 Situation and Actions

The objective of current actions is to bring litter disposal issues onto the right track by ensuring that all disposal plants meet the necessary requirements for the issue operating licences. Information on the status of litter issues is fairly accurate and surveillance of disposal plants in operation is, for the most part, adequate. The situation, therefore, is generally good, though it is always possible to do better.

With the current efforts regarding the treatment of sewage (see Section 2.2) the volume of solids attributable to waste water running into the sea has been reduced.

In 1997 the Minister of the Environment appointed a committee on the disposal of ships. The committee has completed its work and delivered a report on its results [5]. The committee proposes the establishment of clearer legislative provisions in order to ensure the possibility of removing and disposing of ships. The committee also proposed that Act No. 42[JS11]/1926 on Stranded Ships and Flotsam should be adapted to more recent legislation or repealed. It is necessary to enact legislation which makes it clear that ship owners are responsible for their disposal, and this responsibility must be made clear to owners when ships are first registered in Iceland.

2.9.5 Evaluation

Litter from land-based activities is not a large problem on Iceland's coast. In the near future it is probable that litter in the sea derived from land-based activities will further decrease as a result of improved practices and better methods of disposal.

Knowledge of the problems associated with litter is fairly good, and the actions implemented to solve litter pollution are promising. A large majority of waste disposal plants has operating licences. Those that do not are not far from obtaining such licences. Control of litter disposal plants in Iceland is adequate. Actions in sewage issues reduce the amount of waste released into the sea by drainage systems.

A new report has been released on the scrapping, demolition and disposal of ships [5]. The report contains a description of the current status and proposals for improvement. It is clear that the problem is substantial, but it is equally clear that it can be mitigated substantially by relatively simple changes in laws and regulations.

2.9.6 References

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2.10 PHYSICAL ALTERATIONS AND DESTRUCTION OF HABITATS

2.10.1 General Introduction

Habitat refers to coastal zones, such as beaches and mud-flats, as well as to spawning areas and fishing grounds in shallow waters. In addition, the term can include areas with large biodiversity or areas that are important to individual species, such as seal rookeries and eider duck nesting areas.

Many anthropogenic activities can have a negative impact on the quality of habitats, e.g. dredging, excavation, filling, traffic, the construction of harbours and facilities connected with them. The damming of streams/rivers reduces the sediment carried into the sea, which in turn impacts the seabed. The construction of installations may also block natural sediment transport along coastlines. When habitats containing rare or endangered species are altered or destroyed this can affect biodiversity and cause incalculable damage.

Other aspects, such as e.g. mining, drilling for oil and gas, as well as the processing of such materials, can also have an impact on habitats [1]. Trawls can damage or destroy seabed terrain, level out the seabed and impact its ecosystem [2]. These matters are not discussed further here, however, as the subject matter of this plan concerns only the impact on the sea from land-based operations.

2.10.2 Conditions Around Iceland

Iceland is an island which is still in formation, and nature itself can alter habitats. Glacial bursts (known as *jökulhlaup*) resulting from volcanic activity, in addition to natural erosion, can carry a large amount of sediments into the sea, changing the coastline of Iceland and increasing the transfer of sediments to the seabed. The burst from beneath Skeiðarárjökull in 1996, for example, carried huge amounts of sediments into the sea and temporarily enlarged the island. The coast by Vík í Mýrdal, conversely, is steadily receding as a result of the onslaught of the sea and the silt that was carried into the sea when Mt. Katla last erupted in 1918 has almost disappeared.

A major part of development work on the coast is connected with the fishing industry in one way or another. It is important to have good harbours, but the construction of harbour installations, including dredging, can affect habitats in the neighbourhood.

Power development activities have substantially reduced the stream sediment load in southern Iceland (cf. Section 2.8) and road construction across fjords can also affect habitats.

2.10.3 Administrative Actions

Marine habitats are subject to the Marine Research Institute along with various institutions of the Ministry for the Environment in accordance with legislation and regulations in force. These include the Nature Conservation Act No. 44/1999, the Environmental Impact Assessment Act No. 106/2000, the Prevention of Marine Pollution Act No. 32/1986, the Act No. 54/1995 on the Protection of Breiðafjörður, and Act No. 64/1965 on Research on Behalf of Industries, with subsequent amendments.

Legal provisions concerning dredging, mining and cable laying on the seabed outside the limits of private net-laying jurisdictions, [PH12]and the impact of such actions on the environment, are weak. The Minister for Industry is responsible for ownership rights to all seabed resources under Act No. 73/1990. However, according to the Nature Conservation Act, the Minister is obliged to seek the opinion of the Nature Conservation Agency before granting any licence for the excavation of material from the seabed.

2.10.4 Situation and Actions

There is inadequate data available to assess the condition of habitats in and around Iceland. The Institute of Natural History has though began preparation for a project, which aim is to define and map the major habitat types in Iceland. Furthermore, individual research projects are being carried out by the Marine Research Institute in connection with certain habitats in order to assess their condition and any anthropogenic impact [3].

A joint project of the Marine Research Institute, the Icelandic Institute of Natural History, the University if Iceland and the town of Sandgerði, on mapping the distribution of seabed species in the Icelandic exclusive economic zone has been in progress since 1992. Samples will be taken from an estimated total of 600 places within Icelandic territorial waters. The intention is to use the information acquired through the project to create a database on the distribution of seabed species around Iceland [4].

2.10.5 Evaluation

Information regarding habitats, their condition and the dangers facing them is not sufficient to be able to say anything with any degree of confidence about the condition of Iceland's coasts. For instance, the long-term impact of various types of actions in coastal areas and on the seabed is unknown.

However, available data do not indicate substantial changes in habitats on the Icelandic coast. Nevertheless, some actions and activities can have an extensive local impact, and it is therefore necessary to conduct specific studies on the potential impact of development activities on marine habitats and beaches in each case, e.g. in connection with environmental impact assessments.

2.10.6 References

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2.11 HANDLING AND MONITORING OF HARMFUL SUBSTANCES

2.11.1 General Introduction

In this text, the term "harmful substances" is used as a comprehensive name for all substances that can be harmful to the environment. This applies equally to toxic materials, hazardous materials, medicinal products, oils or other materials that, owing to toxicity, radioactivity or other dangerous characteristics, may have a harmful impact on the environment if released as a result of accidents or careless handling.

This chapter is unlike other parts of this plan in many ways. The emphasis here is on preventive measures, i.e. surveillance of importation, handling and disposal of materials which could cause pollution if improperly handled and which can, in themselves, be harmful to humans, the biota and the environment. Many of the materials already discussed, heavy metals, POPs, oils and radioactive substances, come under the above definition of harmful materials. Reference is made to the relevant Sections for further discussion of the individual categories.

It is impossible to list here all the substances or categories of substances that can be harmful to the environment, and such a listing is, in fact, far outside the scope and objective of this report. This Section will therefore look at the parties who handle such substances and, in particular, the parties charged with monitoring responsible handling of harmful substances. To this end, the legal environment of these issues is discussed here, as well as which bodies are intended to ensure and monitor observance of applicable laws and regulations. The content of this Section is, for the most part, gathered from current legislation and regulations. Reference is made to Annex I for the legislation and regulations cited. The website www.rettarheimildir.is contains an accessible database of links to legislation and regulations in force.

The supervision of importation, production, distribution and sales, transportation, handling and disposal of harmful substances in Iceland is largely divided between five institutions and bodies: The Environmental and Food Agency, the Medicines Control Agency, the Administration of Occupational Safety and Health, the Radiation Protection Institute and Municipal Boards of Public Health.

The legal environment is, in most cases, in a state of continuous development, and amendments are frequently made to regulations, particularly in connection with obligations under the EEA agreement. For this reason, a full list of all acts and regulations in force is not included in this paper. Reference is made to the abovementioned website (www.rettarheimildir.is), along with the websites of the parties specified.

2.11.2 Legal Foundation

The primary law concerning harmful substances is Act No. 52/1988 on Toxic Substances and Hazardous Substances. Its scope covers equally the importation, production, distribution and other handling of toxins, hazardous substances and products containing such substances. The act does not, however, cover toxic and hazardous substances if they are used in accordance with the provisions of Act No. 46/1980 on Conditions, Health and Safety in the Work-Place or in accordance with the Medicinal Products Act No. 93/1994.

A large number of regulations has been set on the basis of the above legislation describing in greater detail the environment and the rules that apply in Iceland.

Table 4 and the text below provide a brief overview of applicable legislation and the arrangement of the supervision of importation, use and disposal.

Table 4. Legal framework and parties responsible for supervision of the handling of harmful substances.

Act No.	Name	Responsibility	Ministry	Further information
52/1988	on Toxic Substances and Hazardous Substances	EFA, Municipal Boards of Public Health	Ministry for the Environment	www.hollver.is
56/1996	on Special Fee on Hazardous Waste	Hazardous Waste Commission	Ministry for the Environment	www.hollver.is
7/1998	on Public Health and Pollution Control	EFA, Municipal Boards of Public Health	Ministry for the Environment	www.hollver.is
46/1980	on Working Environment, Health and Safety in the Workplace	Administration of Occupational Safety and Health	Ministry of Social Affairs	www.vinnueftirlit.is
117/1985	on Radiation Protection	Radiation Protection Institute	Ministry of Health and Social Security	www.gr.is
93/1994	Medicinal Products Act	Medicines Control Agency	Ministry of Health and Social Security	www.lyfjastofnun.is
32/1986	on the Prevention of Marine Pollution	EFA	Ministry for the Environment	www.hollver.is

Act No. 52/1988 on Toxic Substances and Hazardous Substances

The Office of Chemicals of the Environmental and Food Agency has primary responsibility for ensuring observance of the Act on Hazardous Substances and Toxic Substances. Legislation and regulations in force is available on the website of the Environmental and Food Agency (www.hollver.is) in addition to extensive information on the operation and field of operations of the institution[.13].

Regulation No. 236/1990 on the Classification, Labelling and Handling of Toxins, Hazardous Substances and Products Containing such Substances, as amended, lays down the principal rules for the handling, labelling and classification of hazardous and toxic substances.

Attachment 1 to the regulation contains a list of toxic and hazardous substances covered by the act and the regulation. It is important for parties subject to the regulation to keep themselves up to date, as the list is under constant review. An updated lit is maintained on the website of the Environmental and Food Agency (www.hollver.is), and the list may also be accessed at the Agency.

Day to day surveillance of the sale of products on the general market is in the hands of Municipal Boards of Public Health under the overall supervision of the Environmental and Food Agency.

Act on Working Environment, Health and Safety in the Workplace No. 46/1980

The objective of the Act is to ensure a safe and healthy environment in the workplace and to ensure protection of workers from accidents, poisoning and diseases. The Administration of Occupational Safety and Health is responsible for monitoring observance of the provisions of this Act. The Administration issues guidelines and instructions on the production, packaging, refilling, labelling, handling, repair, transport, installation and final disposition of hazardous substances. The Administration of Occupational Safety and Health also establishes rules on requirements regarding the organisation, arrangements and conduct of work with such substances.

Information on rules in force in connection with the Act on Working Environment, Health and Safety in the Workplace may be located on the website of the Administration of Occupational Safety and Health (www.vinnueftirlit.is)[PH14]

Medicinal Products Act No. 93/1994

According to the Medicinal Products Act, the Medicines Control Agency is responsible for monitoring the importation, storage and distribution of medicinal products, medicinal substances and raw materials for the production of medicinal products, including veterinary medicines. Diverse information connected with these issues may be accessed at the website of the agency (www.lyfjastofnun.is) together with the principal regulations and criteria.

Other Legislation

Act No. 7/1998 on Public Health and Pollution Control contains general provisions on all types of activities and development in Iceland with the objective of ensuring an unpolluted and healthy environment. The points relating to the potential pollution of the sea are contained mainly in Articles 5 and 6, as well as a substantial number of regulations issued on the basis of these Articles (see the website of the Environmental and Food Agency for a detailed summary). In addition to the above legislation, various special acts and regulations have been issued regarding individual aspects of pollution control. These include Act No. 32/1986 on the Prevention of Marine Pollution, whose objective is to protect the sea and the Icelandic coastline from pollution originating in ships, air transport, rigs or other human installations at sea and from land-based sources resulting from oil and various other substances and which may place human health at risk, damage the living resources of the sea and disrupt its biota, damage the environment or disrupt the lawful utilisation of the sea.

With Act No 56/1996, on a Special Fee on Hazardous Waste, an economic mechanism has been put in place to prevent pollution from certain hazardous substances. The tax is levied on the importation or production of certain product categories which may become hazardous waste and is intended to cover the cost of the receipt, handling and disposal of hazardous waste pursuant to Regulations No. 806/1999 on Hazardous Waste, No. 807/1999 on the Incineration of Hazardous Waste and No. 810/1999 on a Registry of Hazardous Waste and Other Wastes. Article 6 of the Act lists the product groups subject to the fee, and the tariff of the Hazardous Waste Commission is published in Regulation No. 578/2000 on the Imposement of a Special fee on Hazardous Waste. For further and up-to-date information reference is made to the website of the Environmental and Food Agency (www.hollver.is). This information can also be obtained from the staff of the Hazardous Waste Commission which has an office at the Administration of Occupational Safety and Health.

The principal provisions on protection from radioactive materials are contained in the Radiation Protection Act No. 117/1985 along with its relevant Regulations. The Icelandic Radiation Protection Institute is responsible for the implementation of the Act, as described in Section 2.4. Please refer to the Radiation Protection Institute website (www.gr.is) for further discussion and information.

2.11.3 Importation and Production

General

In general, the importation and production of toxic substances and delimited substance categories and compounds containing such substances is banned except with the special permission of the relevant authority and/or monitoring agencies (see Sub-section 2.11.2).

The Environmental and Food Agency must be notified, in accordance with Regulation No. 815/1998, before any importation of new substances or any marketing of a new substances produced in Iceland. The Regulation applies to all substances other than substances produced or imported solely as medicinal products for humans and animals, waste, foodstuffs, animal feeding stuffs, pesticides or radioactive substances.

Importers are under obligation to obtain data on the effects and characteristics of substances and their classification, according to Icelandic Regulations, before products containing toxic substances or harmful substances can be offered for general sale or distribution. The product must also be clearly labelled in Icelandic with the information specified in Regulation No. 236/1990 on the Classification, Labelling and Handling of Toxic Substances, Harmful Substances and Products Containing Such Substances, as amended.

Occupational safety

Notification must be sent to the Administration of Occupational Safety and Health along with information in accordance with Regulation No. 765/2001 when hazardous substances or toxic substances are imported for use in workplaces. The information shall comply with safety guidelines for the use of chemical substances in the workplace (No. 602/1999).

Manufacture of Medicinal Products

The Medicines Control Agency is responsible for all surveillance concerning the importation and manufacture of medicinal products. According to Regulation No. 699/1996, on the Importation and Wholesale Distribution of Medicinal Products, only persons authorised by the Minister of Health and Social Security may import these substances. The regulation contains various conditions to be met by importers and wholesalers. Regulation No. 700/1996 on the Production of Medicinal Products contains provisions for good manufacturing practice and quality requirements in the production process. The provisions of the regulation do not apply to the production of raw materials for the manufacture of Medicinal Products.

Restrictions on importation

Various regulations have been set that restrict or prohibit the importation and/or production of certain harmful substances. These include, for example, No. 870/2000 on the Ban on the Importation and Use of Asbestos, No. 619/2000 on Banning the Use of Substances Containing Mercury Compounds, Arsenic Compounds and the Organic Compounds of Tin (tributyline), No. 447/1996 on the Use and Ban on the Use of Cadmium and its Compounds, No. 419/2000 on the Use and Ban on the Use of Certain Substances During the Treatment of Textiles, No. 656/1997 on the Prevention of Pollution from Ozone-Depleting Substances, No. 177/1998 on the Ban on Utilising Certain Toxic Chemicals and Hazardous Substances, with subsequent amendments and No. 323/1998 on the Importation, Use and Disposal of PCB, PCT and their Environmentally Harmful Substitutes.

2.11.4 Handling

The regulations restricting or banning the importation and production of certain harmful substance (see above) also apply to any kind of use and handling of the substances in question.

Special rules apply to the use of various types of pesticides and eradicative substances, as described in Regulation No. 50/1984 on the Use of Toxic and Hazardous Substances in Agriculture and Horticulture and for the Eradication of Pests, No. 238/1994 on Garden Spraying and relevant provisions of Regulation No. 137/1987 on the Use and Ban on Use of Certain Toxic and Harmful Substances.

The Administration of Occupational Safety and Health has issued a number of rules and guidelines on the handling of and work with harmful substances. These include the following: No 621/1995 on Working with Carcinogenic Substances, No. 698/1995 on Working With Lead and Lead Salts and No. 765/2001 on the Protection for Workers from Loss of Health due to the use of harmful substances in Workplaces.

2.11.5 Distribution, Sales

Special regulations have been established to restrict the sale and use of harmful substances. They are for the most part the same as those already described.

Toxic substances may only be delivered and sold by persons possessing special permit in accordance with regulation No. 39/1984 on the Issuance and Processing of Applications for Toxic Substances and other Relevant Permits. Surveillance of the sale of products on the general market is the responsibility of Municipal Boards of Public Health under the overall supervision of the Environmental and Food Agency.

Entities delivering potentially hazardous substances or product groups for use in industrial operations falling under the Act on Working Environment, Health and Safety in the Workplace No. 46/1980, whether manufacturer, importer, seller or distributor, shall provide the receiving party with safety instructions in Icelandic in accordance with Regulation No. 602/1996.

As regards the distribution and sale of medicinal products the following acts and regulations apply in all cases: the Medicinal Products Act No. 93/1994, the Selling of Medicinal Products Act No. 30/1963 and their attached regulations, e.g. Regulation No. 426/1997 on Permits to Sell Medicinal Products and on Pharmacies.

2.11.6 Transportation

Special precautions must be taken in transporting hazardous cargo. Regulation No. 984/2000 applies to all transportation of hazardous substances on and off roads in Iceland. Drivers must be licensed (ADR-licensed) in accordance with the regulation. Supervision of compliance with this regulation is in the hands of the Administration of Occupational Safety and Health, the Police, the Environmental and Food Agency, the Radiation Protection Institute and Municipal Boards of Public Health, according to the nature of the transportation and the substance.

2.11.7 Disposal

Regulations No. 805/1999 on Waste, No. 806/1999 on Hazardous Waste and No. 810/1999 on a Registry of Hazardous Waste and other Wastes (Annexes IV and V) contain comprehensive rules on the disposal of harmful wastes. Means must always be sought to re-use or recycle waste. In the absence of such re-use or recycling, waste must be transported to licensed collection or receiving stations. A special fee on Hazardous Waste has been imposed to cover the cost of receipt, handling and disposal of hazardous substances in accordance with Regulation No. 578/2000 on the Imposement of a Special Fee on Hazardous Waste.

The exportation of harmful substance for the purposes of their disposal is subject to the observance of the provisions of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, as well as relevant provisions of Regulation No. 377/1994 on Environmental Issues in The European Economic Area.

2.11.8 Situation and Actions

Regulations in force are under continuous review. Icelandic legislation has, in recent years, been adapted to EU legislation in accordance with the EEA Agreement, and the agreement will to a large extent mould legislation and regulations in Iceland in the future.

As described herein a considerable number of acts and regulations underpins the day-to-day surveillance and control of the importation, production, distribution, sale, and disposal of harmful substances in Iceland. However, within each field there is a definite legislative framework laying down the scope and role of monitoring bodies. Surveillance is in the hands of five bodies, the Environmental and Food Agency, the Administration of Occupational Safety and Health, the Medicines Control Agency, the Radiation Protection Institute and Municipal Boards of Public Health. Although the organisation may appear complicated, the diffuseness of administrative responsibility for this issue is less than in many other regions [1].

No continuous registration is in force of the life-cycle of harmful substances from importation or manufacture to disposal. Where different legislation and rules apply to the use of one and the same substance, depending on use, there is the risk that allocation of responsibility for surveillance will be arbitrary where the jurisdiction of different monitoring bodies and the scope of different laws and regulations overlap.

Act No. 52/1988 on Toxic Substances and Hazardous Substances has been slated for review. The review is intended, among other things, to put in place provisions which will make it easier for a monitoring body to gain an overview of the importation and registration of hazardous and toxic substances [1].

2.11.9 Evaluation

No accidents or accidental release are known to have resulted from any failure of the current legal framework. Nevertheless, it is important to maintain alertness with regard to possible improvements in efficiency, e.g. as regards the importation, production, distribution, handling and disposal of harmful substances and prevention of accidents and accidental releases.

The current division of rules in force is based on long tradition and experience. It is appropriate to spread responsibility for the handling of substances among the competent regulatory authorities, but it is important for the boundaries of their scope to be clearly defined and for the flow of information be smooth. Access to this information has been greatly facilitated by the

establishment of a special website containing links to legislation and regulations in force (www.rettarheimildir.is). Owing to the wide range of these issues in the Icelandic legislative environment, however, this work depends on individual administrative bodies maintaining their own websites and updating them regularly.

Five different parties are responsible for the surveillance of importation, production, sales, distribution, transportation, use and disposal of harmful substances in Iceland. It is important to establish a standardised registry of the life-cycles of harmful substances imported to Iceland, their use and disposal, in order to make it possible to acquire an overall view of the substances in Iceland at any given time and their fate. A notification requirement and standardised registration of all these harmful substances would greatly facilitate the flow of information and reduce the risk of some substances or activities falling between jurisdictions and escaping surveillance.

It is important for rules on the use of harmful substances to be clear. Due to the fact that the surveillance of harmful substances is the responsibility of so many parties, it is proposed that these parties should create a working party to review the legislation in force and map out any overlaps and loopholes in the current legal environment.

2.11.10 References

1. Sigurbjörg Gísladóttir Environmental and Food Agency. Verbal source 28. október 1999.

3 ORDER OF PRIORITY

3.1 INTRODUCTION

In such a complex issue it is unavoidable to establish an order of priorities. The UNEP guidelines [1] list the issues to be assessed, i.e. impact on food security, public health, marine and coastal resources, the quality of ecosystems and social and economic benefits. The following issues are also addressed:

- Due consideration is given to undertakings of the Icelandic authorities based on international agreements or other provisions.
- The political objectives of the Government are observed [2].
- Due consideration is given to special Icelandic conditions, e.g. the geographic position of the island, sparse population and the importance of the fishing industry.

The results of this evaluation can be seen in table 5. The impact of the various issues addressed in this report (cf. Chapter 2) regarding the aspects of the environment to be evaluated according to [1] is illustrated in the table. There are three class of impact; small impact (●), moderate impact (●●) and major impact (●●●). Annex III contains further explanation of the evaluation.

It should be noted that this evaluation and prioritisation is based exclusively on Icelandic conditions and applies only to the Icelandic Action Plan. The classification does not necessarily reflect current international opinion. Thus, to give an example, nutrients are low on the list of priorities in Iceland in direct contradiction to current general concern about this issue in the world.

Table 5. The impact of the issues of this report on some aspects of the environment.

	Food Security	**Public Health**	**Marine and Coastal Resources**	**Quality of Ecosystems**	**Social and Economic Benefits**
Sewage	●●	●●	●●	●●	●●●
POPs	●●●	●●●	●●●	●●●	●●●
Radioactive Substances	●●●	●●●	●●●	●●●	●●●
Heavy Metals	●●●	●●●	●●●	●●●	●●
Oils	●●	●	●●●	●●	●
Nutrients	●	●	●●	●●	●
Sediments	●	●	●●	●	●
Litter	●	●●	●●	●●	●
Physical Alterations of Habitat	●●	●	●●	●●	●●
Harmful Substances	●●	●●	●●	●●	●●

Table 6 lays down the order of priority of the issues discussed in Chapter 2 in accordance with the risk evaluation in table 5. The main themes and points of emphasis in this Action Plan on the Prevention of Marine Pollution in Iceland are the same as those of the recently published Arctic Regional Action Plan, to which Iceland is a party. The priorities of these two action plans are, however, not identical in details.

Table 6. Priorities listed according to importance in the Icelandic context.

Group	Issues
I	• Persistent Organic Pollutants • Heavy Metals • Radioactive Substances • Sewage • Handling and Monitoring of Harmful Substances.
II	• Physical Alterations and Destruction of Habitat • Oils
III	• Litter • Sediment Mobilisation and Contamination • Nutrients

The above evaluation of impact and priority must be reviewed regularly in order for the Action Plan to reflect actual conditions and opinion. Increased knowledge and changes in conditions may lead to a re-evaluation of the order of priority. In light of the above, the importance of general basic research on environmental conditions in Iceland cannot be overestimated.

3.2 GROUP I

3.2.1 General

Solutions to problems connected with Group I are the most urgent. The issues are difficult to resolve and they have an extensive impact on public health, natural resources and industries.

A majority of the substances in Group I are derived primarily from land-based sources outside Iceland. The struggle for reductions in their release into the environment must, therefore, primarily be conducted in international fora. This does not detract from the importance of domestic improvements. Iceland must set a good precedent before the issue is raised internationally.

A common feature of many of the substances involved here is that they degrade slowly or not at all once they have been released into the environment. This is why it is extremely important to stop their release as soon as possible and to comprehensively map the extent of the current pollution. Many of the substances are toxic and some are carcinogenic.

3.2.2 Persistent Organic Pollutants

POPs have harmful effects on humans and other living organisms, even in relatively low concentrations. The presence of these substances in some quantity in the sea around Iceland can have a negative impact on the image of Iceland as a clean country and, in a worst case scenario, cause the collapse of overseas markets for marine products. The Icelandic authorities have ranked the struggle against POPs high on their list of priorities. A large part of these substances derive from sources outside Iceland, and international co-operation is therefore necessary to decrease their danger.

3.2.3 Heavy Metals

As heavy metals are elements they do not degrade and thus the impact of their release into the environment can be long-term. They have harmful effects on humans and other living organisms, even in relatively low concentrations. It must be kept in mind that the presence of heavy metals in the environment is a natural state and that many heavy metals in the sea around Iceland derive from natural processes such as volcanic activity, geothermal activity and rock erosion. Pollution consists in increased concentrations above natural background values. The increased concentration of heavy metals in the sea around Iceland can have far-reaching effects on the clean and unpolluted image of Icelandic marine products.

3.2.4 Radioactive Substances

Icelandic authorities are extremely alert to the danger imposed to the sea by radioactive materials [2] and have stressed the prohibition of releases of radioactive substances into the environment. If radioactivity is measured in substantial concentrations in the sea around Iceland this could have a negative impact on the image of Iceland as a clean country and possibly cause the collapse of overseas markets for marine products, even though radioactivity is far below overseas reference values. All anthropogenic radioactivity in the sea is derived from sources outside Iceland and international co-operation is therefore necessary to reduce its risks.

3.2.5 Sewage

The majority of all sewage in Iceland is currently released untreated into the sea. Sewage contains organic wastes, nutrients and various types of litter. Sewage is also a known source of heavy metals and POPs in the sea. There is a risk of oxygen depletion and alterations in the communities of organisms in the vicinity of drainage pipes. Faecal pollution can contain bacteria which can infect wild animals and thereby maintain infection pathways to products and the public. It is a matter of priority to bring sewage matters into an acceptable state as soon as possible. This would reduce many kinds of pollution deriving both from various kinds of substances and microbes as well as promoting improved hygiene and reduced faecal pollution.

3.2.6 Handling, and Monitoring of Harmful Substances.

Recording of the cycle of various types of harmful substances from the time of their importation to Iceland until their disposal is patchy. In order to gain an overview of the volume, use and methods of disposal, of it is an urgent matter to establish such a process of recording. Such information can identify areas needing attention and the available means of combating pollution in various fields.

3.3 GROUP II

3.3.1 General

The issues pertaining to this group are dissimilar in their nature, but are nevertheless strongly interconnected as oil pollution is in many places a serious risk to sensitive habitats, especially in the vicinity of urban areas. The state of affairs is, for the most part, connected with domestic activities and development. The management of actions should, therefore, be easier in some ways than for substances in Group I.

3.3.2 Oils

Problems related to oils are relatively well known, as are the effects of pollution they cause. With greater integration in issue of operating licences and through responsible surveillance, the state of affairs as regards this issue is expected to improve.

3.3.3 Physical Alterations and Destruction of Habitats

One of the biggest problems regarding the condition of habitats is the less than perfect knowledge of their nature, condition and the risks to which they are exposed. The order of priority of this group of issues will need to be re-evaluated following completion of basic research of habitats around Iceland. Various kinds of development activities can have far-reaching harmful effects on habitats, and a comprehensive evaluation of the potential impact of development activities on the environment is urgently needed.

3.4 GROUP III

3.4.1 General

The issues in Group III have, at present, a lower priority than other issues. Nevertheless it is necessary to monitor their condition. Circumstances can change and previously unknown information come to light. It must also be kept in mind that despite their order of priority various measures are needed for their improvement in many places.

3.4.2 Litter

Compared to other issues, refuse from land-based operations ending up in the sea around Iceland is not considered to be a substantial problem. Even so, rubbish is noticeable in many places on Iceland's coastline. This includes shipwrecks, which are a blot on the landscape.

3.4.3 Sediment Mobilisation and Contamination

The concentration of pollutants in marine sediment around Iceland is, generally speaking, very low. Higher concentrations can be detected in the neighbourhood of urban areas and are primarily attributed to effluents, air pollution and port-related activities. Our knowledge of the impact of changes on the sediment load of rivers, on the other hand, is inadequate.

3.4.4 Nutrients

No great quantities of nutrients are believed to be released in Iceland, and nutrient enrichment is not a problem in the sea around Iceland.

3.5 REFERENCES

1. UNEP 1995. **Global programme of action for the protection of the marine environment from land-based activities.** Approved at a United Nations International Conference in Washington D.C., USA, 23 Oct.-3 Nov. 1995, 60 pages.
2. Umhverfisráðuneytið 1997. **Sjálfbær þróun í íslensku samfélagi. Framkvæmdaáætlun til aldamóta**. Reykjavík, umhverfisráðuneytið, 48 bls. **[**The Ministry for the Environment 1997. **Sustainable Development in the Icelandic Community. Action Plan Until the Turn of the Century.** Reykjavík, Ministry for the Environment. 48 pages**]**
3. Arctic Council 1999. **Regional programme of action for the protection of the Arctic marine environment from land-based activities.** Minister of Public Works and Government Services, Canada, 17 pages.

4 STRATEGIC PLANNING AND OBJECTIVES

4.1 OBJECTIVES

Icelanders base their economy on the sea and its resources. It is therefore particularly important for Icelanders to protect this most valuable of resources.

The objective of the action plan is to reduce the danger of marine pollution from land-based sources. The ultimate goal of the action plan is the preservation of the marine environment and sustainable exploitation of its natural resources. Preventive measures to combat the release of pollution into the sea are a far better option than clean-up operations following the occurrence of pollution.

The Global Programme of Action [1] recommends the initiation of actions, primarily on the basis of the solutions already available in each country, to the extent possible.

In order to achieve these objectives, governments must have a clear strategy in place. One of the purposes of the action plan is to highlight this.

4.2 STRATEGIC PLANNING OF ICELANDIC AUTHORITIES

The policy of the Icelandic authorities regarding participation in the field of global environment issues has been absolutely clear since the Rio Conference in 1992. However, it is virtually impossible for a small nation like Iceland to participate in all the work taking place in the field of environmental issues. This inevitably leads to prioritisation, which in turn is based on the specialised knowledge possessed by the nation and its national interests. The following items are at the top of the list [2]:

- Prevention of marine pollution
- Sustainable utilisation of marine resources
- Use of renewable energy supplies

The Icelandic authorities have specially emphasised efforts to stop the release of POPs and radioactive substances into the environment [2].

4.3 CURRENT ACTIONS

Pollution respects no borders and the effects of pollution are sometimes felt far from the source of its release. This is why it is necessary to deal with the problem in the context of international co-operation as well as domestic measures.

Icelanders assumed major obligations when they joined the EEA. This has resulted in a change of focus from domestic initiatives to fulfilment of multinational objectives.

The Action Plan must comply with Iceland’s international obligations and stated intentions. The plan is based mainly on the following obligations and declarations of intent:

4.3.1 Undertakings

The EEA Agreement is legally binding for Icelanders. In the agreement, Icelanders have agreed to harmonise their legislation and regulatory framework, i.a. in the field of environmental issues, with EU legislation. The environmental section of the Agreement addresses all types of pollution. The Agreement will mould our legislation in this field in the future.

United Nations Convention on the Law of the Sea (UNCLOS). This convention lays down the basis for a general legal environment regarding the sea. Iceland has ratified the convention.

The ***OSPAR*** Convention is intended to promote the protection of the North East Atlantic marine environment. The Agreement replaces the Oslo and Paris conventions and is intended to promote the reduction of land-based pollutants released into the sea, in addition to preventing the dumping of wastes and pollutants into the sea from ships and aircraft. Iceland has ratified the Convention.

LRTAP (Long-range Transboundary Air Pollution of Persistent Organic Pollutants) is a multilateral agreement of the European industrial countries, along with the US and Canada, to cease the use of certain persistent organic pollutants and to restrict the production and release of others. Iceland has ratified the Agreement and its annexes on POPs and heavy metals.

POPs international The Stockholm Convention on Persistent Organic Pollutants is designed to minimise the release of POPs into the invironment. The Convention was adopted in 2001.

MARPOL is an International Convention for the Prevention of Pollution from Ships. MARPOL's objectives are to prevent the release of pollutants into the sea from ships at sea or in harbours. Iceland has ratified the agreement and four of the six annexes.

The London Dumping Agreement is a Convention on the Prevention of Marine Pollution by the Dumping of Wastes and Other Matter. Iceland has ratified the Agreement.

The Copenhagen Convention deals with reciprocal co-operation between the Nordic countries in the event of accidents caused by oils and other hazardous substances. Iceland has ratified the Agreement.

4.3.2 Declarations of Intent

The National Sustainable Development Action Plan is for the most part based on the Rio Declaration and Agenda 21. It expresses the opinion of the Icelandic government that POPs pose the most serious threat to the sea. It points out in particular the danger posed by organic tributyltin compounds which have been used in antifouling paints.

The Rio Declaration. The Rio Declaration states several principles to be followed. These include the precautionary principle, the polluter-pays principle and the user-pays principle. The declaration also expresses the rights of individuals to information and education as well as decisions based on the concept of sustainable development.

Agenda 21. In the Action Plan for environmental and developmental issues approved at the Rio Conference (Agenda 21), Chapter 17 discusses the “protection” and “management” of the sea. It specifically addresses marine pollution from land-based sources and lists the primary pollutants.

The Arctic Council was formally established in 1996. The parties to the Council are 8 nations around the Arctic. The Council's primary purpose is to promote the protection of the Arctic and to promote sustainable utilisation. Among other things, a regional action plan on the prevention of marine pollution from land-based sources in the tradition of UNEP has been created.

A summary of the above agreements, co-operation and declarations can be accessed on the website of the Environmental and Food Agency (www.hollver.is).

4.4 PATHWAYS TO STATED OBJECTIVES

The resources available to governments to reach set goals can be divided into four parts. First, through the enactment of legislation and the adoption of regulations. Second, through economic actions or "economic instruments". Third, through education, instruction and dissemination of information. And, finally, through international co-operation.

In addition to governments, individuals, organisations and private entities can help to achieve environmental goals. The influence of such grass-roots movements cannot be overstated.

4.4.1 Legislation and regulations

The enactment of laws and adoption of regulations has, until recently, been the most common means of achieving defined environmental goals. A solid and transparent legal framework is a fundamental feature for the solution of problems. Nevertheless, it is clear that further measures are necessary, and legislation and regulations should not be relied on exclusively to solve all problems.

There are several conditions that must be met in order for laws, regulations and directives to achieve their purpose [2]:

- The aims and purposes of the laws must be clear.
- A technical solution of the requirement must be available or at least in the pipelines.
- The laws must contain compulsory and punitive provisions.
- The laws should not be far ahead of what is generally accepted by the public
- It must be possible to verify compliance with the provisions.

4.4.2 Economic Instruments

Various economic measures can be used to achieve environmental objectives. Economic instruments represent an attempt to influence market behaviour, e.g. through taxes, subsidies and deposit charges.

The application of economic instruments is a method which in many cases can be more suitable than commands and bans. The advantage is that the market is offered the option of finding the most feasible solutions, often with better results than the enactment of laws. The disadvantages are, e.g. that it is unclear whether the objectives will be achieved, largely because economic instruments do not define specified limit values or tools for pollution control. In some cases such regulating devices simply do not apply, e.g. in many issues relating to nature conservation or protection of species.

Economic instruments have been used in Iceland in two cases. The first involves a deposit on disposable containers and the second involves the introduction a special fee on certain types of hazardous waste. Deposits on containers have been a great success. The imposement of the special fee on hazardous waste has not been in effect for very long, and no data is therefore available on the efficacy of the implementation.

Most indications point to economic instruments being suitable for Icelandic conditions. Their increased use should be promoted as well as the widening of their current scope. A report prepared for the Ministry for the Environment dealing with the various types of economical instruments for environmental protection was published in 1997. The report showed that it is possible to obtain more efficient control of environmental management in Iceland through the use of economic instruments.

4.4.3 Education and Dissemination of Information

Good education, together with easy access of individuals and companies to quality information on environmental matters, is very important. Accurate information on the condition of the environment and the risks it faces are a prerequisite for any actions. Education of the public and

companies is necessary for the achievement of results through the enactment of laws and the application of economic instruments.

With the increasing public access to the Internet, it is important to aim for the creation of an integrated database containing environmental information, results of monitoring, results of surveillance programmes and current legislation, regulations and international agreements. Through efficient real-time dissemination of information it is often possible to prevent the uncertainty which can result when wrong or misleading information begins to circulate.

4.4.4 International Agreements

International agreements on pollution control are among the most important weapons in the struggle against transboundary pollution. Some of these agreements are global, such as the agreements of the International Maritime Organisation (IMO), while others apply only to limited regions of various sizes.

The advantages of international agreements are mainly threefold. First, the countries serve as checks on one another because no one want to be the biggest offender. Second, they lead to co-operation in environmental measurements and the search for technical solutions to reduce pollution. And third, the best results in reducing the release of pollutants are achieved through the joint efforts of many nations.

It is in Iceland's best interest to participate in international co-operation for the prevention of marine pollution in the sea around Iceland.

4.4.5 Other

In addition to government authorities, the public and enterprises can influence trends in environmental issues and be a powerful instrument in the struggle against pollution.

Public opinion in industrial countries has been transformed in recent years. The public can have an influence by taking up better environmental practices, e.g. by using more environmentally friendly products or by increased recycling. The public can also pressure the authorities and industrial enterprises to pay more attention to environmental issues.

Industrial enterprises are in a key position to reduce global pollution. By adopting best available techniques (BATs) and best environmental practices (BEPs) a great deal can be achieved in matters of pollution. Such companies gain the confidence and trust of the public, which in turn leads to increased business.

To achieve the best possible results it is necessary for governments, the public and the industries to work together. Private entities have to be reconciled to laws and regulations if their objectives are to be achieved. This cannot be achieved without adequate access to information and continuous education.

4.5 REFERENCES

1. UNEP 1995. **Global programme of action for the protection of the marine environment from land-based activities.** Approved at a United Nations International Conference in Washington D.C., USA, 23 Oct.-3 Nov. 1995, 60 pages.
2. Davíð Egilson 1993. Mengun hafsins. **Árbók VFÍ 1992/1993,** bls. 336-361. [Marine Pollution. **VFÍ Yearbook 1992/1993** pp. 336-361]

5 IMPLEMENTATION OF ACTIONS

5.1 GENERAL

Achievement of the objectives of this plan will require support for its implementation. This section will discuss what will mainly be needed for this purpose.

It is clear that government interest is a prerequisite for anything to happen, and budget appropriations have to be allocated so as to facilitate efficient work according to the plan. Furthermore, close co-operation between public authorities, interest groups and private entities is necessary to ensure good results.

The following is a short description of the structure and execution of the plan. A flow diagram is presented at the end of the section illustrating processes in the implementation of actions and evaluation of progress.

5.2 TECHNICAL CO-OPERATION

Technical support is important in order to achieve the objectives of the plan. Information on methods and solutions which are useful in the fight against marine pollution must be disseminated.

Technical co-operation between institutions, interest groups, companies and private entities, together with comparisons with other domestic and foreign action plans, promotes efficient work and ensures that the best technical methods are being used at each time.

5.3 INFORMATION SYSTEMS (DATABASE)

It is necessary to establish a database containing the best information at any time on matters relating to marine pollution, implementation of actions and evaluation of results. The database must be easily accessible and the Internet is an excellent medium for such a database.

The database must be well organised and the information must be updated regularly so that the most recent and best information is always available. Ideally it would be preferable to build a database that updates itself automatically, so that the information reflects real-time conditions. The database needs to be open to consumers so that everyone has an opportunity to access its general information; at the same time, full confidentiality must be observed towards individual parties, where applicable.

The website of the database must contain links to other websites (databases) which are relevant to the subject matter of the action plan. Such an information system also plays an important educational role for the general public.

5.4 SURVEILLANCE OF IMPLEMENTATION

In order to monitor the implementation of the plan it is important to set up a regular system of surveillance and review. Evaluation of the progress of the action plan must be conducted on a regular basis, followed by status reports assessing the actions already implemented and whether improvements match the objectives of the plan. This must be accompanied by a review of the plan and the introduction of any necessary amendments. Finally, updated information and amended plans can be added to the database.

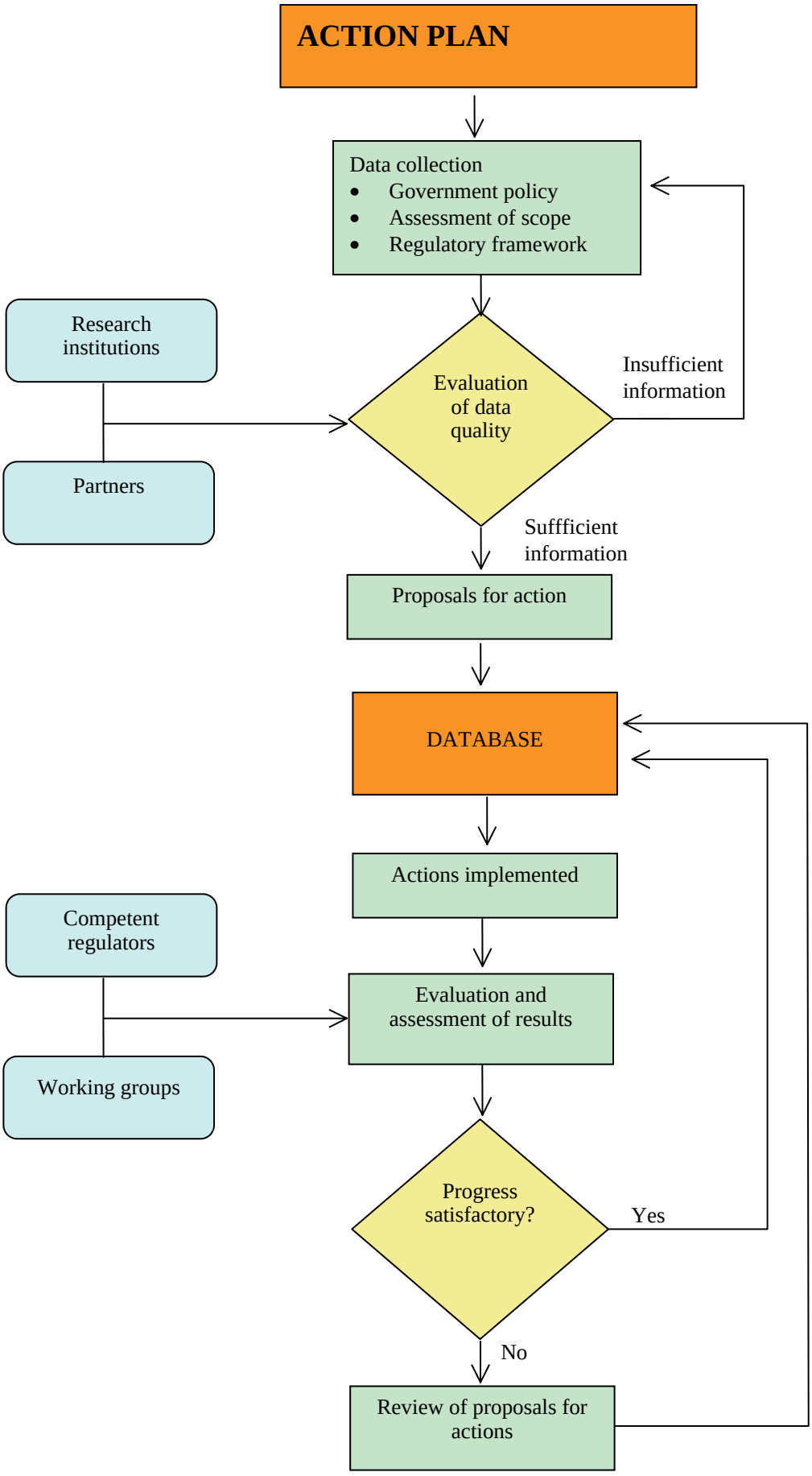
5.5 SUPERVISION OF THE IMPLEMENTATION SCHEDULE

In order to facilitate the co-ordination described above, supervision of the progress of the plan must be entrusted to a single party. A working group (or a committee) must be established to support the implementation of the plan. The main projects of this party should be to:

- Further define the scope of individual projects and actions and channel them to the correct party;
- Establish an information system and ensure that it is kept up to date;
- Supervise harmonisation and communications between parties; and
- Take responsibility for the creation of status reports and review of the action plan.

It goes without saying that such a working group would not do much without appropriate funding.

On the next page there is a flow chart that illustrates the implementation of actions and the evaluation of the progress of the action plan.


ACTION PLAN
Data collection
Government policy
Assessment of scope
Regulatory framework
Research institutions
Partners
Evaluation of data quality
Insufficient information
Suffficient information
Proposals for action
DATABASE
Actions implemented
Competent regulators
Working groups
Evaluation and assessment of results
Progress satisfactory?
Yes
No
Review of proposals for actions

6 ACTIONS

This chapter describes the actions regarded as necessary for the improvement of the current situation. The actions are consistent with the analyses in Chapters 2 and 3 and based on the issues described in Chapters 4 and 5. Generally speaking, although many of these issues are not believed to be a problem in Iceland, there is a lack, in many places, of oversight and co-ordination; this is particularly conspicuous in the issue of heavy metals and POPs. The lack of basic data about the land and nature is also a problem in Iceland which needs to be addressed as soon as possible.

The actions described in the next few pages are for the most part presented in tables. The first column of the table specifies the individual projects. On the one hand, there are immediate projects that need to be initiated as soon as possible and should be completed before the long-term projects begin, and, on the other hand, there are long-term projects that are either based on the results of one or more of the immediate projects or are projects that are not considered as critical as the former projects.

The second column attempts to evaluate the scope of individual projects by rating them on a scale of one to four. The evaluation of scope is based equally on investment expense, operating costs, labour needs and working time, either to complete delimited projects, or annual scope in the case of long-term projects or monitoring. The evaluation is not based on definite figures; instead an attempt has been made to focus on consistency within and between tables.

The third column specifies the party responsible for ensuring that the relevant project is implemented. At this point, a distinction is only made between whether the responsibility lies with government authorities and agencies or with other parties. The "other parties" are not defined here. Projects can be the responsibility of a number of parties, e.g. municipalities, companies or individuals. It should be noted that "responsibility" does not necessarily refer to the financing of the projects. Sewage treatment is an example of this (see 6.1.4). Corrective actions in the sewage system issues of municipalities are the responsibility of the relevant municipalities, although the state also provides funds for construction pursuant to Act No. 53/1995

The issues were listed in order of priority in Chapter 3, with corrective actions regarding the issues in Group I being the most urgent. There is no order of priority in the following listing of projects, nor is there any assessment of the importance of individual projects within each group except as already mentioned. Cost assessment, more detailed prioritisation of projects, further delineation of responsibility, definition of projects and their arrangement are not addressed here. The object of this presentation is to create a better foundation for the next stages. Decisions on the implementation of individual projects are based on the prioritisation of the authorities and other competent parties, budget allocations and other funding, as well as other external conditions.

It should be noted that many of the projects described here are integrated, so that the final total scope will be substantially less than the sum of the projects in the tables. Many of the projects listed here are, or can become, a part of projects relating to work carried out under international obligations or as a part of other domestic projects.

A number of projects have already been initiated and, in some cases, are well under way. Corrective actions in municipal sewage systems, the monitoring of marine pollution, the cessation of low-temperature incineration of litter and the issue of operating licences to polluting industries are examples of this. Nevertheless, these and other projects are listed here in order to facilitate an overview of the progress of the corrective actions when the plan is reviewed and results evaluated.

6.1 GROUP I

6.1.1 Persistent Organic Pollutants

Evaluation: Overview of the issue is inadequate, especially as regards the volume originating in domestic sources as well as the distribution of certain substances in the Icelandic environment.

Connections with other issues: Actions against domestic POPs are directly related to:

a) actions involving the handling of hazardous substances,
b) sewage system issues,
c) waste incineration,
d) industrial activities.

CORRECTIVE ACTION	EVALUATION of Scope	RESPONSIBILITY	
		Government	Others
Immediate Projects			
• Administrative audit	●	**X**	
• Measurement of dioxin and furan	●	**X**	**X**
• Audit of location and scope of release.	●	**X**	
• Measurements of endosulfan.	●	**X**	
• Measurements of concentrations of TBT in the Icelandic environment.	●	**X**	
• Evaluation of emissions, e.g. with PRTR or other similar methods.	●	**X**	
• Issue and review of operating licences.	●●	**X**	**X**
• Mapping of polluted areas and previous sources of pollution.	●●●	**X**	**X**
Long-term projects			
• Administrative improvements based on the above evaluation, especially with regard to operating licences.	●	**X**	**X**
• Cessation of low-temperature incineration of litter.	●●		**X**
• Increase funding for monitoring.	●●●	**X**	**X**

6.1.2 Heavy Metals

Evaluation: The concentration of heavy metals in the Icelandic environment is fairly well known but less is known about current anthropogenic releases. Better information is also unavailable on the ratio of such releases compared with natural sources.

Connections with other issues: Actions against heavy metals are connected to sewage system issues, fuel production and industry types.

CORRECTIVE ACTION	EVALUATION of Scope	RESPONSIBILITY	
		Government	Others
Immediate Projects			
• Mapping of primary release points.	●●	**X**	
• Evaluation of emissions, e.g. with PRTR or other similar methods.	●	**X**	
• Issue and review of operating licences for industries.	●	**X**	**X**
• Survey of Hg concentrations in the atmosphere.	●●	**X**	**X**
• Study of the geochemistry of Cd.	●	**X**	

Long-term projects			
• Monitoring of the concentrations of heavy metals in the Icelandic environment.	●●	**X**	**X**
• Research on impact of anthropogenic activities as compared to natural sources.	●	**X**	**X**

6.1.3 Radioactivity

Evaluation: Good overall view of the issue and pollution from domestic sources is believed to be negligible. Knowledge of the existence of technetium being released from Sellafield in the Icelandic environment is, however, inadequate.

Connections with other issues: Pollution derived from radioactive substances is relatively independent of other issues.

CORRECTIVE ACTION	EVALUATION of Scope	RESPONSIBILITY	
		Government	Others
Immediate Projects			
• Initiate measuring of Tc-99 in the sea around Iceland.	●●	**X**	
Long-term projects			
• Continuous long-term monitoring to maintain overview of the issue.	●●	**X**	
• Renewal and maintenance of reaction plans.	●	**X**	

6.1.4 Sewage

Evaluation: The administrative responsibility for sewage system issues is clear. Most municipalities are working on improvements, but sewage treatment has not been implemented as yet. Chemical pollution has been measured in substantial quantities close to drains from Reykjavík, although knowledge of chemical pollution in sewage systems in other places in Iceland is severely lacking. Statutory evaluations of sewage receiving environments and improvements in drainage system issues are scheduled to be concluded by the year 2005.

Connections with other issues: POPs, heavy metals, oils, nutrients and litter are strongly connected with drainage system issues.

CORRECTIVE ACTION	EVALUATION of Scope	RESPONSIBILITY	
		Government	Others
Immediate Projects			
• The treatment of sewage in accordance with applicable legislation.	●●●●		**X**
• Co-ordinated evaluation of receiving environment around Iceland.	●●●	**X**	**X**
• Mapping of the emission of pollutants from drains in various places in Iceland.	●●●		**X**
• Issue of operating licences for sewage systems.	●●		**X**
• Issue of operating licences for the larger industrial companies.	●●	**X**	**X**
Long-term projects			
• Monitoring of certain substances and substance groups in specific drainage systems in accordance with EEA Agreement requirements.	●●●	**X**	**X**
• Active monitoring of concentrations of pollutants in drains from industrial companies in accordance with operating licences.	●●	**X**	**X**
• Continued treatment of sewage.	●●●		**X**

6.1.5 Handling and Monitoring of Harmful Substances.

Evaluation: Supervision of the issue is in the hands of at least five parties who each supervise a delimited field pursuant to legislation. The legal environment is in many ways complicated and total overview difficult.

Connections with other issues: POPs, heavy metals, oils and radioactive substances are harmful substances.

CORRECTIVE ACTION	EVALUATION of Scope	RESPONSIBILITY	
		Government	Others
Immediate Projects			
• Assessment of legislation and regulations in force.	●	**X**	
• Improved and co-ordinated legal framework with clear boundaries between monitoring bodies.	●●	**X**	
• Establishment of a co-ordinated registration system for harmful substances from importation to disposal.	●	**X**	**X**
Long-term projects			
• Active surveillance of importation, handling and disposal of harmful substances.	●●	**X**	**X**
• Registration of the cycle of harmful substances.	●●		**X**
• Co-operation between inspection bodies improved and maintained	●	**X**	**X**

6.2 GROUP II

6.2.1 Physical alteration and destruction of habitats

Evaluation: A full overview of this issue is unavailable. The disturbance of habitats and species as a result of land-based anthropogenic activities does not seem to be a large problem based on current knowledge. Exceptions to this are mainly in confined areas, especially those close to urban areas.

Connections with other issues: The protection of habitats and species is closely tied to general regional planning and nature conservation. Integrated coastal management has special significance in this context. It is quite possible that alterations in stream sediment loads due to development work may have an impact on habitats.

CORRECTIVE ACTION	EVALUATION of Scope	RESPONSIBILITY	
		Government	Others
Immediate Projects			
• Mapping of habitats close to land	●●●●	**X**	**X**
Long-term projects			
• Total regional planning of coastal zones, especially those close to urban areas.	●●●	**X**	**X**
• Monitoring of the impact of sediment shifts and activities on habitats.	●●		**X**

6.2.2 Oils

Evaluation: There is some way to go before the pollution sources of oils are well known in Iceland. Pollution is considered negligible if accidents are excluded. However, equipment and responses to serious pollution accidents need to be improved. The introduction of pollution equipment into petrol stations and oil depots must also be continued as before.

Connections with other issues: Oils contain POPs and heavy metals. They can be transported into sewage systems and if they are carried to the sea they can pollute habitats and sediment.

CORRECTIVE ACTION	EVALUATION of Scope	RESPONSIBILITY	
		Government	Others
Immediate Projects			
• Complete the issue of operating licences for petrol stations and other operations where oil handled in great quantities.	●●		**X**
• Establish notification requirements for accidents on land.	●	**X**	**X**
• Creation of reaction plans for serious pollution accidents.	●●	**X**	**X**
Long-term projects			
• Maintenance of reaction plans for serious pollution accidents.	●	**X**	**X**
• The creation of risk maps with regard to the oil pollution of coastlines.	●●●	**X**	

6.3 GROUP III

6.3.1 Nutrients

Evaluation: Known results of measurements of nutrients in the sea around Iceland do not show any signs of eutrophication. In light of current knowledge, nutrients are not considered a problem in Iceland, in contrast with the norm in other countries.

Connections with other issues: Nutrients are strongly connected with sewage.

CORRECTIVE ACTION	EVALUATION of Scope	RESPONSIBILITY	
		Government	Others
Immediate Projects			
• Chemical analyses around major outfalls and streams/rivers.	●●●	**X**	**X**
Long-term projects			
• Monitoring and registration of the frequency of algal blooms around Iceland	●●	**X**	
• Monitoring of nutrient conditions in surface water in accordance with EEA undertakings	●●	**X**	**X**
• Monitoring of the chemical content of streams.	●●	**X**	

6.3.2 Litter

Evaluation: Litter from land-based activities which is transported to the sea is currently not a large problem and a smaller problem than before. Even so, it is important to continue the work currently in progress, including the issue of operating licences for disposal installations.

Connections with other issues: Discussion on litter has connections with heavy metals, POPs and sewage, not least in terms of leachate from landfills.

CORRECTIVE ACTION	EVALUATION of Scope	RESPONSIBILITY	
		Government	Others
Immediate Projects			
• Complete the issue of operating licences for disposal installations.	●●	X	
• Closure of disposal installations that do not have an operating licence.	●●	X	
Long-term projects			
• Removal of shipwrecks from coasts.	●●●●	X	X
• Monitoring and cleanup of areas where litter accumulates.	●●●	X	X

6.3.3 Sediment Mobilisation and Contamination

Evaluation: The monitoring of the disposal of dredging materials is fairly good. Knowledge of the impact of sediment shift on the biota, on the other hand, is limited. According to current knowledge, the anthropogenic impact on sediment mobilisation or sediment pollution is not considered a problem that calls for increased remedial action.

Connections with other issues: Sediment shift is connected to changes in habitats and sediment pollution is connected to chapters on sewage , POPs, heavy metals and oils.

CORRECTIVE ACTION	EVALUATION of Scope	RESPONSIBILITY	
		Government	Others
Immediate Projects			
• Acquire an overview of natural sediment transportation into the sea.	●	X	
• Study the natural flow of pollutants to the sea on suspended particles and in turbid water.	●	X	
• Study the impact of activities (damming of streams, crossing of fjords, harbour construction, coastal installations) on natural sediment shifts and other environmental aspects.	●●●	X	X
Long-term projects			
• Follow up on the implementation of rules on the dumping of dredging materials.	●	X	
• Evaluate the long-term impact of activities on sediment shifts and pollution at the planning stage.	●●		X
• Laws on environmental impact assessment should also cover dredging and seabed mining.	●	X	

ANNEXES

ANNEX I LEGISLATION AND REGULATIONS

ANNEX II ABBREVIATIONS AND DEFINITIONS

ANNEX III EVALUATION OF THE IMPACT OF INDIVIDUAL ASPECTS ON THE ENVIRONMENT

ANNEX I

LEGISLATION AND REGULATIONS

A special website has been established containing laws and regulations in force, including amendments. Reference is also made to the websites of government agencies, most of whom have a summary of the statutes and regulations in force in their respective fields.

Below is a list of the statutes and regulations referred to in this report with their Icelandic name

Statutory Law

No.	Icelandic Name	Responsible Agency	Website	Ministry
42/1926	Lög um skipsströnd og vogrek			Ministry of Justice
3/1955	Lög um skógrækt	Iceland Forest Service	www.isholf.is/ skograektin	Ministry of Agriculture
30/1963	Lyfjasölulög	Medicines Control Agency	www.lyfjastofnun.is	Ministry of Health and Social Security
64/1965	Lög um rannsóknir í þágu atvinnuveganna	Marine Research Institute	www.hafro.is	Ministry of Fisheries
171/1965	Lög um landgræðslu	State Land Reclamation Service	www.landgr.is	Ministry of Agriculture
46/1980	Lög um aðbúnað, hollustuhætti og öryggi á vinnustöðum	Administration of Occupational Safety and Health	www.ver.is	Ministry of Social Affairs
117/1985	Lög um geislavarnir	Radiation Protection Institute	www.gr.is	Ministry of Health and Social Security
32/1986	Lög um varnir gegn mengun sjávar	Environmental and Food Agency	www.hollver.is	Ministry for the Environment
52/1988	Lög um eiturefni og hættuleg efni	Environmental and Food Agency	www.hollver.is	Ministry for the Environment
73/1990	Lög um eignarrétt íslenska ríkisins að auðlindum hafsbotnsins			Ministry of Industry and Commerce
63/1993	Lög um mat á umhverfisáhrifum	Planning Agency	www.skipulag.is	Ministry for the Environment
93/1994	Lyfjalög	Medicines Control Agency	www.lyfjastofnun.is	Ministry of Health and Social Security
53/1995	Lög um stuðning við framkvæmdir sveitarfélaga í fráveitumálum			Ministry for the Environment
54/1995	Lög um verndun Breiðafjarðar			Ministry for the Environment
56/1996	Lög um spilliefnagjald	Hazardous Waste Commission		Ministry for the Environment
73/1997	Skipulags- og byggingarlög	Planning Agency	www.skipulag.is	Ministry for the Environment
7/1998	Lög um hollustuhætti og mengunarvarnir	Environmental and Food Agency	www.hollver.is	Ministry for the Environment
44/1999	Lög um náttúruvernd	Nature Conservation Agency	www.natturuvernd.is	Ministry for the Environment
75/2000	Lög um brunavarnir	Brunamálastofnun	www.brs.is	Ministry for the Environment

Regulations

No.	Year	Icelandic name	Amendments (fram til nóvember 2001)	Reference Act No.	Reference Article
39	1984	Reglugerð um útgáfu og afgreiðslu eiturbeiðna og annarra tilsvarandi leyfa.		52/1988	7.
50	1984	Reglugerð um notkun eiturefna og hættulegra efna í landbúnaði og garðyrkju og til útrýmingar meindýra.	213/1984, 235/1986, 461/2001	52/1988	16.
356	1986	Reglugerð um öryggisráðstafanir gegn jónandi geislun.		117/1985	9
137	1987	Reglugerð um notkun og bann við notkun tiltekinna eiturefna og hættulegra efna.	610/1987, 412/1997	52/1988	16., 18.
149	1990	Heilbrigðisreglugerð.	285/1990, 334/1990, 42/1991, 305/1992, 194/1993, 470/1993, 617/1996, 179/1997, 248/1997, 466/1997, 591/1997, 293/1998	7/1998	4.
236	1990	Reglugerð um flokkun merkingu og meðferð eiturefna, hættulegra efna og vörutegunda, sem innihalda slík efni.	348/1990, 664/1997, 766/1997, 459/1998, 460/1998, 500/1998, 639/1998, 77/1999, 150/1999, 548/1999, 754/1999, 613/2000, 921/2000, 380/2001	52/1988	2., 9., 20., 29.
516	1993	Reglugerð um innflutning á reykskynjurum er innihalda geislavirk efni		117/1985	9
517	1993	Reglugerð um innflutning á geislatækjum er framleiða útfjólubláa geisla		117/1985	
35	1994	Reglugerð um varnir gegn olíumengun frá starfsemi í landi.		32/1986	23.
48	1994	Mengunarvarnareglugerð.	378/1994, 536/1994, 394/1996, 26/1997, 273/1997, 23/1998, 485/1998	32/1986 7/1998	9., 10., 12. 5.
238	1994	Reglugerð um garðaúðun.		52/1988	16.
621	1995	Reglur um vinnu með krabbameinsvaldandi efni		46/1980	38
698	1995	Reglur um vinnu með blý og blýsölt.		46/1980	38., 51.
447	1996	Reglugerð um notkun og bann við notkun kadmíums og efnasambanda þess.		52/1988	18.
699	1996	Reglugerð um innflutning og heildsöludreifingu lyfja	484/2001	93/1994	44
700	1996	Reglugerð um framleiðslu lyfja		93/1994	44
426	1997	Reglugerð um lyfsöluleyfi og lyfjabúðir		93/1994	44
656	1997	Reglugerð um varnir gegn mengun af völdum ósoneyðandi efna.	(tók við rg. 546/1994 og 144/1995)	52/1988 81/1988	29. 3.
107	1998	Reglur um varnir gegn sorpmengun frá skipum		32/1986	7
177	1998	Reglugerð um bann við notkun tiltekinna eiturefna og hættulegra efna.	(tók við rg.449/1996), 466/1998	52/1988 81/1988	
323	1998	Reglugerð um innflutning, notkun og förgun PCB, PCT og umhverfisskaðlegra staðgengilsefna þeirra.		7/1998	5.
465	1998	Reglugerð um viðbrögð við bráðamengun sjávar.	203/1999	32/1986 7/1998	
815	1998	Reglugerð um tilkynningaskyldu varðandi ný efni.	333/2001	52/1988 7/1998	
602	1999	Reglur um öryggisleiðbeiningar vegna efnanotkunar á vinnustöðum			
785	1999	Reglugerð um starfsleyfi fyrir atvinnurekstur sem getur haft í för með sér mengun.	849/2000, 48/2001	7/1998	5.
796	1999	Reglugerð um varnir gegn mengun vatns.	833/2001	7/1998	5.
798	1999	Reglugerð um fráveitur og skólp.		7/1998 32/1986	5.
804	1999	Reglugerð um varnir gegn mengun vatns af völdum köfnunar-efnissambanda frá landbúnaði og öðrum atvinnurekstri.	592/2001	7/1998 32/1987	5. 9.
805	1999	Reglugerð um úrgang.		7/1998	4., 5.
806	1999	Reglugerð um spilliefni.		7/1998	5.
807	1999	Reglugerð um brennslu spilliefna.		7/1998	5.
810	1999	Reglugerð um skrá yfir spilliefni og annan úrgang.		7/1998	5.
419	2000	Reglugerð um notkun og bann við notkun tiltekinna efna við meðhöndlun á textílvörum.		52/1988 7/1998	18.
578	2000	Reglugerð um álagningu spilliefnagjalds.		56/1996	6.
619	2000	Reglugerð um bann við notkun gróðurhindrandi efna sem í eru kvikasilfurssambönd, arsensambönd og lífræn tinsambönd.		52/1988 7/1998 32/1986	18.
870	2000	Reglugerð um takmarkanir á innflutningi, notkun og meðhöndlun asbests.		52/1988 7/1998	18., 29. 5.
984	2000	Reglugerð um flutning á hættulegum farmi.		50/1987	50., 60., 73.
765	2001	Reglur um verndun starfsmanna gegn hættu á heilsutjóni af völdum efnafræðilegra skaðvalda á vinnustöðum.		46/1980	38., 39., 50., 51

ANNEX II

ABBREVIATIONS AND DEFINITIONS

The report of the AMSUM group on the measurement of pollutants in and around Iceland contains a comprehensive list of definitions and information on various abbreviations commonly used in the discussion on pollution and pollutants. The list here covers only the abbreviations and terms used in this report and those which are not always accompanied by an explanation of the full name.

AMAP. **A**rctic **M**onitoring and **A**ssessment **P**rogramme

AMSUM. A working group on pollution measurement and environmental monitoring. The name is an amalgamation of the name of the **AM**AP-project and the name of the previous working group (**SUM**MIS).

Bq. Becquerel, international unit of radioactivity.

Agenda 21. Action Plan on Sustainable Development in the World in the 21st Century[.15]. Adopted at the United Nations Global Conference on the Environment and Development, held in Rio de Janeiro, Brazil on 3-14 June 1992.

DDT. **D**ichloro**d**iphenyl**t**richloroethane – a well known insecticide..

Halogenated hydrocarbons POPs that contain elements from the halogen group along with polycyclic carbons (see also the AMSUM report).

HCB. **H**exa**c**hlorocyclo**b**enzene – formed i.a. in some industrial processes and in waste incineration.

HCH. **H**exa**c**hlorocyclo**h**exane – pesticide. Among well-known substances is lindane which was used as a dip for sheep.

Fluorocarbon POPs Containing chlorine together with polycyclic carbons (see also the AMSUM report).

Polycyclic carbons Carbon cycles in, on and near the earth.

Biosphere. The part of the earth and its atmosphere where life can exist Reaches from the deepest layers of the sea to approximately 10 km height above the earth.

OSPAR. Convention for the Protection of the Marine Environment of the North-East Atlantic

PAH. **P**olycyclic **A**romatic **H**ydrocarbon

PCB. **P**oly**c**hlorinated **b**yphenyl

Population equivalents (p.e.). The amount of organic material, nutrient salts and other substances that one individual, on average, is estimated to emit in 24 hrs. One p.e. of organic material is the amount of organic material, e.g. sewage, that can degenerate organically with 60 g of oxygen per day.

PRTR. **P**ollutant **R**elease and **T**ransfer **R**egisters. Collection and analysis of data on emission and the cycle of harmful substances, especially in connection with industrial production.

SUMMIS. Pollution measuring team in Iceland

TBT. **Tt**ri**b**utyl**t**in – a toxic organic tin compound that has been used, among other things, in antifouling paint for the hulls of ships to prevent growth.

Dumping. Disposal of material (e.g. dredging materials) into the sea.

Receiving environment. Area that receives pollution and dilutes or eliminates it. The term is usually used in the context of sewage, i.e. rivers, lakes, estuaries, beach areas or the sea.

Persistent Organic Pollutants (POPs). Pollutants are labelled persistent if they bind to organisms and degrade slowly or not at all. Organic substances are a group of compounds constructed of connected carbon atoms, often in long chains or circles.

Heavy metals. Metals that are heavier than iron (are placed behind iron in the periodic table). They are elements and can be found in different concentrations in rock, the sea, the atmosphere, soil and biota.

UNEP. **U**nited **N**ations **E**nvironment **P**rogramme.

ANNEX III

EVALUATION OF THE IMPACT OF INDIVIDUAL POLLUTION ASPECTS ON THE ENVIRONMENT

The following is a discussion of the impact on the environment of the individual aspects of pollution discussed in this report and their order of priority in the Icelandic context. See also tables 5 and 6.

Sewage

Food Security. Bacteria and various pollutants, such as POPs and heavy metals, which are toxic and reduce the quality of marine organisms as foodstuffs, are transported by sewage.
Public Health. Untreated sewage released on or near coastlines has a negative impact on public health. Faecal pollution in the vicinity of food preparation and in environments frequented by wild animals is a risk factor for bacterial infection.
Marine and Coastal Resources. In many places drainage pipes from sewage systems are in the tidal area or slightly beyond it. As a result, the recreational value of many beaches in the vicinity of urban areas is diminished.
Ecosystem Quality. The localised impact of sewage on ecosystems can be substantial, especially if individual species are to be utilised as food. The effects of sewage on ecosystems, marine resources and food security are inextricably linked.
Social and Economic Benefits. With the growing importance of environmental issues in the public awareness, the environmental situation, e.g. sewage, has an impact on the position and image of municipalities and may influence choice of residence and activities in the municipalities, such as tourism, to name an example. The imperfect situation in sewage matters therefore limits the potential for growth and development in municipalities.
Conclusion: The situation in sewage matters is a disgrace in many places in Iceland. Sewage is in most places released untreated into the sea or into another receiving environment. It is therefore regarded as a priority to conclude, as soon as possible, the statutory improvements in sewage matters. Priority group I.

Persistent Organic Pollutants

Food Security. POPs are one of the priorities of the Icelandic authorities in the field of environmental affairs. The increased concentrations of these substances can seriously affect the quality of marine animals as a food source.
Public Health. Various POPs are toxic or carcinogenic.
Marine and Coastal Resources. Same as above.
Ecosystem Quality. Same as above.
Social and Economic Benefits. An increase in the concentration of POPs can have a substantial impact on the market position of marine products and the Icelandic economy as a whole.
Conclusion: Knowledge of the condition of the sea with regard to various POPs is limited. It is known that many of these substances, e.g. PCB and DDT, originate mainly in overseas sources. The knowledge of domestic emission, on the other hand, is slight. POPs are harmful to the environment and hazardous to human health. The increased concentration of POPs in the sea can also substantially affect Iceland's image. Priority group I.

Radioactive Substances

Food Security. Restrictions on the release of radioactive substances are among the priorities of the Icelandic authorities in the field of environmental affairs. Increased radioactivity in the sea around Iceland can seriously affect the quality of marine animals as a food source.
Public Health. There is no immediate risk to public health from radioactive substances. There are no domestic sources, and radioactivity in the sea is well below reference thresholds..
Marine and Coastal Resources. It is believed that there is no real immediate risk from radioactivity in Iceland. Increased radioactivity in the sea can, however, have a large effect on Iceland’s image and on the image of marine products from Iceland.

Ecosystem Quality. Ecosystems in the North Atlantic are vulnerable and sensitive to any increased pressures.
Social and Economic Benefits. Due to the importance of fisheries in Iceland, any increase in radioactivity in the sea can have a substantial economic impact.
Conclusion: Domestic sources are negligible and the concentration of radioactive substances in the sea around Iceland is low. On the other hand, there is a continuous risk of radioactive substances being transported to Iceland by ocean currents and that increased concentrations may lead to the collapse of markets for marine products. Priority group I.

Heavy Metals

Food Security. Heavy metals can have a major impact on the biota, especially in the sea. Increased concentrations, e.g. in delimited areas, would have a measurable negative impact on the quality of marine animals as food.
Public Health. The concentration of certain heavy metals has been measured over reference limits in some marine organisms. Serious effects of heavy metals on public health are known.
Marine and Coastal Resources. Heavy metal pollution in the marine environment around Iceland seems to be connected mainly with limited areas close to sources.
Ecosystem Quality. The impact of heavy metals on ecosystems can be substantial, particularly if individual species are to be utilised as food. The effects of heavy metals on ecosystems, marine resources and food security are inextricably linked.
Social and Economic Benefits. An increase in the concentration of POPs can have a substantial impact on the market position of marine products and the Icelandic economy as a whole.
Conclusion: Knowledge of the concentrations of various heavy metals in the sea and in the environment in general is in many ways limited. Knowledge of emissions from domestic sources is also patchy. Priority group I.

Oils

Food Security. Oils can have extensive toxic effects on the marine biota. The effects are usually temporary and natural degradation eliminates the oil over time.
Public Health. In general, oil pollution poses little direct risk to public health.
Marine and Coastal Resources. In the event of oil pollution, the effect on the biota is major, and the signs of oil pollution are clearly discernible in coastal areas. Their recreational value plummets and the image of the relevant area becomes tarnished. The effects, however, are not long-term.
Ecosystem Quality. The temporary effects are substantial, although the ecosystems usually revert in time.
Social and Economic Benefits. Oil polluted coasts can have temporary effects on tourism and affect the earnings of locals in that area. The consequences are not considered to last, nor be considerable on a larger scale
Conclusion: Large localised impacts may be expected in the event of a large oil spill near Iceland. Such effects are temporary, however, both in their impact on the biota and in their potential effects on the harvesting of seafood and the market position of Icelandic marine products. Through active actions, such as preventive measures and reaction plans, it is possible to reduce the risk and minimise the effects. Priority group II.

Nutrients

Food Security. Based on current knowledge and conditions there is no indication that the flow of nutrients has a measurable impact on the harvesting of seafood.
Public Health. Little impact, if any.
Marine and Coastal Resources. Localised effects cannot be dismissed due to the synergetic effects of nutrient enrichment and environmental conditions.
Ecosystem Quality. In the case of nutrient enrichment there is some risk that the ecosystem will be at least temporarily damaged.
Social and Economic Benefits. The impact of a possible nutrient enrichment is not expected to impact the Icelandic economy.
Conclusion: There are few indications that direct actions are necessary to reduce the flow of nutrients into the sea. However, current actions in progress, e.g. in sewage matters, will probably decrease the flow of nutrients into the sea. Priority group III.

Sediment Mobilisation and Sediment Contamination

Food Security. Theories have been expounded to the effect that silica in turbid streams plays an important part in the growth of some species of algae in the sea on which various species of fish feed. Such effects cannot be pinned down, however, and on the whole it seems that alterations to sediment shifts and the dumping of dredging materials have little measurable impact on fishing or other harvesting of seafood.
Public Health. No known impact.

Marine and Coastal Resources. Some localised alterations to coastlines and natural quality of the sea can be traced to the pollution of sediments and alterations to natural sediment shift. However, the impact is not believed to be extensive.
Ecosystem Quality. Individual species have been damaged as a result of polluted sediments, as shown by malformations in dogwhelks in the vicinity of harbours. No extensive impact on the ecosystem of the places in question has, in general, been observed.
Social and Economic Benefits. Small to non-existent impact.
Conclusion: No urgent action needed. Pollution of sediment appears, in general, to be negligible and there are no known direct effects on the biota that can be traced to alterations in sediment stream loads. Basic knowledge of this matter, however, is patchy in many places. Priority group III.

Litter

Food Security. The direct impact of litter released into the sea from land-based anthropogenic activities on the harvesting of seafood is limited in Iceland.
Public Health. There are no known direct connections between litter and public health.
Marine and Coastal Resources. Shipwrecks and other refuse is in many places are a blot on the landscape and decrease the recreational value of these areas.
Ecosystem Quality. Uncontrolled burning of litter and the pollution associated with it has decreased dramatically. It may be possible to detect some impact on biota in the vicinity of such plants, but as yet there are no measurements available.
Social and Economic Benefits. Litter on the coast line or in the sea does not have any impact.
Conclusion: Litter is not considered to be a prevailing problem in comparison with the other aspects discussed in this action plan. Priority group III.

Physical Alterations and Destruction of Habitats

Food Security. In the event of alterations to certain habitats or species that live near the land it is likely that this would have some impact on the fishing of commercial fish species, at least in the long-term. Disruption of habitats is not considered to be a problem in Iceland, although knowledge about the habitats around Iceland is slight and therefore the opinion does not rest on a reliable foundation.
Public Health. Little direct effect.
Marine and Coastal Resources. The disruption of habitats inevitably leads to some impact on marine resources. However, there is no known measurable impact in Iceland.
Ecosystem Quality. Habitats and ecosystems are closely connected, and the disruption of habitats inevitably leads to a reduction in the quality of the ecosystem. The scope of this is unknown, but all precautions must be taken.
Social and Economic Benefits. The Icelandic economy is very dependent on the condition of the sea and the organisms living in it. Any changes may cause a major impact. The current situation does not, however, call for immediate actions.
Conclusion: The maintenance of habitats and their diversity around Iceland is very important. Knowledge of the issue is by no means adequate. There are no available data on any measurable or general negative impact of development or activities on habitats around Iceland, except in limited areas. It is important to evaluate the impact of development on habitats, especially at the planning stages (e.g. through environmental impact assessment) and to increase basic research. Priority group II.

Handling and Monitoring of Harmful Substances

Food Security. Many of the various substances discussed here are toxic and could affect the quality of seafoods if released into the environment.
Public Health. In the event of accidental release, many of the substances under this heading could have diverse effects on human health.
Marine and Coastal Resources. In the event of accidental release, many of the substances under this heading could have diverse effects on coastal zones and various marine resources.
Ecosystem Quality. Same as above.
Social and Economic Benefits. Same as above.
Conclusion: No continuous or integrated controls of the cycle of harmful substances from importation to disposal or exportation are in place. Knowledge of the scope of the issue is, therefore, inadequate. In the event of an accident during the use of many of the substances in this category, the impact could be long-term and substantial. Priority group I.